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Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis

Upper Granite Creek Watershed Mines, Wallowa-Whitman National Forest, Oregon

Prepared for

USDA Forest Service
1220 SW 3rd Avenue
Portland, Oregon 97204

Prepared by

Terraphase Engineering Inc.
610 SW Broadway, Suite 405
Portland, Oregon 97205

February 7, 2025

Project Number O031.005.002

This is a draft document and the information contained herein is subject to change. It should not be relied upon; consult the final document

File: rpt-EECA-0031-004-002-DFCR

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Acronyms and Abbreviations

ABA	acid-base accounting
ABP	acid-base potential
ARAR	applicable or relevant and appropriate requirement
ARD	acid rock drainage
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CES	Cascade Earth Sciences
COPCs	contaminant of potential concern
cy	cubic yards
EA	EA Engineering, Science, and Technology, Inc
EC	engineering control
EE/CA	engineering evaluation/cost analysis
FS	Forest Service Road (prefix)
IC	institutional control
LiDAR	light detection and ranging
mg/kg	milligram per kilogram
mg/L	milligram per liter
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ODEQ	Oregon Department of Environmental Quality
ppm	parts per million
PRG	preliminary removal goal
RAOs	removal action objectives
RCRA	Resource Conservation Recovery Act
RG	removal goal
Site	Upper Granite Creek Watershed Mines
SPLP	synthetic precipitation leaching procedure
tCaCO3/kt	tons of calcium carbonate to neutralize a kiloton of waste
TCLP	toxicity characteristic leaching procedure
Terraphase	Terraphase Engineering Inc.
UCL	upper confidence limit
UCLM	95 percent upper confidence limit on the mean
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
XRF	x-ray fluorescence

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Signatures

DRAFT

Don Malkemus, RG | Date

Associate Hydrogeologist

DRAFT

James Farrow, RG | Date

Principal Hydrogeologist

DRAFT

Kevin Long, Principal Consultant | Date

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Executive Summary

Terraphase Engineering Inc. (Terraphase) has prepared an engineering evaluation/cost analysis (EE/CA) for the Upper Granite Creek Watershed Mines (the "Site"; Figure 1) in the Wallowa-Whitman National Forest. The Site consists of the following nine abandoned gold mines along Granite Creek between Forest Service Road (FS) 7345 and its headwaters:

1. Monumental Mine (divided into Upper-Upper Monumental Mine, Upper Monumental Mine, and Lower Monumental Mine)
2. Cap Martin Mine
3. Tillicum Mine
4. Sheridan Mine
5. Golden Fraction Mine
6. Central Mine
7. Granite Creek #5 Mine
8. Granite Creek #6 Mine
9. Granite Creek #7 Mine

The purpose of the EE/CA is to develop alternatives for the removal action, make comparative analysis between the alternatives (including cost), and recommend a preferred alternative based on the comparative analysis of the alternatives. The goal of the preferred alternative is to minimize or eliminate any release or threat of release of a hazardous substance into the environment or impact on public health and welfare.

Site characterization occurred between 2003 and 2024 and involved collection of soil, sediment, porewater, plant tissue, and surface water samples; the identification of ecological species; wetland delineation; surveying; test pit excavation; mapping; and x-ray fluorescence measurement. Human health and ecological risk assessments were prepared by Cascade Earth Sciences (CES) in 2006 (updated in 2011) based on the sample data, observed Site conditions, and ecological observations. The main driver for risk at the Site is arsenic-contaminated tailings and waste rock piles. The highest contaminant concentrations were detected in samples from Monumental Mine, particularly in tailings piles at the former mill and crusher. Surface water in adit seeps and ponds in proximity to the mines were above ecological screening criteria; however, surface water samples in Granite Creek were generally less than these criteria. Updated preliminary removal goals of 190 and 110 milligrams per kilogram (mg/kg) for arsenic in soil/waste rock and tailings, respectively, were calculated based on conservative assumptions regarding potential exposure of human health receptors at the Site and information obtained through additional sampling and analysis to determine the relative bioavailability of arsenic in these media at the Site. These preliminary removal goals are proposed as removal goals (RGs).

Four removal action alternatives were evaluated for effectiveness, implementability, and cost:

- **Alternative 1** – No Action: Under this alternative, no remedial action, monitoring, or maintenance would be performed.
- **Alternative 2** – On-site Containment: Under this alternative, waste rock and tailings above RGs would be graded and covered with clean soil sourced from the Site.
- **Alternative 3**- Excavation and On-site Disposal: Under this alternative, waste rock and tailings above RGs would be excavated and placed in a repository constructed on Site.

- **Alternative 4**- Excavation and Off-site Disposal: Under this alternative, waste rock and tailings above RGs would be excavated and hauled to an off-site sanitary landfill.

Taking into consideration the evaluation criteria presented in this EE/CA, the recommended removal action alternative for the Site is a combination of Alternatives 1, 2, 3, and 4. The Site mines, and the features at each mine, have individual attributes such that a single remedy would not be appropriate for the entire Site. The rationale for selecting an alternative for each mine is presented below.

Monumental Mine

The recommended removal action at Monumental Mine is a combination of Alternatives 1, 2, 3, and 4, as described below.

Upper-Upper Monumental Mine

Alternative 1 is recommended for waste rock piles at the Upper-Upper Monumental Mine with 95 percent upper confidence limit (UCL) on the mean (UCLM) below RGs.

Alternative 2 is recommended for waste rock piles with UCLMs above RGs. Piles can be moved using a bulldozer into trenches and covered with local clean borrow material. The cover material would be placed on the partially open shaft to prevent a trespasser or recreator from falling. Access to this area would require minimal road improvement.

Upper Monumental Mine

Alternative 2 is recommended for waste rock pile B. The shaft has sufficient capacity to accept the waste rock pile. Cover material can be supplied from the Upper-Upper Monumental Mine area and the unnamed road adjacent to the pile would require minimal improvement for equipment access.

A combination of Alternatives 2 and 3 is recommended for waste rock pile A. The steep slope of the waste rock pile will not likely allow recontouring of the entire pile without significant grubbing of the surrounding forest. It is recommended that the over-steepened portion of the pile be pushed with a bulldozer downslope to FS 7345 and taken to an on-site repository. Approximately half of the pile could then be spread and contoured to the existing topography. During the removal action, efforts would be made to maximize the volume of soil left in place, graded, and covered, and minimize the volume of soil transported to the on-site repository.

Alternative 4 is recommended for tailings piles A, B, and C. A vacuum truck should be used to remove the fine tailings without disturbing the historical structures and minimize creating dust in this particularly fine material with high arsenic concentration. The contents of the vacuum truck will be transferred to a highway-rated truck with appropriate hazardous waste placards and a lined, covered bin at a staging area near the intersection of FS 7345 and FS 73 for transport to a Subtitle C landfill. After removing tailings to the extent practicable, clean cover soil will be placed in the excavated areas to provide an exposure barrier from remnant tailings. No road improvements would be necessary except a vacuum truck with sufficient hose length could park on FS 7345. Tailings pile C could be accessed from the unnamed access road that transects Lower Monumental Mine.

The wetlands near the tailings piles B and C will be restored following the removal of hazardous substances in accordance with the 1994 United States Environmental Protection Agency guidance document *Considering Wetlands at CERCLA Sites*. If needed, clean organic fill may be imported from off Site for placement in the new wetland system. Wetland plants will be obtained either off Site or from a local borrow area pending United States Department of Agriculture Forest Service approval.

Lower Monumental Mine

Alternative 4 is recommended for tailings pile A. Similar to the Upper Monumental Mine, a vacuum truck could be used to remove the fine tailings without disturbing the historical crusher structure. The contents of the vacuum truck will be transferred to a highway-rated truck with appropriate hazardous waste placards and a lined, covered bin at a staging area near the intersection of FS 7345 and FS 73 for transport to a Subtitle C landfill. Some road improvement would be necessary to allow a vacuum truck to drive on the unnamed road. Removing tailings would help reduce the capacity for this material to leach chemicals of potential concern and migrate to Cap Martin Creek and nearby wetlands.

Alternative 2 is recommended for waste rock piles A and B. The area surrounding the waste rock piles is relatively flat and would support grading. The over-steepened northeastern portion of waste rock pile A could be regraded to the north–northwest, and across tailings pile A to the northeast, taking care not to bury or obscure the historically significant crusher. A portion of waste rock pile A could be placed in the open adit to prevent access to this physical hazard. Waste rock pile B could be placed in the area in front of adit 3 and the rest appropriately graded downslope. Cover material could be sourced from the area to the east of the unnamed access road or to the south of waste rock pile A. Capping the waste rock piles would be protective of human health, cost effective, and less difficult to implement than Alternatives 3 and 4.

Granite Creek Aquatic Station 03

Alternative 1 is recommended for Granite Creek Aquatic Station 03 waste rock pile A due to low arsenic concentrations indicative of background conditions.

Alternative 2 is recommended for Granite Creek Aquatic Station 03 waste rock pile B. Minimal road improvement would be necessary along FS 720 to allow for a bulldozer or excavator to regrade and pull the waste rock pile away from Granite Creek and cover it with material from waste rock pile A or another local cover source. Alternative 2 would be protective of human health, reduce risk to ecological receptors, be cost effective, and relatively easy to implement.

Cap Martin Mine

Alternative 1 is recommended for the Cap Martin Mine. Only waste rock pile C at this mine had a UCLM (243.5 mg/kg) above the arsenic RG of 190 mg/kg. At this waste rock pile, only three of the eight sample locations had concentrations above the arsenic RG (maximum concentration of 365.8 mg/kg). Cap Martin Mine is in a remote area of the Site, with difficult access through small trees and brush by foot and no access by road or trail. It is unlikely that a trespasser or recreator would discover Cap Martin Mine, and even more unlikely that they would spend time in the area of waste rock pile C with elevated arsenic concentrations. Implementing Alternatives 2, 3, or 4 would necessitate constructing a new road down a steep and densely vegetated portion of national forest. These alternatives would be expensive and provide only marginal benefit for the protection of human health.

Sheridan Mine

Alternative 1 is recommended for the Sheridan Mine. All samples collected at this mine had arsenic concentrations well below the RG. The mine is in a remote portion of the Site and is difficult to access.

Granite Creek #7 Mine

Alternative 1 is recommended for Granite Creek #7 Mine. Of the seven analytical samples collected at this mine, only one exceeded the RG with a concentration of 220 mg/kg. Calculated UCLMs for the waste rock piles were below RGs. The mine is in a remote area of the Site that would be difficult to access.

Granite Creek #6 Mine

Alternative 1 is recommended for Granite Creek #6 Mine. Two samples collected from waste rock pile A exceeded RGs (maximum concentration 504 mg/kg). However, the waste rock pile is relatively small, and the mine is in a remote portion of the Site with difficult access. This mine was difficult to locate with a map and GPS device and offers no historically significant features that trespassers or recreators would be interested in. To implement Alternatives 2, 3, or 4, it would be necessary to construct a new road along Granite Creek that would likely cause unwanted turbidity and undercut the uphill slopes.

Tillicum Mine

Alternative 1 is recommended for Tillicum Mine. Only waste rock pile A had a calculated arsenic UCLM (357.7 mg/kg) above the RG of 190 mg/kg. This pile is downhill from FS 280, between the road and Granite Creek. Human health exposure to the waste rock pile is likely minimal as it would require descending a steep hill from the road. Soil downslope of waste rock pile A had similar arsenic concentrations to the pile, which indicates that erosion of the pile to Granite Creek is ongoing; however, pool and riffle samples collected in 2003 adjacent to the pile did not have measurable arsenic concentrations. The concentration of total arsenic in the 2024 Granite Creek surface water sample collected downstream of Tillicum Mine was slightly less than the upstream sample. These data suggest that even though material from the waste rock pile is eroding into Granite Creek, it is not having a significant effect on downstream water quality. Implementing Alternatives 2, 3, or 4 at Tillicum Mine would require improving approximately 0.75 miles of FS 280, including a portion across privately held land, which would be labor and capital intensive.

Granite Creek #5 Mine

Alternative 1 is recommended for the Granite Creek #5 Mine. The calculated arsenic UCLM for waste rock pile A is 293.2 mg/kg, which exceeds the RG. However, six of the eight x-ray fluorescence measurement or analytical sample locations had arsenic concentrations below the RG. Furthermore, the sample collected downslope of the waste rock pile, between the pile and Granite Creek, had an arsenic concentration less than half of the minimum concentration of waste rock pile A samples. The concentration of total arsenic in the 2024 Granite Creek surface water sample collected downstream of the Granite Creek #5 Mine was slightly less than the upstream sample, suggesting Granite Creek #5 Mine does not significantly contribute to contaminant loading in Granite Creek. Implementing Alternatives 2, 3, or 4 at the Granite Creek #5 Mine would require improving approximately 0.4 miles of FS 280, including a portion across privately held land.

Golden Fraction Mine

Alternative 1 is recommended for Golden Fraction Mine. Waste rock pile A had arsenic concentrations above the RG (calculated UCLM of 332 mg/kg). However, this waste rock pile is located high up a steep hillside from the most likely access point of a trespasser or recreator, and it is unlikely that there is an associated human health risk. This waste rock pile is relatively small and implementation of Alternatives 2, 3, or 4 would require constructing an access road across a very steep hillside, which may not be feasible. In 2011, CES collected a sample from the area of a trench within waste rock pile C that had an arsenic concentration of 1,340 mg/kg. Terraphase measured arsenic concentrations at four locations in this area and collected a sample from the trench and was unable to reproduce this result (maximum concentration 102 mg/kg when not including the CES sample). It is possible that this sample was collected from a different area or it represents an anomalous result unrepresentative of the bulk of the pile. In either case, this waste rock pile does not represent a significant human health risk and does not warrant removal action.

Central Mine

Alternative 2 is recommended for Central Mine waste rock pile A, which had a calculated arsenic UCLM of 239.5 mg/kg, slightly above the RG. This waste rock pile is easily accessible along FS 280, just west of its intersection with FS 280, which has parking at nearby FS 73. Waste rock pile A would be pulled up from the Granite Creek floodplain and placed in the open space at the adit and contoured into the adjacent hillside. Cover material is available downslope of FS 280, though it would need to be tested prior to application. Although there is higher likelihood of trespassers and recreators, no action is needed at waste rock piles B, C, or D as they had calculated UCLMs below the RG.

Recommended Removal Action Summary

The recommended removal action for the Site includes a combination of Alternatives 1, 2, 3, and 4, as summarized above. Combined estimated costs for the recommended removal action are $1,218,259, as summarized in Table 10.

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1 Introduction

In accordance with United States Department of Agriculture (USDA) Forest Service Contract BPA Call No. 1240BE24A0015/1240BD24F0080, Terraphase Engineering Inc. (Terraphase) has prepared this engineering evaluation/cost analysis (EE/CA) for the nine Upper Granite Creek Watershed Mines (the "Site"; Figure 1) in the Wallowa Whitman National Forest in accordance with:

- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) cleanup authorities (42 USC § 9604[a] and 7 CFR § 2.60[a][39]) and Federal Executive Order 12580;[1]
- The provisions of National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR § 300.415(b)(4)(i);[2] and
- The United States Environmental Protection Agency's (USEPA) *Guidance on Conducting Non-Time-Critical Removal Actions under CERCLA* (1993).

Cascade Earth Sciences (CES) prepared an EE/CA for the Site in 2011 based on data collected between July 2003 and September 2009 (CES 2011a). This EE/CA updates that report with additional field and laboratory data.

1.1 Site Mines

The Site consists of the following nine abandoned gold mines, most along Granite Creek between Forest Service Road (FS) 7345 and its headwaters, approximately 5 to 8 aerial miles north of Granite, Oregon (Figure 2):

1. Monumental Mine (divided into Upper-Upper Monumental Mine, Upper Monumental Mine, and Lower Monumental Mine)
2. Cap Martin Mine
3. Tillicum Mine
4. Sheridan Mine
5. Golden Fraction Mine
6. Central Mine
7. Granite Creek #5 Mine
8. Granite Creek #6 Mine
9. Granite Creek #7 Mine

The mines are managed by the USDA Forest Service under CERCLA authorities.

[1] "Response authorities," 42 USC § 9604, https://www.govinfo.gov/content/pkg/USCODE-2023-title42/pdf/USCODE-2023-title42-chap103-subchapI-sec9604.pdf.
"Chief, Forest Service." 7 CFR § 2.60, https://www.ecfr.gov/current/title-7/subtitle-A/part-2/subpart-J/section-2.60
"Superfund implementation," Executive Order 12580, https://www.archives.gov/federal-register/codification/executive-order/12580.html.

[2] "Removal action." 40 CFR § 300.415, https://www.ecfr.gov/current/title-40/chapter-I/subchapter-J/part-300/subpart-E/section-300.415.

1.2 EE/CA Purpose and Organizational Structure

The NCP authorizes and describes two processes for responding to releases: (1) a removal action process, and (2) a remedial action process (see 40 CFR §§ 300.400–300.440).[3] Based on environmental investigations at the Site, USDA Forest Service determined that site conditions warranted additional response to address the release or threatened release of hazardous substances and that a non-time-critical removal action is appropriate at the Site as specified in 40 CFR § 300.415(b). The purpose of the EE/CA is to develop alternatives for the removal action; make comparative analysis between the alternatives, including cost; and recommend a preferred alternative based on the comparative analysis of the alternatives. The goal of the preferred alternative is to minimize or eliminate any release or threat of release of a hazardous substance into the environment or impact on public health and welfare.

The EE/CA evaluates risks that mine-related contamination poses to (primarily) human and (secondarily) ecological health, the extent that remedial action is necessary to mitigate identified risks, and the best course of action to pursue if remedial action is necessary.

This EE/CA report is organized by the following topical headings, which also represent the overall objectives of the EE/CA:

- Characterize the nature and extent of contamination at the Site (Section 2);
- Identify applicable or relevant and appropriate requirements (ARARs; Section 3);
- Develop removal action objectives (RAOs) and removal goals (RGs; Section 4);
- Identify and analyze potential removal action alternatives (Sections 5.1–5.4);
- Conduct a comparative evaluation of the removal action alternatives (Section 5.5); and
- Recommend a removal action alternative (Section 6).

2 Site Characterization

This section describes the local climate, nearest surface water, and regional geology and hydrogeology of the Site and surrounding area; setting, operational history, and previous investigations of the Site; chemicals of potential concern (COPCs); and a summary of the human health and ecological risk assessments.

2.1 Local Climate

The Wallowa-Whitman National Forest has an alpine climate with cool nights and generally sunny days in the summer and early fall. Average minimum and maximum temperatures range from a low of 11 to 31 degrees Fahrenheit in January to a high of 39 to 79 degrees Fahrenheit in July. Average precipitation

[3] "Subpart E—Hazardous Substance Response," 40 CFR §§ 300.400–300.440, https://www.ecfr.gov/current/title-40/chapter-I/subchapter-J/part-300#subpart-E.

and snow depth are 24 and 168 inches, respectively.[4] There are likely differences in snowpack and temperature with elevation across the Site.

2.2 Surface Water

The Site mines, except Monumental Mine, are located along Granite Creek. Monumental Mine is located at the headwaters of Cap Martin Creek (previously identified as an unnamed tributary), which joins Granite Creek between the Sheridan and Granite Creek #6 and #7 Mines. Granite Creek empties into the North Fork John Day River approximately 13 miles downstream of Central Mine, the furthest downstream of the nine mines. The Granite Creek watershed encompasses 94,480 acres primarily in the boundaries of the Wallowa-Whitman National Forest (40,624 acres) and the Umatilla Nation Forest (49,539 acres), with the remainder held as private land (USDA Forest Service 2016). The runoff-streamflow regime is dominated by spring snowmelt with peaks occurring in May and June and water levels dropping in the summer (USDA Forest Service 2016). Several wetlands are present at and near the Site. Wetland delineation conducted at Monumental Mine as part of the 2011 EE/CA identified wetlands in the areas of the settling ponds, and downstream near Cap Martin Creek (CES 2011b). The wetland delineation report is included as Appendix A.

2.3 Geology and Hydrogeology

The Granite Creek Mines are located within the Elkhorn Mountains area of the Blue Mountains geomorphic province. The lode mines of the Granite Mining District lie along the southwestern edge of the Bald Mountain Batholith, a large granodiorite body with an outcrop area of more than 170 square miles. The principal lode mines occur in a northeast-trending belt of veins and mineralized shear zones about 2 miles wide and 5 miles long (Engineering, Science, and Technology, Inc. [EA] 2004). Within the district, the veins occur primarily in older Argillite of the Elkhorn Ridge Argillite. However, eight of the nine mines target veins within the Bald Mountain Batholith and only one (Central) occurs within the Elkhorn Ridge Argillite.

The Bald Mountain Batholith is of Lower Cretaceous and Upper Jurassic age. It primarily consists of granodiorite and tonalite, with small amounts of norite and quart monzonite (Ferns, Brooks, and Ducette 1982). Dikes and sills of similar compositions occur along the borders of the batholith.

Shallow groundwater at the Site discharges to seeps and springs, which contribute flow to Granite Creek. Shallow groundwater previously encountered at some of the mines likely does not form a laterally continuous aquifer in the study area due to the presence of igneous intrusions and shallow bedrock. Deep, regional groundwater is likely present in cracks and fissures within the intrusive rocks that may discharge along faults or fissures; however, no local study of deeper groundwater has been conducted.

[4] Measured at the Granite, Oregon, weather station; https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?or3430.

2.4 Mine Descriptions

The following subsections describe each mine, based on summaries provided in the previous EE/CA (CES 2011a) and field observations. All waste rock/tailings volumes and distances are considered approximate and are based on measurements completed in the field and their relationship to LiDAR-derived digital elevation model topographic contours.[5] The mines are described from east to west, upstream to downstream of Granite Creek. The details on the figures associated with the mines are from field observations. During the investigation, features identified in the previous EE/CA were geolocated and the maps were updated accordingly so that the mapped features better represent features visible in the LiDAR imagery and observed in the field. Photographs of the mines are included in Appendix A of the Terraphase *Supplemental Site Investigation Report* (Terraphase 2024), which is included as Appendix B to this EE/CA report.

2.4.1 Monumental Mine

Monumental Mine is situated on moderate to steep hillsides near the headwaters of Cap Martin Creek. The largest of the nine mines, Monumental Mine is approximately 12 acres and is split into the following three areas (Figures 3-5):

1. Upper-Upper Monumental Mine
2. Upper Monumental Mine
3. Lower Monumental Mine

The mine consists of over 4,000 feet of underground workings reaching 700 feet below ground surface (EA 2004). The upper-upper mine area was not previously mapped or investigated.

2.4.1.1 Upper-Upper Monumental Mine

The upper-upper mine area consists of 9 shafts, 3 trenches, and 10 waste rock piles (Figure 3). Shafts 2 and 3 are partially open and present physical hazards to humans and terrestrial wildlife. A total of 500 cubic yards (cy) of waste material is scattered in numerous piles throughout the area, with piles ranging in size from 5 to 395 cy. Features resembling a shaft or trench identified by LiDAR but not observed during the field investigation are shown on Figure 3 as a “potential” shaft or trench.

2.4.1.2 Upper Monumental Mine

Upper Monumental Mine includes several distinct areas:

- The upper shaft area is located just downhill from an unnamed former roadway that connects to FS 7345 and consists of a partially open shaft and an associated 60 cy waste rock pile (WRB; Figure 4).
- The upper adit area has an open adit and associated 7,905 cy waste rock pile (WRA; Figure 4). A seep was observed flowing from the adit and infiltrating into the eastern section of the waste rock pile.

[5] https://oceanservice.noaa.gov/facts/lidar.html

- The former mill area includes the remains of a 20-stamp, dry crusher mill, flotation table, chlorination plant, and stone conduit (chlorination flue). Though referenced in previous documents, the location of the former chlorination plant is unknown. A layer of pink-colored concentrations/tailings (TLA, 125 cy; Figure 4) extends 80 feet from the former flotation table to the edge of a steep slope above FS 7345 to the northwest.

A spring which forms the first observable water of Cap Martin Creek discharges below the upper waste rock area. The spring flows across FS 7345 and into a series of settling ponds, all of which are connected by surface water flow. The settling ponds have developed into a small wetland system. Two tailing piles (TLB and TLC, 305 and 10 cy, respectively; Figure 4) are present at and surrounding the settling ponds. A potential trench and waste rock pile are present below the lower settling pond. These features were observed in the field and in LiDAR imagery. X-ray fluorescence (XRF) measurements of these features did not show arsenic concentrations above background and no further evaluation of the potential trench and waste rock pile was conducted.

2.4.1.3 Lower Monumental Mine

Lower Monumental Mine is accessible via an unnamed road that spurs from FS 7345 and contains one open adit, one collapsed adit, two waste rock piles, a former crusher, and tailings associated with the former crusher. The open adit is adjacent to a large waste rock pile (WRA, 5,560 cy; Figure 5). The collapsed adit is adjacent to a smaller waste rock pile, approximately 170 cy (WRB). The crusher and tailings pile (TLA, 180 cy) are adjacent to the north of the WRA waste rock pile. The lower settling pond is south of the open adit. Water was observed seeping from the open adit through a constructed ditch to the lower settling pond. No outlet for the lower settling pond was observed but seeps were observed at the base of the waste rock pile A. A series of parallel cuts in the hillslope are present to the south of waste rock pile A. Collapsed cabins are adjacent to the open adit and downslope from the tailings pile and an intact cabin is present near the waste rock pile B.

2.4.2 Granite Creek Aquatic Station 03

Although not identified as a mine site, CES evaluated and recommended remedial action for waste rock adjacent to its Aquatic Station 03 (Figure 6). Terraphase mapped two waste rock piles in this area (WRA and WRB at 15 and 80 cy, respectively). Both piles are close to Granite Creek. No adits, shafts, or structure were observed in the immediate area of these waste rock piles. These waste rock piles are the furthest upstream features sampled along Granite Creek.

2.4.3 Cap Martin Mine

Cap Martin Mine, approximately 1,500 feet downstream of Granite Creek Aquatic Station 03, consists of six collapsed adits (Figure 7). Mining activity, including evidence of placer mining, occurred on both sides of Granite Creek. Collapsed cabins and one standing cabin are on the north side of Granite Creek. Two waste rock piles associated with adits are south of Granite Creek (WRA and WRB at 370 and 10 cy, respectively) and a single large waste rock pile (WRC, 735 cy) is north of Granite Creek, near the other four adits. Placer spoils were observed near an intermittent stream and along Granite Creek (Figure 7). A small wetland area was observed to the west of the placer spoils.

2.4.4 Sheridan Mine

Sheridan Mine is located 0.25 miles downstream of Cap Martin Mine on moderately steep slopes on the south side of Granite Creek (Figure 8). Mining targeted veinlets with pyrite, chalcopyrite, and tetrahedrite in a series of short adits (Ferns, Brooks, and Ducette 1982). The mine consists of four adits and three waste rock piles (WRA, WRB, and WRC at 65, 30, and 5 cy, respectively). A small wetland was observed to the west of waste rock pile B. Placer deposits are along the southern bank of Granite Creek and adjacent to a tributary west of the mine that flows into Granite Creek from the south. Previous mapping identified a collapsed cabin, though Terraphase was unable to locate this feature.

2.4.5 Granite Creek #6 Mine

Granite Creek #6 Mine is approximately 100 feet northeast of Sheridan Mine on the northeast side of Granite Creek (Figure 9). The mine consists of one open adit with an associated waste rock pile (WRA, 45 cy) and a “wet trench” with a larger pile of material likely generated from the creation of the trench (WTP, 140 cy). The open adit represents a potential physical hazard.

2.4.6 Granite Creek #7 Mine

Granite Creek #7 Mine is approximately 100 feet upstream (north) of Granite Creek #6 Mine on the north side of the confluence between Cap Martin Creek and Granite Creek. The mine consists of two collapsed adits and associated waste rock piles (WRA and WRB at 195 and 125 cy, respectively). There is a trench north of the adits that CES mapped as a “canal” (2011a; Figure 10).

2.4.7 Tillicum Mine

Tillicum Mine, 0.25 miles downstream of the Sheridan Mine on moderately steep slopes along the north bank of Granite Creek, is accessible by FS 280 (Figure 11). Underground workings were over 400 feet accessed from five or more adits across several narrow shear zones targeting small quartz veins (Brooks and others 1982). Two primary veins and associated adits are about 50 feet apart (EA 2004). These were the only adits observed (Figure 11). The upper adit is directly uphill of the lower adit. Waste rock piles are adjacent to both adits (WRB, 145 cy and WRC, 210 cy) and a third waste rock pile is between FS 280 and Granite Creek (WRA, 205 cy). Ruins are present below the upper adit and adjacent to WRC.

2.4.8 Granite Creek #5 Mine

Granite Creek #5 Mine is approximately 0.3 miles downstream of Tillicum Mine (Figure 12). Brooks et al. (1982) mapped a mine as “name unknown” in the approximate location of Granite Creek #5 Mine and stated it targeted a shear zone with small quartz veins. The mine consists of one collapsed adit, a waste rock pile that encompasses the ridges on either side of the adit entrance, a portion of FS 280, an area between FS 280 and Granite Creek (WRA, 285 cy), and a small waste rock pile that appeared distinct to the east of WRA (WRB, 10 cy). EA identified a seep emerging from the hillside approximately 150 feet east of the adit (EA 2004); however, Terraphase did not observe this feature. Based on its location, EA did not think that the seep was associated with the Granite Creek #5 Mine.

2.4.9 Golden Fraction Mine

Golden Fraction Mine is approximately 1,600 feet downstream of Granite Creek #5 Mine (Figure 13). Brooks et al. (1982) mapped a mine as “Eddy Group” in the approximate location of Golden Fraction Mine and stated it had five short adits targeting two parallel shear zones with quartz lenses and pyrite stringers in argillite, metagabbro, and quartz diorite. The mine has three collapsed adits, each with an associated waste rock pile (WRA, WRB, and WRD at 295, 145, and 1,105 cy, respectively) and a trench surrounded by waste rock (WRC, 295 cy). A cabin was previously mapped by EA but Terraphase could not locate it. The mine is accessed by FS 280, and a portion of WRD is over the road. A spring was observed at the lower adit that created a small marshy area uphill of FS 280.

2.4.10 Central Mine

Central Mine is located approximately 800 feet downstream of Golden Fraction Mine to the northwest of where Granite Creek flows under FS Road 73 (Figure 14). It is the only Site mine known to target the Permian Elkhorn Ridge Argillite (unless Golden Fraction Mine is the referenced “Eddy Group Mine”). The mine is described as targeting two parallel shear zones 90 feet apart and consisting of more than 500 feet of workings in three adits (Brooks et al. 1982). However, five collapsed adits, one potential collapsed adit, and four waste rock piles (WRA, WRB, WRC, and WRD at 80, 25, 105, and 25 cy, respectively) were observed during the 2024 Site visit. The mine is accessible from either FS 73 or FS 280, which separates Adit 1 from waste rock pile WRA. A trench was observed running east–west below FS 280.

2.5 Operational History

Mining in the Granite Creek area began as early as the 1860s and continued until World War II when it was curtailed. Monumental Mine was discovered in 1870 and operated until 1928, with at least 11 different claims targeting during this time span (EA 2004). Mining was primarily conducted by following quartz veins within granodiorite of the Cretaceous Bald Mountain Batholith, though the Central Mine targeted shear zones within Permian Elkhorn Ridge Argillite (Brooks et al 1982; Ferns, Brooks, and Ducette 1982). Ore minerals in the Monumental Mine included pyrite, arsenopyrite, sphalerite, galena, and tetrahedrite (Ferns, Brooks, and Ducette 1982). Hand dredging was common before the 1880s when it was replaced by lode mining using large-scale mining equipment and chemical extraction methods. Dredging began again in the 1920s using large-scale dredging equipment (EA 2004).

Initial dredge and placer mining was replaced in the late 1880s, when lode mining became the most profitable form of mining because of the advent of large-scale drilling and crushing equipment and chemical extraction methods to extract the gold from its alloys. Use of fluid amalgamation processes is evident at the Monumental Mine. In the 1920s, dredging for gold in the rivers again became profitable using large-scale dredging equipment (EA 2004). Numerous dredge tailings piles are still visible along these creeks. Hydraulic mining methods involved sluices and sorting the tailings by hand. Rows of hand-piled rocks remain along the shoreline and within Granite Creek at many of the Site mines. Limited historical gold production information for four of the nine named mines is provided below.

- **Monumental Mine.** Gold was discovered in 1870 by Harvey Robbins, Isaac Nail, and Isaac Klopp and the mine operated intermittently until 1928. Between 1875 and 1906, several new claims were established and several of the original claims were relocated. The mine consisted of two tunnels, two shafts, several raises, and a stoop that daylights to the surface near one of the shafts, all totaling approximately 4,000 feet (EA 2004).

  In 1875, a ton of the ore, with a value of $1,500, was shipped to San Francisco to attract investors. With the added capital, a 20-stamp mill was constructed on the mine site. The Monumental Gold and Silver Mining Company operated both the mine and the mill in the late 1880s. In 1902, the mill included a chlorination plant. The total output through 1928 has been estimated at $100,000 (EA 2004).
- **Cap Martin Mine.** Gold was discovered by Cap Martin. The mine consisted of three adits totaling approximately 300 feet (Ferns, Brooks, and Ducette 1982).
- **Tillicum Mine.** Gold production was reported to be minimal, and development occurred in approximately 400 feet of five or more adits, two of which were the primary adits (Brooks et al. 1982; EA 2004)
- **Central Mine.** It is not known when the mine was established but production was reported to be very minimal, and development consisted of approximately 500 feet in three adits (Brooks et al. 1982).

2.6 Previous Investigations

Previous site assessment and risk evaluations performed for the Site are summarized in the following subsections.

2.6.1 Environmental Impact Statement – 2002

In 2002, the USDA Forest Service completed a *Draft Environmental Impact Statement, Granite Area Mining Projects*, which included the Upper Granite Creek Watershed. The report noted that the Columbia River bull trout and Mid-Columbia steelhead had been observed in the Granite Creek Watershed and were listed as threatened under the Federal Endangered Species Act. In addition, several of the streams within the watershed were on the state of Oregon 303(d) list of impaired waters, as described by the Clean Water Act.[6]

The USDA Forest Service also conducted *Abbreviated Preliminary Assessments* on both Monumental and Tillicum Mines using an XRF device to field analyze samples to determine whether the potential existed for a release of hazardous contaminants to the environment (2003a, 2003b). Summaries of these abbreviated preliminary assessments are provided below as presented in the EA's 2004 *Site Inspection* report.

[6] https://www.epa.gov/tmdl

- **Monumental Mine.** Three samples from the waste rock piles and two from the tailings ponds were analyzed. The results indicated that arsenic, lead, and mercury exceeded USEPA Region 9 preliminary removal goals (PRGs).
- **Tillicum Mine.** One waste rock sample was collected and analyzed; results exceeded USEPA Region 9 PRGs for arsenic and lead.

2.6.2 Site Inspection – 2004

In 2003, EA conducted a site inspection at the Monumental, Cap Martin, Sheridan, Tillicum, and Central Mines to determine if waste material posed an immediate or potential threat to human health and the environment, and to collect data to assess the necessity of further action. Tasks performed during the inspection included background research and file review, on- and off-site reconnaissance, and collection and analysis of soil, waste rock, surface water, pore water, sediment, plant tissue, and benthic macroinvertebrate samples (EA 2004). Results of the site inspection indicated the following:

- Metals from the Site were not notably impacting surface water, pore water, or sediments in Granite Creek.
- Lead, manganese, arsenic, and selenium were detected at levels above the comparison criteria in surface water samples collected from the seeps and upper settling pond at Monumental Mine.
- There did not appear to be significant benthic habitat impairment or decreased benthic macroinvertebrate diversity and abundance along Granite Creek.
- Arsenic was identified above screening levels and background concentrations at the five mines evaluated. Antimony, cadmium, lead, mercury, silver, and zinc were detected above screening levels and background concentrations in samples from at least one mine.
- Bull trout (Salvelinus confluents), listed as threatened under the Endangered Species Act, were observed in small numbers throughout the study area. Two small trout (either west slope cutthroat or redband trout) were observed at locations along Granite Creek. Both species are federally listed as “species of concern” and identified as vulnerable by the Oregon Fish and Wildlife Commission.

EA recommended the completion of an EE/CA based on the results of the site inspection. Sample locations from the site inspection are included on Figures 3 through 14.

2.6.3 Risk Assessment – 2006

CES prepared a *Human Health and Ecological Risk Assessment* (Risk Assessment) in 2006 for the five mines assessed during the site investigation (Monumental, Cap Martin, Tillicum, Sheridan, and Central Mines). The following potential risks were described.

- **Human Health Risks:**
  - Current and future potential receptors were identified as hunters, hikers, and campers.
  - Arsenic and lead were identified as the soil/waste rock, sediment, and surface water non-carcinogenic COPCs.

  - No unacceptable non-carcinogenic health effects were anticipated under both the central tendency exposure and reasonable maximum exposure conditions.
  - Arsenic was the only carcinogenic COPC identified at the mines.
  - Carcinogenic risks were predicted from exposure to arsenic-impacted surface water and soil/waste rock under both the central tendency and the reasonable maximum exposure conditions at each of the mines.
  - The Monumental Mine had the highest arsenic concentrations and represented the highest level of human health risk.
  - No carcinogenic risks were predicted from exposure to sediment.
- **Ecological Risks:**
  - Ecological impacts were predicted for immobile species, primarily plants and terrestrial invertebrates, due to COPCs in soil and waste rock.
  - Ecological impacts were also predicted for aquatic life and wildlife exposed to COPCs in surface water and pore water. However, the lack of background data in 2006 made it more difficult to predict the potential for impacts.
  - Benthic invertebrates and wildlife appeared to have the potential to be impacted by total arsenic, cadmium, and zinc, which were present at elevated concentrations at nearly all sediment sample locations.
  - The Monumental and Tillicum Mines had more locations with elevated COPC concentrations in soil/waste rock than the other mines and therefore represent the highest level of ecological risk.
  - Ecological “hot spots” are generally defined as concentrations greater than 10 times the ecological risk-based screening concentration. Multiple ecological hot spots were identified at each mine.

A cleanup concentration of 143 milligrams/kilogram (mg/kg) for arsenic was calculated as part of the risk assessment. CES recommended an EE/CA be prepared, and a data gap investigation be conducted. Following the 2006 risk assessment, the USDA Forest Service added four additional mines to the Site (GC-5, GC-6, GC-7, and the Golden Fraction Mine).

2.6.4 Additional Abbreviated Preliminary Assessments - 2006

In August 2006, the USDA Forest Service conducted abbreviated preliminary assessments on the Golden Fraction, Central, Cap Martin, Granite Creek #5, Granite Creek #6, and Granite Creek #7 Mines (USDA Forest Service 2006a–2006f). The assessments included the collection of in situ soil samples using an XRF device; cataloging mine features, location, and access; and recommendations for further action. The Upper Central and Granite Creek #6 Mines were ranked low priority for further assessment (USDA Forest Service 2006b, 2006e). The Golden Fraction, Cap Martin, Granite Creek #5, and Granite Creek #7 Mines were ranked as high priority for further assessment (USDA Forest Service 2006a, 2006c, 2006d, 2006f).

2.6.5 EE/CA Data Gap Investigation – 2007

In June 2007, CES conducted a data gap investigation to fill the data gaps identified in its 2006 risk assessment. The objective of the investigation was to:

- Verify previously identified hazardous substances, mining features, and waste volumes at the Central, Sheridan, Tillicum, Cap Martin, and Monumental Mines;
- Inspect the new mines (Granite Creek #5, Granite Creek #6, Granite Creek #7, and the Golden Fraction Mines) and collect waste rock, soil, and water samples;
- Collect three background sediment, surface water, and pore water samples from Granite Creek, and four streambank/floodplain sediment samples;
- Collect background soil samples within the upper Granite Creek Watershed;
- Assess each mine for alternatives for the EE/CA (i.e., access, repository locations, etc.); and
- Develop human health and ecological risk assessment updates based on the new data collected.

2.6.6 Supplemental Data Gap Investigation at the Monumental Mine – 2009

In September 2009, CES completed an additional data gap investigation at Monumental Mine, which included the following activities:

- Adit and spring sampling to characterize the quality and flow rate for potential water diversion during and after the removal action;
- Additional topographic survey of waste rock piles, tailings, and pertinent features for accurate volume estimation;
- Detailed field screening of waste rock and tailings with an XRF to guide additional sampling and analysis activities;
- Collection of waste rock and tailings samples for laboratory analysis for total metals, synthetic precipitation leaching procedure (SPLP), and toxicity characteristic leaching procedure (TCLP) metals; and
- A wetland delineation of the upper and middle settling ponds for possible mitigation activities.

2.6.7 Wetland Delineation Report – 2011

The results of the 2009 wetland delineation were described in CES' 2011 *Wetland Delineation Report*. The report describes the delineation of one approximately 0.08-acre wetland at the Monumental Mine. Proposed remedial activity would potentially include the removal of tailings within the wetland and potential destruction of a 0.04-acre portion of the wetland. CES recommended that this potential wetland destruction be mitigated by restoration or creation of 0.04 to 0.06 acres of wetland to compensate for potential wetland removal. The wetland delineation was included as Appendix B to CES' 2011 EE/CA and is included as Appendix A to this report.

2.6.8 Human Health and Ecological Risk Assessment – 2011

CES conducted an update of its 2006 risk assessment to include additional data collected at the original five mines and data from Golden Fraction Mine and Granite Creek #5 through 7 Mines (CES 2011c). The 2011 risk assessment had similar conclusions to the 2006 assessment—notably that arsenic was the only COPC with human-health risk for ingestion and dermal contact above the standard of $1x10^{-6}$, and that arsenic, cadmium, and zinc had elevated concentrations in sediments that could be indicative of mine-related impact to ecological receptors. The 2011 risk assessment report was included as Appendix C to CES' 2011 EE/CA and is included as Appendix C to this report.

2.6.9 Non-Time-Critical Removal Action EE/CA – 2011

In 2011, CES prepared an EE/CA for completing a non-time-critical removal action related to hazardous substances at the Site. The EE/CA presented alternatives, made comparative analysis between the alternatives, and recommended a preferred alternative based upon the comparative analysis of the alternatives with the goal of "minimizing or eliminate any release or threat of release of a hazardous substance into the environment or impact on public health and welfare." The proposed removal action aimed to achieve cleanup of site-related hazardous substances to acceptable levels of risk to humans and the environment.

Four alternatives were evaluated and compared as potential removal actions:

- Alternative 1: No Action ($0)
- Alternative 2: On-site Containment ($499,000)
- Alternative 3: Excavation and On-site Containment/Disposal in Repository ($903,000)
- Alternative 4: Excavation and Off-site Disposal ($6,155,000)

A combination of Alternatives 1, 2, and 3 were recommended by CES as the most appropriate, effective, and cost-effective alternatives. The total cost to implement this recommended blended alternative was $691,000. Most of the cost was related to removal action at Monumental Mine .

On-site waste rock contouring with the surrounding terrain, covering with unimpacted soil, and revegetation was recommended for the Golden Fraction (Middle)/Central Mines and Upper Granite Creek Near Station GC-03 due to elevated arsenic concentrations approaching or exceeding the calculated cleanup level, and accessibility of the Central Mine to the public.

No action was recommended for the Golden Fraction, Cap Martin, Sheridan, Tillicum, Granite Creek #5, Granite Creek #6, and Granite Creek #7 Mines due to concentrations of arsenic in waste rock piles at or well below the cleanup level, and limited access to the public.

2.6.10 Supplemental Sampling Investigation – 2024

In October 2024, Terraphase collected additional XRF and analytical data, as described in the *Supplemental Site Investigation Report* provided as Appendix B. Each mine feature was mapped (Figures 3 through 14) as part of the investigation. Waste rock pile volumes were recalculated based on updated mapping using a LiDAR-derived digital elevation model. PRGs of 190 and 110 mg/kg for waste rock and tailings, respectively, were calculated for arsenic based on an updated human health risk calculation using the results of in-vitro bioavailability sampling. Ninety-five percent upper confidence limits (UCLs) on the mean (UCLMs) were calculated for each waste rock and tailings pile. Figures 3 through 14 shade each waste rock pile based on a comparison between calculated UCLMs and the updated arsenic PRG.

2.6.11 Previous Cleanup Response Actions

To date there have been no actions to control or treat site-related contaminants. The 2011 EE/CA was never formally accepted.

2.7 Chemicals of Potential Concern

Based on the environmental investigations conducted to date, COPCs for the Site are the metals antimony, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, selenium, silver, thallium, vanadium, and zinc. These metals exceed one or more screening criteria in at least one medium (soil, sediment, surface water; Tables 1 through 3). Arsenic is considered the main driver for human health risk (Section 2.8), and the primary COPC for the Site. The presence of metals above screening criteria is either due to naturally elevated background concentrations or the concentration of these metals during processing of mine-related waste rock and tailings. Background soil samples collected during investigations in 2003 and 2007 indicated concentrations of arsenic, barium, cadmium, chromium, copper, manganese, mercury, nickel, selenium, thallium, vanadium, and zinc above one or more screening criteria. Regional background concentrations for antimony, arsenic, barium, beryllium, cadmium, chromium, copper, lead, manganese, mercury, nickel, selenium, vanadium, and zinc also exceed one or more screening criteria (Oregon Department of Environmental Quality [ODEQ] 2019). The following subsections provide a description of the extent and potential transport mechanisms of COPCs in soil, sediment, surface water, pore water, groundwater, and air at the Site.

2.7.1 Soil

COPCs are present in soil above site-specific and regional background concentrations in waste rock piles, tailings piles, and in soil adjacent to the piles. COPCs that exceed local and regional background concentrations in one or more sample at each Site mine are as follows (Table 1):

- Monumental Mine: antimony, arsenic, cadmium, copper, lead, mercury, selenium, silver, and zinc
- Cap Martin Mine: antimony, arsenic, cadmium, lead, silver, and zinc
- Sheridan Mine: antimony, arsenic, and silver
- Granite Creek #6 Mine: arsenic
- Granite Creek #7 Mine: antimony, arsenic, cadmium, and silver
- Tillicum Mine: antimony, arsenic, cadmium, lead, selenium, silver, and zinc
- Granite Creek # 5 Mine: antimony, arsenic, cadmium, lead, silver, and zinc
- Golden Fraction Mine: antimony, arsenic, cadmium, lead, selenium, silver, and zinc
- Central Mine: antimony, arsenic, cadmium, lead, selenium, silver, and zinc

The highest concentrations of COPCs are in Monumental Mine waste rock and tailings piles. The highest detected concentration of arsenic (excluding XRF measurements) was 14,000 mg/kg in a sample from Upper Monumental Mine waste rock pile B, which is several orders of magnitude higher than the highest local background arsenic concentration (43.5 mg/kg).

Soil can be transported by erosion of the waste rock and tailings piles by precipitation or wind. Incidental transport can also occur by erosion caused by animals walking along the piles and by uprooting soil by the root systems of falling trees. Erosion is likely most pronounced via surface water runoff in periods of high precipitation and snowmelt. However, samples collected immediately downslope of waste rock piles in native soil generally had much lower arsenic concentrations than the associated waste rock pile. Samples collected by Terraphase, labeled "-DS," were collected within 10 feet of the edge of a waste rock pile with the same sample nomenclature. For example, sample UMM-WRA-1-DS (arsenic concentration 37.5 mg/kg) was collected within 10 feet of Upper Monumental Mine waste rock pile A, close to sample UMM-WRA-1 (arsenic concentration 1,300 mg/kg). This suggests that surficial erosion of the piles is relatively minor and that the piles are stable.[7]

COPCs can also leach from soil and enter shallow groundwater or surface water. Acid-base accounting (ABA) was analyzed on 28 waste rock, tailings, and soil samples. The acid-base potential (ABP) is the result of the acid neutralizing potential minus the acid generating potential. A negative ABP indicates that the acid generating potential is greater than the acid neutralizing potential; thus, the material has the potential to produce acid rock drainage (ARD). ABP's ranged from -20 (Lower Monumental Mine crusher) to 98 (Upper Monumental Mine waste rock pile) tons of calcium carbonate to neutralize a kiloton of waste (tCaCO3/Kt). Generally, ABP values below -20 tCaCO3/Kt indicate a strong potential for ARD and values above +20 tCaCO3/Kt indicate that material is unlikely to form ARD. Most of the sample results were between -20 and 20 tCaCO3/Kt, which indicates an uncertain result. The most negative ABP, and therefore the most likely sample to produce ARD, was collected at the Lower Monumental Mine tailings pile A, near the former crusher. Other samples collected from tailings piles also had negative ABP values. Samples collected from the Upper and Lower Monumental Mine tailings piles had the lowest pH (3.1–4.6), which is consistent with a higher propensity for ARD.

Thirty waste rock, tailings, and soil samples were submitted for TCLP and SPLP analyses for the eight Resource Conservation Recovery Act regulated constituents (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver). There are no applicable standards for SPLP; however, the results can be compared to Resource Conservation Recovery Act TCLP disposal limits. No waste rock samples had TCLP or SPLP extracts exceeding the TCLP limits. However, samples collected from Upper Monumental Mine tailings pile A had TCLP and SPLP arsenic results with concentrations of 15.6 and 9.4 milligrams per liter (mg/L), respectively, and a sample collected from Upper Monumental Mine tailings pile B contained a

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[7] One notable exception is at Tillicum Mine's waste rock pile A (Figure 11), which is on a steep slope close to Granite Creek. The arsenic UCLM based on XRF measurements at sample location TL-WRA-1 was 175.2 parts per million (ppm; duplicate measurement UCLM for this sample was 182.5 ppm). Samples collected downslope of this sample location, closer to Granite Creek, had XRF-derived arsenic UCLMs of 185.7 (sample location TL-WRA-1-DS) and 187.2 (sample location TL-WRA-1-DS-2) ppm. Laboratory analytical arsenic concentration from sample location TL-WRA-1-DS-2 was 267 mg/kg, which is higher than the associated waste rock sample. The difference for this waste rock pile is likely the proximity to Granite Creek.

TCLP arsenic result at a concentration of 8.5 mg/L. The USEPA TCLP regulatory threshold for arsenic is 5.0 mg/L. The exceedances of TCLP thresholds for tailings but not waste rock are consistent with the ABA results, suggesting that tailings are more likely to contribute contaminant loading to surface water than waste rock.

2.7.2 Sediment

Contribution of COPCs from the Site in Granite Creek sediment were evaluated relative to sediment samples collected upstream (Table 2). Arsenic, lead, silver, and zinc concentrations increase from upstream to downstream sediment sample locations, which shows the cumulative effect of the Site mines. However, sediment COPC concentrations are much less than soil COPC concentrations. The highest sediment sample arsenic concentration collected by CES from Granite Creek upstream of the confluence with Lucas Gulch was 127 mg/kg. The highest arsenic concentration in sediment samples collected by Terraphase was 35.2 mg/kg in the furthest downstream sample. Samples collected from Lucas Gulch had arsenic concentrations up to 303 mg/kg; however, these concentrations reflect contribution from other sources (East Eddie group and Ajax Magnolia Mine Complex). A UCLM for arsenic of 27.1 mg/kg was calculated for Granite Creek sediment samples upstream of Lucas Gulch after removing the 127 mg/kg outlier. This value is similar to background soil arsenic concentrations.

Sediment with elevated COPCs is derived from down-slope erosion of waste rock piles and tailings from the Site mines. Once deposited as sediment, COPCs migrate with flowing surface water. Deposition of sediment is expected in areas protected by rocks and trees, and in sand bars and other stream depositional features in areas of lower velocity water. The low concentrations of arsenic in sediment supports the lack of significant erosion from and stability of the waste rock piles.

2.7.3 Surface Water

Similar to sediment, COPCs in surface water generally increase with distance from upstream to downstream of the Site (Table 3). Concentrations of antimony, arsenic, lead, and zinc are higher in downstream samples relative to upstream samples. However, nearly all Granite Creek surface water sample concentrations were below the most conservative screening levels. Samples collected from Lucas Gulch, further downstream from the Site, had detections of mercury above screening levels, though this is due to the contribution of other sources. Surface water quality is likely worse during high precipitation events and snowmelt, as these conditions would be expected to increase turbidity and COPCs within suspended solids.

Surface water samples have also been collected from adit seeps, springs, and ponds. Samples were collected at Monumental Mine (springs, adit seeps, settling ponds), Granite Creek #5 Mine (seep/spring), Golden Fraction Mine (adit seep), and Cap Martin Mine (adit seep). Table 3 summarizes the data and highlights concentrations exceeding ecological screening criteria. Concentrations of arsenic in surface water from these samples are between one and three orders of magnitude higher than concentrations in the furthest upstream Granite Creek samples. Samples from surface water features at Upper and Lower Monumental Mines have the highest COPC concentrations. The surface water bodies present in these areas drain through Cap Martin Gulch and enter Granite Creek between Sheridan and Granite Creek #6/#7 Mines. Arsenic concentrations in Granite Creek surface water have the largest increase between samples upstream and downstream of the confluence of Cap Martin Creek and Granite Creek. This suggests that the highest contribution of contaminant loading to surface water is from Monumental Mine and the adit seeps and springs that flow across Monumental Mine waste rock piles and tailings. However, as discussed above, detections of COPCs in surface water samples within Granite Creek itself have been generally below ecological screening levels, suggesting that the relative contribution of flow from mine-related springs and seeps is not significant.

2.7.4 Groundwater

Shallow groundwater at the Site would be expected to discharge to Granite Creek via springs and seeps, and COPCs in groundwater would therefore be expected to be accounted for in surface water data. No drinking water wells are present at the Site. The closest well is more than 4 miles away in the town of Granite, Oregon, and is several hundred feet deep (CES 2011a). The drinking water pathway is considered incomplete, and the lack of groundwater data is not considered significant for the purposes of the EE/CA.

2.7.5 Air

No air samples were collected as part of environmental investigations at the Site. COPCs could be present in dust from waste rock piles and tailings, particularly if disturbed by humans or animals. However, no visible dust was observed during site investigation activities, and remedial action addressing COPCs in soil would address COPCs in dust; therefore, the lack of COPC data in air is not considered significant for the purposes of the EE/CA.

2.8 Risk Evaluation

As discussed in Section 2.7, human health and ecological risk assessments were completed for the Site in 2006 and updated in 2011 (CES 2006, 2011c). The 2011 risk assessment is included as Appendix C. The following subsections summarize the results of the risk assessment.

2.8.1 Human Health

The following human health exposure pathways were identified for the Site:

- Dermal contact of soil/waste rock
- Incidental ingestion of soil/waste rock
- Inhalation of soil/waste rock (dust)
- Dermal contact with sediment
- Incidental ingestion of sediment
- Dermal contact with surface water
- Incidental ingestion of surface water

These pathways were considered complete for hikers, campers, and hunters—the recreator or trespasser receptors (CES 2011c).

CES compared media-specific cumulative cancer risks and hazard indices to a cumulative cancer risk of 1×10^{-6} and noncancer HI of 1, respectively, to help determine whether remedial action is warranted for a particular media at a particular area of the Site. These risk management goals are equivalent to those used by ODEQ for risk assessment decision making (ODEQ 2020).

CES estimated that potential receptor exposure to arsenic in soil at the Site could result in noncancer hazard indices greater than 1. Similarly, CES estimated that potential receptor exposure to arsenic in soil at the Site could result in cumulative cancer risk greater than 1×10^{-6}.

CES conducted a hot spot evaluation and determined that no hot spots were present at the Site with consideration for human health exposure. Hot spots were identified by CES as those locations exhibiting cumulative cancer risks greater than 1×10^{-4} in accordance with ODEQ guidance (2010). Arsenic concentrations in soil greater than 14,330 mg/kg would result in cancer risk estimates greater than this threshold. Since the 2011 risk assessment update, Terraphase measured arsenic concentrations using XRF that exceeded this threshold at Monumental Mine (Appendix B, Table 1).

CES calculated a PRG for arsenic of 143 mg/kg. Terraphase developed updated PRGs in the 2024 *Sampling and Analysis Plan* for antimony, arsenic, beryllium, cadmium, cobalt, copper, mercury, nickel, selenium, silver, and vanadium (Table 1). Only arsenic concentrations exceeded Terraphase PRGs. Using relative bioavailability data generated via the 2024 sampling, Terraphase recalculated arsenic PRGs of 190 and 110 mg/kg for soil/waste rock and tailings, respectively (Appendix B).

2.8.2 Ecological

Ecological receptors at the Site include birds, mammals, plants, amphibians, reptiles, and invertebrates that inhabit upland terrestrial areas, the on-site wetland areas, and within or adjacent to Granite Creek and its tributaries. Cap Martin Creek supports a native population of redband trout. Middle Columbia River Steelhead have summer spawning and rearing habitat near the confluence of Granite Creek and Cap Martin Creek, and Bull Trout have been observed in Granite Creek as far upstream as the Cap Martin Mine (CES 2011a).

Plants roots may absorb contaminants from upland or wetland soil or surface water. Animals may be exposed to contaminants in shallow (surface) soils and surface water via direct contact and incidental or intentional ingestion. Animals may also consume mercury and lead that readily accumulate in the tissues of plants and animals.

COPCs with unacceptable risk ratios for ecological receptors included antimony, arsenic, iron, lead, manganese, mercury, silver, vanadium, and zinc for soil/waste rock; arsenic, cadmium, selenium, and zinc for sediment; and barium for surface water/pore water. Additional COPCs were retained for risk evaluation due to bioaccumulation potential, a lack of screening criteria to calculate risk ratios, or elevated reporting limits.

Based on COPCs with concentrations greater than 10 times the screening criteria or background concentrations, CES identified ecological hot spots in soil/waste rock at Monumental Mine, Cap Martin Mine, Golden Fraction Mine, Tillicum Mine, Granite Creek #7 Mine, and Granite Creek Aquatic Station 03; in surface water at Monumental Mine springs and settling ponds; at the Cap Martin Mine adit seep;

in Granite Creek water samples collected near the Sheridan, Tillicum, Central, and Cap Martin Mines; and in Granite Creek porewater near the Tillicum and Central Mines.

Predicted risk from soil/waste rock to ecological receptors were primarily due to arsenic but antimony, lead, mercury, silver, and zinc also contributed to total risk. Plants, immobile invertebrates, and individual birds or small mammals living on or adjacent to waste rock piles were considered at risk; however, population level impacts were not expected considering the relatively small footprint of waste rock piles compared to the home-ranges of identified species.

No PRGs were calculated based on ecological risk; however, remedial action taken to reduce human health risk will also reduce ecological risk.

3 Potential Applicable or Relevant and Appropriate Requirements

ARARs include standards, requirements, criteria, or limitations under federal or more stringent state environmental law (CERCLA § 121(d)(2)(A)) that should be considered at the Site.[8] To be adopted as an ARAR, the requirement is either "applicable" to conditions at the Site or if not applicable the requirement is both "relevant" and "appropriate" based on Site conditions. Applicable requirements are defined by 40 CFR § 300.5 as those requirements "that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site."[9] That is, they are laws and regulations that would be enforceable at a particular site even if a CERCLA response action was not occurring. Relevant and appropriate requirements are defined as those requirements "that, while not 'applicable' to a hazardous substance, pollutant, contaminant, remedial action location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their uses are well suited to the particular site." In addition to being applicable or relevant and appropriate, ARARs must be substantive, rather than administrative, and promulgated. It is necessary to identify ARARs prior to evaluating and selecting a cleanup action since circumstances may arise where non-time-critical removal action is expected to be the first and final action at the Site and therefore, the selected removal action must satisfy all adopted ARARs.

ARARs are classified into the three following categories:

- **Chemical-specific** ARARs that address specific hazardous substances and are typically health or risk-based numerical values that cleanups must achieve.
- **Location-specific** ARARs that place restrictions on the concentration of hazardous substances or the conduct of activities solely because the response actions occur in the specific location.

[8] https://www.epa.gov/superfund/applicable-or-relevant-and-appropriate-requirements-arars

[9] "Definitions." 40 CFR § 300.5, https://www.ecfr.gov/current/title-40/chapter-I/subchapter-J/part-300/subpart-A/section-300.5.

- **Action-specific** ARARs are typically technology or activity-based requirements or limitations on actions taken with respect to specific hazardous substances.

Other factors "to be considered" are non-promulgated criteria, advisories, guidance, and proposed standards issued by federal or state governments. These factors are not enforceable and a response action is not required to attain them; however, these factors may be appropriate in shaping or guiding the development or implementation of a response action in certain circumstances; for example, where ARARs do not provide sufficient direction.

Tables 4 through 6 evaluate ARARs for applicability to the Site. Potential ARARs are grouped as federal or state of Oregon potential ARARs; no specific local potential ARARs were identified. Potential ARARs are identified by a statutory or regulatory citation, followed by a brief explanation of the potential ARAR, and whether the potential ARAR is (1) "potentially applicable," (2) "potentially relevant and appropriate," or (3) "to be considered." In accordance with § 121(e) of CERCLA, no permits are required for an on-site removal action. However, as discussed above, substantive requirements, which a permit might otherwise address, must be met to the extent practicable. Key ARARs are discussed below.

3.1.1 Chemical-Specific ARARs

ODEQ allows for the calculation of risk-based cleanup levels for human and ecological receptors. As discussed in Section 2.9, human health PRGs were calculated for the Site. However, although ecological risk assessments were completed, no ecological cleanup levels have been calculated, therefore the following ARARs are considered for the evaluation of ecological risk:

- National recommended water quality criteria (Section 304(a) of the Clean Water Act [33 USC § 1314])[10]
- Oregon water quality standards (OAR 340-41, Table 20)[11]
- Federal freshwater sediment standards, threshold effects level and probably effects level, as outlined in the National Oceanic and Atmospheric Administration 2008 *Screening Quick Reference Tables*[12]

3.1.2 Action-Specific ARARs-

The solid waste disposal ARARs establish the performance standards for proper handling and disposal of solid waste; outline responsibilities of various entities and stakeholders; and outline requirements for solid waste handling facility location, design, construction, operation, and closure. All substantive requirements for closure and post-closure of non-municipal landfills (OAR 340-95) are potential ARARs,

[10] "Information and guidelines," 33 USC § 1314, https://uscode.house.gov/USC-prelim-title33-section1314.

[11] "Water Quality Standards: Beneficial Uses, Policies, and Criteria for Oregon," OAR 340-41, https://secure.sos.state.or.us/oard/340-41.

[12] https://repository.library.noaa.gov/view/noaa/9327

particularly if a repository is constructed.[13] Additional requirements would be triggered if the repository were to store hazardous waste (ORS 466).[14] Hazardous waste transportation requirements are also potential ARARs.

3.1.3 Location-Specific ARARs

Portions of the Northwest Forest Plan are potentially key ARARs for assessing Site removal action alternatives.[15] The Northwest Forest Plan includes standards and guidelines that are potentially relevant and appropriate to actions at the Site, including activities within or that affect riparian management areas. These standards and guidelines control the design, construction, and use of temporary and permanent roads and other modifications within riparian reserves. In addition, the standards control solid waste and mine waste facilities within riparian reserves.

The following ecological ARARs are considered key in planning and executing the removal action:

- Endangered Species Act of 1973 (16 USC §§ 1531(h)-1543)[16]
- Section 404 of the Clean Water Act (33 CFR 330) and Executive Order Number 11990 – Protection of Wetlands (40 CFR § 6.302(a) and Appendix A)[17]
- Executive Order Number 119988 – Floodplain Management (40 CFR § 6.302(g) and Appendix A)
- Oregon Wildlife Diversity Program and Plant Protection (OAR 635- 100)[18]

Key potential historic and cultural ARARs, which may be applicable during removal action, at and around historic mine infrastructure are:

- National Historic Preservation Act (16 USC § 470)[19]
- Historic Site, Buildings, Objects, and Antiquities Act (16 USC §§ 461-467)[20]

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[13] "Solid Waste: Land Disposal Sites Other Than Municipal Solid Waste Landfills," OAR 340-95, https://secure.sos.state.or.us/oard/340-95.

[14] "Chapter 466—Hazardous Waste and Hazardous Materials II," OAR 466, https://www.oregonlegislature.gov/bills_laws/ors/ors466.html.

[15] https://www.fs.usda.gov/detail/r5/landmanagement/planning/,

[16] "Endangered Species," 16 USC §§ 1531(h)-1543, https://uscode.house.gov/title16/chapter35.

[17] "Part 330--Nationwide Permit Program," 33 CFR 330, https://www.ecfr.gov/current/title-33/chapter-II/part-330
""Responsible official requirements," 40 CFR § 6.302, https://www.ecfr.gov/current/title-40/chapter-I/subchapter-A/part-6/subpart-C/section-6.302.

[18] "Wildlife Management Plans: Wildlife Diversity Plan," OAR 635-100, https://oregon.public.law/rules/oar_chapter_635_division_100.

[19] "Short title; Congressional finding and declaration of policy," 16 USC § 470, https://uscode.house.gov/USC-2007-title16-section470.

[20] "Chapter 1A—Historic Sites, Buildings, Objects, and Antiquities," 16 USC §§ 461-467, https://uscode.house.gov/USC-2000-title16-chapter1A.

- Archeological and Historic Preservation Act (16 USC § 469)[21]

4 Removal Action Goals and Objectives

RAOs are specific goals for protection of human health and the environment that identify response actions to adequately address human health and ecological risks. RAOs for the Site are:

- Protection of human health by minimizing exposure and hazards to receptors.
- Reduction of possible mobilization of hazardous substances.
- Compliance with ARARs.

4.1 RG Selection

RGs are selected with consideration for the risk-based PRGs discussed in Section 2.9, ARAR-specific PRGs noted in Section 3, and background concentrations for naturally occurring COPCs. The calculated PRGs are considered the most appropriate RGs as they represent a more realistic exposure scenario than generic ARAR-specific PRGs and incorporate background metals concentrations in their calculation. PRGs are listed in Table 1. For arsenic, the PRGs of 190 and 110 mg/kg are selected as RGs for soil/waste rock and tailings, respectively. The difference between these media is the results of bioavailability testing and is likely due to differences in grain size and processing mechanism between waste rock and tailings. As arsenic is the only contributor for human health risk, and the primary driver for ecological risk, removal action that reduces exposure of arsenic to below the RGs will achieve the RAOs. As there are no surface water or sediment risks to human health, no RGs are considered for these media.

4.2 Scope of the Removal Action

The scope of the removal action is to remove or cover tailings or waste rock piles exceeding RGs to the extent practicable and to mitigate Site physical hazards.

4.3 Removal Action Schedule

It is highly recommended that the removal action be implemented within a few years of completion and approval of this EE/CA. If the removal action is done in phases, the most time-sensitive action would be removal of tailings piles from the Upper and Lower Monumental Mines as tailings are more bioavailable than waste rock. The tailings are in areas of historical significance and would be expected to attract more recreational visitors. The tailings are at or near Cap Martin Creek, which provides contaminant load to Granite Creek.

[21] "Preservation of historical and archeological data threatened by dam construction or alterations of terrain," 16 USC § 469, https://uscode.house.gov/USC-1999-title16-section469.

5 Identification and Analysis of Removal Action Alternatives

The purpose of this section is to present the removal action alternatives proposed to achieve the RAOs identified in Section 4. The selected removal action must meet the RAOs and comply with ARARs. The identified potential remedial technologies and process options were preliminarily screened according to their overall applicability (technical implementability). The purpose of this screening effort is to evaluate the available technologies and process options and to eliminate those not applicable to the Site. The following potential remedial technologies were evaluated through a preliminary screening, as follows:

- **No Action.** No action leaves contaminated materials in their current condition and assumes no further remedial activities will occur. No monitoring is associated with this approach.

  Preliminary Screening Evaluation. Consistent with the NCP and CERCLA guidance, a no action alternative is retained for further evaluation as a baseline for comparison to other remedial alternatives developed.

- **Institutional Controls (ICs).** ICs restrict access to or control the use of the Site (e.g., zoning, deed restrictions, environmental easements, or access restrictions). Enforcement of ICs can require periodic inspections and patrols, training for USDA Forest Service personnel required to access the restricted areas, maintaining physical barriers (e.g., signage, gates, and fencing), and potentially legal action against trespassers.

  Preliminary Screening Evaluation. ICs at the Site could include land use controls or physical barriers. Establishing restricted legal use of the Site is not likely to achieve a reduction in human health risk without security or other enforcement to ensure the legal restrictions are adhered to. Given the remote nature of the Site, this is not feasible and trespassers would still be able to access the waste rock piles and other Site features with elevated COPCs. Adding physical barriers around areas with elevated COPCs could temporarily reduce exposure to trespassers but would require frequent maintenance against vandalism. Placing barriers over open holes and shafts could reduce the potential for falling in these features. None of these ICs would reduce the risk of COPCs to ecological receptors. Of the ICs, barricading open holes and shafts was retained as a common item.

- **Engineering Controls (ECs).** ECs refer to physical modifications or installations designed to mitigate or eliminate exposure to hazardous substances, reduce risks to human health and the environment, or manage contaminant migration. Containment is a type of EC used to reduce the mobility of and exposure to COPCs in soils. These goals are accomplished by creating a barrier that prevents direct exposure and transport of surface soil through erosion. ECs do not reduce the volume or toxicity of the hazardous material. Containment barriers could consist of imported topsoil, asphalt/concrete, local soil, geotextile fabrics, or an engineered clay cap.

  Other potential engineering controls that could work in parallel with containment include regrading, installing piping to reroute surface water runoff, consolidating waste rock piles, revegetating after capping, and using waste rock to block access to physical hazards.

Preliminary Screening Evaluation. The primary risk drivers for arsenic are dermal contact and ingestion. If implemented appropriately, containment using a surface cap would reduce these risks and help achieve RAOs. Of the potential caps, using soil or rock obtained from unimpacted areas proximal to the Site mines or from a nearby quarry is the most feasible from a cost and implementability standpoint. On-site containment is retained for further evaluation. Other ECs are also retained, as suitable, for a particular mine site.

- **Treatment.** According to the Federal Remediation Technologies Roundtable Remediation Technologies Screening Matrix and Reference Guide 4.0,[22] potentially applicable treatment technologies for metals in soil include in-situ solidification/stabilization or ex-situ physical or chemical treatment. Available ex-situ physical/chemical treatment technologies for metals in soil include chemical extraction, chemical reduction/oxidation, separation, soil washing followed by precipitation, and solidification/stabilization. Another possible treatment technology would require off-site reprocessing of the waste rock at an operating mill or smelter.

  Preliminary Screening Evaluation. The large quantity of soil above RGs, combined with the steep embankments, difficult access, and the absence of suitable areas to install treatment equipment, make in-situ and ex-situ treatment options less favorable and more costly compared to other available technologies; therefore, treatment technologies have not been retained for further evaluation.

- **Excavation and Disposal in an On-site Repository.** Excavation and disposal in an on-site repository would involve removing tailings and waste rock piles with concentration above RGs and placing the piles at a designated repository at or near the Site. Excavated areas are backfilled with clean soil, returned to original grade, if necessary, and revegetated or otherwise stabilized to prevent erosion. A repository would need to be prepared by grubbing and scraping vegetation, digging to a depth that would ensure a stable slope once filled, covering with clean soil, and revegetating. The presence of an on-site repository would require maintenance and inspection, and potential liability as it would retain the hazardous substances on forest service property in perpetuity.

  Preliminary Screening Evaluation. Excavating soil above RGs is a feasible remedial strategy although site-specific conditions, such as the presence of steep slopes, existing structures and retaining walls, and sensitive ecological receptors at the Site would require special consideration to comply with ARARs. It would eliminate on-site exposure to COPCs and reduce contaminant loading to Cap Martin and Granite Creeks. Construction of an on-site repository is possible in the relatively flat area at the crest of the hill at Upper-Upper Monumental Mine. This option is retained for further evaluation.

- **Excavation and Disposal in an Off-site Repository.** Excavation and off-site disposal involve removal of contaminated soil and subsequent off-site disposal in a landfill licensed to accept the waste. Excavated areas are backfilled with clean soil, returned to original grade, if necessary, and revegetated or otherwise stabilized to prevent erosion. Excavated soil would be stockpiled at an on-site staging area for waste characterization or would be characterized in situ to facilitate direct loading of soil into trucks. Excavated soil would be transported off Site to an appropriate disposal

[22] http://www.frtr.gov/matrix2/top_page.html

facility. Some soil failed the TCLP hazardous waste criteria, and it may be necessary to dispose this soil at a Subtitle C facility.

Preliminary Screening Evaluation. Excavation of soil at the Site is implementable although site-specific conditions, such as the presence of steep slopes, existing structures and retaining walls, and sensitive ecological receptors at the Site would require special consideration to comply with ARARs. Off-site disposal would have less long-term liability and would achieve RAOs. However, if disposal at a Subtitle C facility would be required for all waste rock and tailing piles, the cost could be prohibitive. Excavation and off-site disposal are retained for further evaluation.

Remedial alternatives were developed using the remedial technologies retained following the initial screening. Each alternative is described in the following subsections. Cost estimate details for each alternative are provided in Tables 7 through 9. The costs were estimated using order-of-magnitude unit cost provided by a local remedial contractor, as well as methodologies prescribed by USEPA in cost estimating guidance for CERCLA sites (USEPA 2000).

5.1 Alternative 1: No Action

Consistent with the NCP and CERCLA guidance, a no action alternative is considered as a baseline for comparison. Under this alternative, no remedial action, monitoring, or maintenance would be performed. This alternative would not include a mechanism to prevent future exposure to contaminants and would fail to achieve the RAOs for the Site. If no action is taken, arsenic and other COPCs would continue to pose an unacceptable risk to human and ecological receptors for tailings and waste rock piles above RGs. The Sheridan and Granite Creek #7 Mines do not have waste rock piles above RGs; therefore, no action is appropriate for these mines and they are not discussed in sections outlining other alternatives. No action may also be appropriate in cases in which the benefit of the removal action is outweighed by the environmental damage that the removal action would cause.

5.2 Alternative 2: On-site Containment and Other ECs

On-site containment would consist of covering tailings and waste rock piles exceeding RGs with a minimum of 1 foot of clean soil. The lower 6 inches would be machine compacted, and the upper 6 inches would be loosely applied to better promote root development. Prior to placement, piles with slopes greater than a three to one horizontal to vertical ratio would be regraded to the extent practicable. All covered waste material would be revegetated to the satisfaction of the USDA Forest Service. CES proposed revegetation using weed-free WoodStraw mulch, a seed mix based on USDA Forest Service consultation, and a fertilizer consisting of 16 percent total nitrogen, 16 percent available phosphoric acid, 16 percent total water-soluble potash, and 5 percent sulfur applied at the rate of 400 pounds per acre (CES 2011a). However, the final revegetation protocol should be specified in the remedial design documents. During regrading and application of soil cover, berms, channels, or ditches for conveying stormwater and snowmelt should be constructed at the upgradient side of the piles to reduce erosion. Individual grading and water conveyance ECs are described for each Site mine in the following subsections.

For Site mines at which a local source of suitable clean cover soil cannot be identified, cover soil can be obtained from the location of the on-site repository discussed in Alternative 3 (Section 5.3). CES completed test pits at the Upper Granite Creek Saddle, 1 mile east of Monumental Mine on FS 7345. The test pits found ash and loam in the upper 2.5 feet below ground surface, underlain by weathered granite. The presence of vegetation within the proposed borrow area suggested that it would allow for revegetation after use as cover soil (CES 2011a). A closer potential repository and cover soil borrow location is the area adjacent to and southeast of Upper-Upper Monumental Mine. This area has relatively shallow topography closer to the Site and is accessible by road; however, additional engineering evaluation would be necessary to assess the suitability of soils in this area during the remedial design.

Roads would require improvement to facilitate haul trucks and construction equipment, notably FS 7345 (for access to potential repository, Monumental Mine, Cap Martin Mine, and Granite Creek Aquatic Station 03 waste rock piles) and FS 280 (for access to Central, Golden Fraction, Granite Creek #5, and Tillicum Mines). Additional specific road improvements are discussed for each mine in the following subsections. After completion of the removal action, any temporary access roads would be decommissioned at USDA Forest Service's discretion to limit unauthorized vehicles. Decommissioning may consist of ripping the roads, revegetating, and recontouring for drainage, and blocking using large boulders, trees, or tank ditches.

During construction, water will be applied to prevent fugitive dust emissions. The remedial contractor could potentially withdraw water for this purpose from Site surface water features, with USDA Forest Service's permission.

5.2.1 Monumental Mine

The following subsections describe on-site containment at Monumental Mine areas.

5.2.1.1 Upper-Upper Monumental Mine

Waste rock piles A, D, and F at Upper-Upper Monumental Mine (395, 10, and 10 cy, respectively) exceed RGs. Waste rock piles B, C, and E (5, 5, and 5 cy, respectively) are below RGs, and waste rock piles G, H, I, and J (10, 25, 5, and 15 cy, respectively) have not been evaluated. Prior to implementation of the removal action, waste rock piles with no data should be assessed using an XRF device. Waste rock piles can be accessed via the unnamed roadway that connects to FS 7245 approximately 0.1 miles north of the area. The obstructions currently present at the road would need to be removed and the road graded to allow for a haul truck. Under Alternative 2, where practicable, piles can be spread to adjacent shafts and trenches, particularly those that are open or partially open and represent physical hazards. Any remaining waste rock should be graded and all waste rock covered using clean cover soil from the shallow topographic area to the southeast or from the borrow area at Granite Creek Saddle.

5.2.1.2 Upper Monumental Mine

All tailings and waste rock piles at Upper Monumental Mine exceed RGs. Under Alternative 2, Waste rock pile B (60 cy) can be pushed into the adjacent shaft, which will accommodate its volume, and graded to match surrounding topography after placement of cover material. Cover material could be obtained from the Upper-Upper Monumental Mine area or from the Granite Creek Saddle. Access to waste rock pile B would require improvement of approximately 0.25 miles of an unnamed road that splits from the Upper-Upper Monumental Mine's unnamed road close to FS 7345.

Waste rock pile A (7,905 cy) is the largest waste rock pile at the Site and is situated on a steep, heavily vegetated slope, which would make grading difficult. The thick forest adjacent to the pile would preclude the use of local cover material and require hauling from the Upper-Upper Monumental Mine area or from the Granite Creek Saddle. Grading at this pile would require the removal of several trees. A portion of waste rock pile A could be placed in the open adit to prevent passageway to this physical hazard and the rest graded and covered. The adit seep would be redirected around the side of the waste rock pile using a pipe or drainage ditch. The low flow of the seep would be expected to infiltrate into the native soil. Access to waste rock pile A would require improvement of approximately 0.25 miles of FS 025 as well as FS 7345.

On-site containment at the former mill site (tailings pile A, 125 cy) would require scraping the thin tailings into a well-graded pile and covering with local borrow material, potentially from material on the eastern side of the clearing that had much lower arsenic concentrations. Care would need to be taken to remove tailings from around the flotation table to maintain the integrity of this historical feature, which may necessitate the use of hand tools, vacuum devices, and engineering controls to avoid exposure to dust and fine particles. The work may be completed using a small excavator, which may be able to access the area from FS 025 or through one of the drainages from FS 7345.

Tailings pile B (305 cy) includes tailings at and surrounding the upper settling pond. Covering this material would necessitate redirecting the flow of Cap Martin Creek to the north and adding berms to ensure it did not recapture its existing drainage and remove the cover material. Grading would be required to allow for access downslope from FS 7345. Cover material may be identified in the immediate surrounding area or sourced from the Upper-Upper Monumental Mine area or from the Granite Creek Saddle.

Tailings pile C (10 cy) is at and surrounding the middle settling pond. Covering this material would necessitate redirecting the flow of Cap Martin Creek to the south and adding berms to ensure it did not erode the cover material. Access would be difficult but the small areal extent of the tailings pond could allow for the use of hand carried materials. Access is likely easiest from the unnamed roadway that leads to the Lower Monumental Mine.

5.2.1.3 Lower Monumental Mine

Lower Monumental Mine waste rock pile A (5,560 cubic yards) and tailings pile A are in a relatively flat area. Under Alternative 2, the over-steepened northeastern portion of waste rock pile A could be regraded to the north–northwest and across tailings pile A (180 cy) to the northeast, taking care not to bury or obscure the historically significant crusher. A portion of waste rock pile A could be placed in the open adit to prevent passageway to this physical hazard. Waste rock pile B (170 cubic yards) could be placed in the area in front of adit 3 and the rest appropriately graded downslope. Cover material could be sourced from the area to the east of the unnamed access road or to the south of waste rock pile A. Accessing this area would require improvement of approximately 0.25 miles of the unnamed road.

The seep emanating from adit 1 would be redirected via a pipe under the unnamed access road to the lower settling pond. The flow of Cap Martin Creek from the lower settling pond would be directed via rock-lined drainage ditch around the lower waste rock pile so it does not contact or erode the regraded, covered pile. Details of the water management would be included in the remedial design documents.

Preliminary XRF measurements of the “potential waste rock pile” depicted on Figure 5 indicated arsenic concentrations similar to background; however, additional evaluation of this feature should be conducted during remedial design.

5.2.2 Granite Creek Aquatic Station 03

Waste rock pile A (15 cy) is below RGs and requires no action. Waste rock pile B (80 cy), approximately 70 feet upstream of the intersection between Granite Creek and FS 720, has an arsenic UCLM above the RG. Under Alternative 2, the pile would be graded away from Granite Creek to the northeast. Waste rock pile A, which had arsenic concentrations similar to Site background, could potentially be used as a local cover source or material could be sourced from the Upper-Upper Monumental Mine area or the Granite Creek Saddle. Removal action at the waste rock pile would necessitate the improvement of approximately 0.3 miles of FS 720, in addition to FS 7345.

5.2.3 Cap Martin Mine

Waste rock piles A and B (370 and 10 cy, respectively) are less than RGs and would require no action. Under Alternative 2, waste rock pile C (735 cy) would be regraded and covered with local borrow material. The depression that separates the east and western portions of waste rock pile C, where adits 4, 5, and 6 are located, could be filled with material from the northernmost portion of the western half of the pile that forms a steep mound. Most of the pile is vegetated and would require tree removal prior to containment. Cover material would be identified in the immediate area and likely require additional tree removal. Access to Cap Martin Mine would require the installation of a new road. Although closer to FS 7345, it would be easier to build a road on the less steep slopes to the north of FS 720. This would require improvement of approximately 0.75 miles of FS 720, as well creating an approximately 0.25-mile new road.

5.2.4 Granite Creek #6 Mine

The wet trench pile (140 cy) is below RGs and requires no action. Waste rock pile A (45 cy) is above PRGs and Alternative 2 would involve regrading the over-steepened portion into the open adit. The pile is extensively vegetated and would require grubbing and scraping prior to regrading and capping. Cover material could be from the adjacent and larger wet trench pile, which had arsenic concentrations at or below background. Access to the Granite Creek #6 Mine would require building a new road, 0.3 miles along Granite Creek from Tillicum Mine on FS 280. If a road is built to access Cap Martin Mine, it may be easier to construct a road west along Granite Creek from Cap Martin Mine, although either scenario would require extensive regrading, grubbing, and scraping.

5.2.5 Tillicum Mine

Waste rock piles B and C (145 and 210 cy, respectively) are below RGs and would require no action. Waste rock pile A (205 cy), between FS 280 and Granite Creek, is above RGs. Under Alternative 2, waste rock pile A would be partially graded and pulled into the concave portion of the hillside downslope of adit 2. Most of the pile may fit within this area and the rest would be regraded to match the surrounding contours. No local cover material is available due to the steep slopes adjacent to the mine and Alternative 2 would likely require sourcing from the Upper-Upper Monumental Mine area, the Granite Creek Saddle, or other closer borrow area. Action at Tillicum Mine would require improvement of 0.75 miles of FS 280.

5.2.6 Granite Creek #5 Mine

Waste rock pile B (10 cy) is below RGs and would require no action. Waste rock pile A (285 cy) is above RGs. Under Alternative 2, waste rock pile A would be regraded to fill the collapsed adit. Waste rock downhill from FS 280 would be pulled away from Granite Creek and graded into the existing hillside. No local cover material is likely available due to the steep slopes adjacent to the mine and Alternative 2 would likely require sourcing from Upper Upper-Monumental Mine area or from the Granite Creek Saddle or other closer borrow area. Action at the Granite Creek #5 Mine would require improvement of 0.4 miles of FS 280.

5.2.7 Golden Fraction Mine

No action is necessary at waste rock piles B, C, or D (145, 295, and 1,105 cy, respectively) based on calculated UCLMs for these features. Under Alternative 2, waste rock pile A (295 cy) would be recontoured into the concave depression downslope of collapsed adit 3 and covered with clean borrow material. No immediately local cover material is likely available due to the steep slopes adjacent to the mine and this alternative would likely require sourcing from the Upper-Upper Monumental Mine area, from the Granite Creek Saddle, or other closer borrow area to be identified during remedial design. Access to this waste rock pile would be difficult due to the steep terrain and would likely require construction of a temporary road uphill to the pile from FS 280 as building a road from FS 7345 would likely put the road at risk of being undercut.

5.2.8 Central Mine

Waste rock piles B, C, and D (25, 105, and 25 cy, respectively) are less than RGs and would require no action. Under Alternative 2, material from waste rock pile A (80 cy) would be pulled up the slope away from Granite Creek into the concave topography at adit 1 and graded into the surrounding hillside. It is possible that a local source of cover material could be excavated from the hillside between FS 280 and Granite Creek. Waste rock pile A is densely vegetated and would require grubbing and scraping prior to regrading and cover. Access to this mine is from FS 280, close to where it meets FS 73, and would require minimal improvement. In the previous EE/CA, CES suggested removing a transite pipe identified at the mine by EA that may contain asbestos as part of the removal action. If the pipe is encountered during construction, it should be excavated, tested for asbestos, and removed from the Site.

5.3 Alternative 3: Excavation and On-site Disposal

Under this alternative, all waste material exceeding the RGs of 190 and 110 mg/kg total arsenic for waste rock and tailings, respectively, would be excavated and disposed in an on-site repository. CES proposed a repository be constructed at the proposed cover soil borrow area at the Granite Creek Saddle (2011a). Another potential location for a repository would be near the Upper-Upper Monumental Mine to the southeast of the mapped area. The repository would be excavated to a sufficient depth to allow for placement of material and for creation of a cap. The aerial extent of the repository will be dependent upon the volume of soil placed in the repository. ABA and TCLP results suggest that tailings have the possibility to leach contaminants and waste rock does not. Once material is mixed, additional TCLP and ABA testing could be completed to facilitate decision making. The necessity of lining or otherwise preventing toxic leachate should be evaluated during the remedial design. The repository will be constructed such that it does not exceed a three to one horizontal to vertical slope ratio to prevent erosion. Material placed in the repository would be compacted in 6-inch lifts. The repository would be capped with 1 foot of clean excavated borrow material stockpiled during its construction. The bottom 6 inches of the cap would be compacted and the upper 6 inches placed loosely to help develop root formation. The cap would be vegetated to USDA Forest Service specifications. Similar to the contained piles, berms and channels will be constructed to prevent stormwater and precipitation run-on.

In either location, the repository would be constructed beyond accessible roadways and require partial road construction/improvement. After the repository is constructed, the access road would be blocked to prevent unauthorized access.

Details regarding waste rock piles necessitating action, waste rock volumes, roadway improvements, stormwater controls, and other necessary controls are consistent with protocols outlined in Alternative 2 per mine site. Tailings at the Upper and Lower Monumental Mines would be removed using a vacuum truck to minimize disturbance to historically significant structures due to the relative thin nature of these materials, their fine grain size, and their high arsenic concentrations. A vacuum truck parked on FS 7345 could remove tailings from Upper Monumental Mine tailings piles A and B, and a vacuum truck parked on the unnamed road accessing Lower Monumental Mine could remove Upper and Lower Monumental Mine tailings pile C and A, respectively.

Excavated material would be based on visual observations and XRF measurements. Laboratory analytical samples of the underlying material would be taken to verify material above RGs had been removed. After excavation, the exposed surfaces would be graded, covered with clean soil, and revegetated to match the surroundings.

5.4 Alternative 4: Excavation and Off-site Disposal

Under this alternative, all waste material exceeding the RGs of 190 and 110 mg/kg total arsenic for waste rock and tailings, respectively, would be excavated and disposed of off Site. Procedures for this alternative would be the same as Alternative 3; however, instead of requiring the creation of a repository, material would be loaded directly from the respective mine into haul trucks. Due to the TCLP results, tailings would need to be transported as hazardous waste to Chemical Waste Management of the Northwest in Arlington, Oregon, a Subtitle C facility. Waste rock could either be transported to the USDA Forest Service repository planned at FS 7350 or to the Baker City Landfill approximately 4 and 55 miles from the intersection between FS 73 and FS 7345, respectively. Material transported to a municipal landfill would be temporarily stockpiled at a staging area to the west of the intersection between FS 73 and FS 7345, and then transferred to trucks more suitable for highway travel.

5.5 Analysis of Selected Removal Action Alternatives

Pursuant to the NCP, each alternative described above was analyzed using the following evaluation criteria: effectiveness, implementability, and cost. The effectiveness of each alternative was evaluated by each alternative's protectiveness of human health and the environment; attainment of ARARs; reduction of toxicity, mobility, or volume through treatment; long-term effectiveness and permanence; and short-term effectiveness. The implementability criterion addresses the technical feasibility of implementing the response (including availability of services and materials), the administrative feasibility, and Oregon State and community acceptance. Projected costs were calculated using direct capital costs, indirect capital costs, and annual post-removal Site control costs. Consistent with guidance, the costs presented are estimated using current costs of labor and materials, and actual costs are expected to range from 30 percent below to 50 percent above the costs presented. The projected costs presented for the EE/CA removal action alternatives are estimates only for the sole purpose of comparing alternatives and should not be considered design-level cost estimates. Details that formed the basis for the removal action alternative cost projections are provided in Tables 7 through 9.

5.5.1 Effectiveness

The following subsections evaluate an alternative's ability to meet the RAOs as identified in Section 4; in particular, its ability to achieve the criteria of protectiveness of human health and the environment and to attain ARARs. Other factors that affect the overall protectiveness of a removal action include preference for treatment to reduce contaminant toxicity, mobility, or volume for principal threats, short-term effectiveness, and long-term effectiveness/permanence. Details regarding the effectiveness evaluation criteria are presented in the following subsections.

5.5.1.1 Overall Protection of Human Health and the Environment

Under Alternative 1, the Site would remain as it currently exists and no active efforts to minimize contaminated areas or migration pathways would be made. Therefore, COPCs in soil would continue to pose an unacceptable risk to human health and the environment.

Alternative 2 would cover all tailings and waste rock piles exceeding RGs with clean cover, which would be effective in preventing direct contact to human receptors and improve conditions for some ecological receptors. The alternative would also involve regrading, which would reduce erosion, and rerouting surface water features flowing through tailings and waste rock piles, which would reduce contaminant load to streams. However, leaving the piles in place with a permeable cap would still allow infiltration, leaching, and migration of COPCs to surface water bodies. This is particularly problematic for tailings, which have a higher propensity for ARD and leaching.

Alternative 3 would involve removing all soil above RGs and placing it in an on-site repository. This would provide a high level of protection to human health and the environment. Some environmental receptors (burrowing mammals and invertebrates, plants) would still have some exposure if living at the repository, though population level species would be expected to be protected. The repository would be constructed far from streams and contaminant load from leaching would be less than under Alternative 2.

Alternative 4 would involve removing all soil above RGs and transporting it offsite. This would provide a high level of protection to human health and the environment. Material with high toxicity and propensity for ARD and leaching would be transported to a Subtitle C landfill. The remaining soil would be transported to an off-site repository or landfill, which would be expected to provide the highest level of protection to human health and the environment.

5.5.1.2 Compliance with ARARs

Alternative 1 does not comply with ARARs.

Alternative 2 partially complies with ARARs. Leaving tailings in areas with the potential to leach into Cap Martin Creek is potentially against ARARs protective of ecological environments, including the Clean Water and Endangered Species Acts.

Alternatives 3 and 4 comply with ARARs.

5.5.1.3 Reduction of Toxicity, Mobility, or Volume through Treatment

None of the alternatives evaluated reduce the toxicity, mobility, or volume of contamination through treatment. The COPCs are not biodegradable and will continue to pose an unacceptable risk to human health and the environment, though Alternative 4 would place the material in a permitted landfill, which may have treatment requirements (solidification) prior to placement.

5.5.1.4 Short-Term Effectiveness

Alternative 1 has poor short-term effectiveness because potential risk from COPCs at the Site is not reduced. The length of time until protection is achieved is indefinite under this alternative.

Alternative 2 through 4 offer equal short-term effectiveness as each would be completed in a relatively short period of time (less than 2 years), and would minimize exposure to COPCs immediately after implementation.

Short-term air quality impacts to the immediate environment may occur during excavation of contaminated soil. These short-term risks could be mitigated through appropriate dust control procedures.

A small increase in short-term risk to human health would be encountered during the excavation and transport phase of this work due to the truck trips required. These impacts could be mitigated through a transportation plan for the waste materials.

Impacts associated with construction activities are considered short term and should not significantly impact human health.

5.5.1.5 Long-Term Effectiveness

Alternative 1 does not provide long-term effectiveness or a permanent remedy for COPCs at the Site.

Alternative 2 provides a high level of long-term effectiveness for waste rock piles, particularly if cap inspection and maintenance is conducted on a regular schedule. Alternative 2 has a moderate level of long-term effectiveness for tailings, which would be expected to continue to leach and impair surface water bodies.

Alternative 3 provides a high level of long-term effectiveness, provided the repository cap is inspected and maintained at a regular interval and that the remedial design includes a mechanism to reduce the ability of tailings placed in the repository to leach and adversely affect downstream surface water bodies.

Alternative 4 provides the highest level of long-term effectiveness in that it does not rely on inspection or maintenance and material removed would be off Site in perpetuity.

5.5.2 Implementability

This section provides an evaluation of the technical and administrative feasibility of implementing an alternative and the materials and services that would be required for its implementation.

5.5.2.1 Technical Feasibility

Technical Implementation Considerations

Alternative 1 is simple to implement, as no action is taken.

Alternatives 2, 3, and 4 are technically feasible, though implementation would be difficult due to the remote nature of the Site, the steep slopes surrounding some of the waste rock piles, the presence of vegetation, the lack of access roads, and the relatively short season in which actions can be implemented (i.e., between June snowmelt and October precipitation). All three alternatives would require a geotechnical engineer to provide feedback on necessary road improvements and the extent to which steep waste rock piles could be safely accessed. The technical feasibility of these options is higher at Site mines located on or near existing roadways and lower for Site mines without road access.

Alternative 2 would be simpler to implement if clean cover material were available close to a particular mine and pile, and more complicated to implement if the nearest cover material was sourced from the proposed upland area.

Implementation of Alternative 3 would require additional analysis of the need for impermeable lining at the bottom of the repository, as well as mechanisms for trapping and treating leachate, and would require additional logistics if needed.

Alternative 4 would require additional logistics to transfer waste material from off-road dumps to highway-approved dumps, which would likely require additional workforce to complete in a reasonable amount of time.

Availability of Services and Materials

No services or materials for Alternative 1 are required.

It is likely that a contractor and engineering design team would be available to implement Alternatives 2, 3, and 4. However, the remote nature of the Site could be logistically challenging and would likely reduce the work week to provide time to travel to and from the Site.

The capacity of an appropriately licensed off-site waste facility to accommodate the anticipated soil excavation volumes is anticipated if Alternative 4 is selected.

5.5.2.2 Administrative Feasibility

This section provides an evaluation of the activities needed for coordination with other offices and agencies. Under CERCLA, federal, state, and local permits are not required for on-site CERCLA response actions; however, the substantive requirements of all permits that would otherwise be required must be met (40 CFR § 300.400(e)). Construction of an on-site repository would need to follow the substantive requirements of OAR 340-95, which describes solid waste disposal sites other than municipal solid waste landfills. Additional requirements would be triggered if hazardous wastes were planned to be stored in the repository (ORS 466).

Community Acceptance

It is likely that the public would not support Alternative 1 for the entire Site as it provides no protection for human health or the environment. The public may support Alternative 1 for Site mines that are especially remote and which would cause environmental damage if a removal action were to be implemented.

The public would likely support Alternatives 2 through 4, depending on the extent of environmental degradation caused by the removal action. Community acceptance will be determined following the community review and comment period after completion of the EE/CA. These comments will be addressed prior to finalizing the EE/CA and issuance of the action memorandum.

5.5.3 Cost

Evaluation of costs consists of developing conservative, order-of-magnitude estimates based on the description of work items developed for each removal action alternative. A similar set of assumptions is used for the alternatives, so that the *relative* difference in cost between alternatives is represented.

Tables 7 through 9 detail costs for Alternatives 2 through 4. Estimated costs (net present value) are presented below:

- Alternative 1 – No Action...$0
- Alternative 2 – On-site Containment..$1,125,184
- Alternative 3 – Excavation and On-site Containment in Repository $1,783,232
- Alternative 4 – Excavation and Off-site Disposal.......................................$3,250,456

5.6 Comparative Analysis of Removal Action Alternatives

The effectiveness of the retained alternatives was evaluated based on advantages in each of the evaluation criteria outlined in Section 5.3, as well as the removal action goals and objectives. The following table summarizes the comparison.

<table>
<tr><th colspan="7">Comparison of Alternatives</th></tr>
<tr><th>Criterion</th><th colspan="2">Alternative</th><th>Alternative 1: No Action</th><th>Alternative 2: On-site Containment</th><th>Alternative 3: Excavation and On-site Disposal</th><th>Alternative 4: Excavation and Off-site Disposal</th></tr>
<tr><td rowspan="7">Effectiveness</td><td rowspan="2">Protective of:</td><td>HH?</td><td>No</td><td>Yes</td><td>Yes</td><td>Yes</td></tr>
<tr><td>Env?</td><td>No</td><td>Mostly – Leaching to Surface water bodies, species level risk at piles</td><td>Mostly; species level risk at repository</td><td>Yes</td></tr>
<tr><td colspan="2">Complies with ARARs?</td><td>No</td><td>Yes- though leaching not 100% supportive of Clean Water and Endangered Species Acts</td><td>Yes</td><td>Yes</td></tr>
<tr><td colspan="2">Reduces Toxicity, Mobility, or Volume through Treatment</td><td>No</td><td>No</td><td>No</td><td>No</td></tr>
<tr><td rowspan="2">Effectiveness Duration</td><td>Short Term</td><td>No</td><td>Yes</td><td>Yes</td><td>Yes</td></tr>
<tr><td>Long Term</td><td>No</td><td>Yes, except possible leaching; requires inspection and maintenance of multiple caps</td><td>Yes; requires inspection and maintenance of repository.</td><td>Yes</td></tr>
<tr style="display:none"><td></td></tr>
<tr><td rowspan="3">Implementability</td><td rowspan="2">Feasibility</td><td>Tech.</td><td>High</td><td>Moderate - Implementation logistically and technically difficult, particularly at Site mines without existing road access</td><td>Moderate; implementation logistically and technically difficult, particularly at Site mines without existing road access</td><td>Moderate; implementation logistically and technically difficult, particularly at Site mines without existing road access</td></tr>
<tr><td>Admin</td><td>Low</td><td>High</td><td>Moderate (repository construction)</td><td>High</td></tr>
<tr><td>Acceptance</td><td>Communit y</td><td>Not expected</td><td>Yes</td><td>Yes</td><td>Yes</td></tr>
<tr><td colspan="3">Cost</td><td>$0</td><td>$1,125K</td><td>$1,783K</td><td>3,250K</td></tr>
</table>

Note: Env = environment; HH = human health

6 Recommended Removal Action Alternative

Taking into consideration the evaluation criteria presented in this EE/CA, the recommended removal action alternative for the Site is a combination of Alternatives 1, 2, 3, and 4. The Site mines, and the features at each mine, have individual attributes such that a single remedy would not be appropriate for the entire Site. The rationale for selecting an alternative for each mine is presented in this section.

6.1 Monumental Mine

The recommended removal action at Monumental Mine is a combination of Alternatives 1, 2, 3, and 4, as described below.

6.1.1 Upper-Upper Monumental Mine

Alternative 1 is recommended for waste rock piles at the Upper-Upper Monumental Mine with UCLMs below RGs.

Alternative 2 is recommended for waste rock piles with UCLMs above RGs. Piles can be moved using a bulldozer into trenches and covered with local clean borrow material. The cover material would be placed on the partially open shaft to prevent a trespasser or recreator from falling. Access to this area would require minimal road improvement.

6.1.2 Upper Monumental Mine

Alternative 2 is recommended for waste rock pile B. The shaft has sufficient capacity to accept the waste rock pile. Cover material can be supplied from the Upper-Upper Monumental Mine area and the unnamed road adjacent to the pile would require minimal improvement for equipment access.

A combination of Alternatives 2 and 3 is recommended for waste rock pile A. The steep slope of the waste rock pile will not likely allow recontouring of the entire pile without significant grubbing of the surrounding forest. It is recommended that the over-steepened portion of the pile be pushed with a bulldozer downslope to FS 7345 and taken to an on-site repository. Approximately half of the pile could then be spread and contoured to the existing topography. During the removal action, efforts would be made to maximize the volume of soil left in place, graded, and covered, and minimize the volume of soil transported to the on-site repository

Alternative 4 is recommended for tailings piles A, B, and C. A vacuum truck should be used to remove the fine tailings without disturbing the historical structures and minimize creating dust in this particularly fine material with high arsenic concentration. The contents of the vacuum truck will be transferred to a highway-rated truck with appropriate hazardous waste placards and a lined, covered bin at a staging area near the intersection of FS 7345 and FS 73 for transport to a Subtitle C landfill. After removing tailings, to the extent practicable, clean cover soil will be placed in the excavated areas to provide an exposure barrier from remnant tailings. No road improvements would be necessary except for accessing the repository, as a vacuum truck with sufficient hose length could park on FS 7345. Tailings pile C could be accessed from the unnamed access road that transects Lower Monumental Mine.

The wetlands near the tailings piles B and C will be restored following the removal of hazardous substances in accordance with the 1994 USEPA guidance document *Considering Wetlands at CERCLA Sites*. If needed, clean organic fill may be imported from off Site for placement in the new wetland system. Wetland plants will be obtained either off Site or from a local borrow area pending USDA Forest Service approval.

6.1.3 Lower Monumental Mine

Alternative 4 is recommended for tailings pile A. Similar to the Upper Monumental Mine, a vacuum truck could be utilized to remove the fine tailings without disturbing the historical crusher structure. The contents of the vacuum truck will be transferred to a highway-rated truck with appropriate hazardous waste placards and a lined, covered bin at a staging area near the intersection of FS 7345 and FS 73 for transport to a Subtitle C landfill. Some road improvement would be necessary to allow a vacuum truck to drive on the unnamed road. Removing tailings would help reduce the capacity for this material to leach COPCs and migrate to Cap Martin Creek and nearby wetlands.

Alternative 2 is recommended for waste rock piles A and B. The area surrounding the waste rock piles is relatively flat and would support grading. The over-steepened northeastern portion of waste rock pile A could be regraded to the north–northwest and across tailings pile A to the northeast, taking care not to bury or obscure the historically significant crusher. A portion of waste rock pile A could be placed in the open adit to prevent passageway to this physical hazard. Waste rock pile B could be placed in the area in front of adit 3 and the rest appropriately graded downslope. Cover material could be sourced from the area to the east of the unnamed access road or to the south of waste rock pile A. Capping the waste rock piles would be protective of human health, cost effective, and less difficult to implement than Alternatives 3 and 4. Construction of water diversion features would be conducted as outlined in Section 5.2.1.3.

6.2 Granite Creek Aquatic Station 03

Alternative 1 is recommended for Granite Creek Aquatic Station 03 waste rock pile A due to low arsenic concentrations indicative of background conditions.

Alternative 2 is recommended for Granite Creek Aquatic Station 03 waste rock pile B. Minimal road improvement would be necessary along FS 720 to allow for a bulldozer or excavator to regrade and pull the waste rock pile away from Granite Creek and cover it with material from waste rock pile A or other local cover source. Alternative 2 would be protective of human health, reduce risk to ecological receptors, be cost effective, and relatively easy to implement.

6.3 Cap Martin Mine

Alternative 1 is recommended for the Cap Martin Mine. Only waste rock pile C at this mine had a UCLM (243.5 mg/kg) above the arsenic RG of 190 mg/kg. At this waste rock pile, only three of eight sample locations had concentrations above the arsenic RG (maximum concentration of 365.8 mg/kg). Cap Martin Mine is in a remote area of the Site, with difficult access through small trees and brush by foot and no access by road or trail. It is unlikely that a trespasser or recreator would discover Cap Martin Mine, and even more unlikely that they would spend time in the area of waste rock pile C with elevated arsenic concentrations. Implementing Alternatives 2, 3, or 4 would necessitate constructing a new road down a steep and densely vegetated portion of national forest. These alternatives would be expensive and provide only marginal benefit for the protection of human health.

6.4 Sheridan Mine

Alternative 1 is recommended for the Sheridan Mine. All samples collected at this mine had arsenic concentrations well below the RG. The mine is in a remote portion of the Site and is difficult to access.

6.5 Granite Creek #7 Mine

Alternative 1 is recommended for Granite Creek #7 Mine. Of the seven analytical samples collected at this mine, only one exceeded the RG with a concentration of 220 mg/kg. Calculated UCLMs for the waste rock piles were below RGs. The mine is in a remote area of the Site that would be difficult to access.

6.6 Granite Creek #6 Mine

Alternative 1 is recommended for Granite Creek #6 Mine. Two samples collected from waste rock pile A exceeded RGs (maximum concentration 504 mg/kg). However, the waste rock pile is relatively small, and the mine is in a remote portion of the Site with difficult access. This mine was difficult to locate with a map and GPS device and offers no historically significant features that trespassers or recreators would be interested in. To implement Alternatives 2, 3, or 4, it would be necessary to construct a new road along Granite Creek that would likely cause unwanted turbidity and undercut the uphill slopes.

6.7 Tillicum Mine

Alternative 1 is recommended for the Tillicum Mine. Only waste rock pile A had a calculated arsenic UCLM (357.7 mg/kg) above the RG of 190 mg/kg. This pile is downhill from FS 280, between the road and Granite Creek. Human health exposure to the waste rock pile is likely minimal as it would require descending a steep hill from the road. Soil downslope of waste rock pile A had similar arsenic concentrations to the pile, which indicates that erosion of the pile to Granite Creek is ongoing; however, pool and riffle samples collected in 2003 adjacent to the pile did not have measurable arsenic concentrations. The concentration of total arsenic in the 2024 Granite Creek surface water sample collected downstream of Tillicum Mine was slightly less than the upstream sample. These data suggest that even though material from the waste rock pile is eroding into Granite Creek, it is not having a significant effect on downstream water quality. Implementing Alternatives 2, 3, or 4 at Tillicum Mine would require improving approximately 0.75 miles of FS 280, including a portion across privately held land, which would be labor and capital intensive.

6.8 Granite Creek #5 Mine

Alternative 1 is recommended for the Granite Creek #5 Mine. Calculated arsenic UCLM for waste rock pile A is 293.2 mg/kg, which exceeds the RG. However, six of the eight XRF measurement or analytical sample locations had arsenic concentrations below the RG. Furthermore, the sample collected downslope of the waste rock pile, between the pile and Granite Creek, had an arsenic concentration less than half of the minimum concentration of waste rock pile A samples. The concentration of total arsenic in the 2024 Granite Creek surface water sample collected downstream of the Granite Creek #5 Mine was slightly less than the upstream sample, suggesting Granite Creek #5 Mine does not significantly contribute to contaminant loading in Granite Creek. Implementing Alternatives 2, 3, or 4 at the Granite Creek #5 Mine would require improving approximately 0.4 miles of FS 280, including a portion across privately held land.

6.9 Golden Fraction Mine

Alternative 1 is recommended for Golden Fraction Mine. Waste rock pile A had arsenic concentrations above the RG (calculated UCLM of 332 mg/kg). However, this waste rock pile is located high up a steep hillside from the most likely access point of a trespasser or recreator, and it is unlikely that there is an associated human health risk. This waste rock pile is relatively small and implementation of Alternatives 2, 3, or 4 would require constructing an access road across a very steep hillside, which may not be feasible. In 2011, CES collected a sample from the area of a trench within waste rock pile C that had an arsenic concentration of 1,340 mg/kg. Terraphase measured arsenic concentrations at four locations in this area and collected a sample from the trench and was unable to reproduce this result (maximum concentration 102 mg/kg when not including the CES sample). It is possible that this sample was collected from a different area or it represents an anomalous result unrepresentative of the bulk of the pile. In either case, this waste rock pile does not represent a significant human health risk and does not warrant remedial action.

6.10 Central Mine

Alternative 2 is recommended for Central Mine waste rock pile A, which had a calculated arsenic UCLM of 239.5 mg/kg, slightly above the RG. This waste rock pile is easily accessible along FS 280, just west of its intersection with FS 280, which has parking at nearby FS 73. Waste rock pile A would be pulled up from the Granite Creek floodplain and placed in the open space at the adit and contoured into the adjacent hillside. Cover material is available downslope of FS 280, though it would need to be tested prior to application. Although there is higher likelihood of trespassers and recreators, no action is needed at waste rock piles B, C, or D as they had calculated UCLMs below the RG.

6.11 Summary of Recommended Removal Action Alternative

The following table provides a summary of the recommended removal action alternative by Site mine. This information, including the total waste rock volume associated with each alternative, is also provided as Table 11.

Recommended Removal Action Alternatives		
Mine	**Feature**	**Recommended Removal Action Alternative**
Upper-Upper Monumental Mine	Waste rock piles A, D, and F (395, 10, and 10 cy)	Alternative 2
	Waste rock piles B, C, and E (5, 5, and 5 cy)	Alternative 1
	Waste rock piles G, H, I and J (10, 25, 5, and 15 cy)	To be determined (requires characterization)
Upper Monumental Mine	Waste rock pile A (7,905 cy)	Alternatives 2 and 3
	Waste rock pile B (60 cy)	Alternative 2
	Tailings piles A, B, and C (125, 305, and 10 cy)	Alternative 4
Lower Monumental Mine	Waste rock piles A and B (5,560 and 170 cy)	Alternative 2
	Tailings pile A (180 cy)	Alternative 4
Granite Creek Aquatic Station 03	Waste rock pile A (15 cy)	Alternative 1
	Waste rock pile B (80 cy)	Alternative 2
Cap Martin Mine	All features	Alternative 1
Sheridan Mine	All features	Alternative 1
Granite Creek #7 Mine	All features	Alternative 1
Granite Creek #6 Mine	All features	Alternative 1
Tillicum Mine	All features	Alternative 1
Granite Creek # 5 Mine	All features	Alternative 1
Golden Fraction Mine	All features	Alternative 1
Central Mine	Waste rock pile A (80 cy)	Alternative 2
	Waste rock piles B, C, and D (25, 105, and 25 cy)	Alternative 1

6.12 Recommended Removal Action Cost

The recommended removal action includes a combination of Alternatives 1, 2, 3, and 4 as summarized above. Combined estimated costs for the recommended removal action are $1,218,259, as summarized in Table 10.

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Tables

Table 1
Summary of Soil Analytical Results
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

AOI	Company	Location	Collection Depth (ft bgs)	Sample Date	Metals													
					Aluminum	Antimony	Arsenic	Arsenic, IVBA	Arsenic, Total IVBA	Barium	Beryllium	Cadmium	Calcium	Chromium (total)	Cobalt	Copper	Iron	Lead
PRG for SAP					--	4895	82	--	--	--	24468	9113	--	--	3681	489424	--	--
Tailings PRG					--	--	110	--	--	--	--	--	--	--	--	--	--	--
Waste Rock/Soil PRG					--	--	190	--	--	--	--	--	--	--	--	--	--	--
ODEQ Blue Mountain Region Clean Fill					--	1.3	14	--	--	950	2.6	0.69	--	190	--	120	--	21
ODEQ Eco RBC Plant Direct Toxicity					--	11	18	--	--	110	2.5	32	--	--	13	70	--	120
ODEQ Eco RBC Inverts Direct Toxicity					--	78	6.8	--	--	330	40	140	--	--	--	80	--	1700
ODEQ Eco RBC Bird					--	--	15	--	--	630	--	0.29	--	23	76	14	--	11
ODEQ Eco RBC Mammal					--	0.27	19	--	--	1800	21	0.27	--	34	230	42	--	56
ODEQ Excavation Worker RCB					--	--	420	--	--	--	19000	9700	--	--	--	390000	--	800
Background	EA	BG-SSS-19	0.5	7/19/2003	24400	0.84 J	4.5	NA	NA	288	1.2	0.43 J	1830	31.3	11.3	30.7	24600	8.4
		BG-SSS-34	0.5	7/15/2003	26400	ND (0.38)	3.4	NA	NA	187	0.72	0.35 J	1130	5.7	5.5	8.9	10800	3.8
		BG-SSS-35	0.5	7/15/2003	31200	ND (0.4)	5.5	NA	NA	268	1	0.54	2110	6.2	6.7	15.4	12400	5.9
		BG-SSS-36	0.5	7/15/2003	19400	ND (0.33)	11.4	NA	NA	319	0.55	ND (0.026)	2080	27.4	10.2	11	17700	6.3
	CES	BGS-01	0.5 - 1	6/26/2007	NA	ND (0.2)	6.2	NA	NA	NA	0.6 J	*1.1*	NA	12	NA	8	22900	8.04
		BGS-02	0.5 - 1	6/26/2007	NA	ND (0.2)	7.8	NA	NA	NA	0.6 J	*1.45*	NA	7	NA	10	13600	5.98
		BGS-03	0.5 - 1	6/26/2007	NA	0.2 J	5.4	NA	NA	NA	0.4 J	0.39	NA	11	NA	8	20300	4.58
		BGS-04	0.5 - 1	6/26/2007	NA	ND (0.2)	9	NA	NA	NA	0.8 J	*2.03*	NA	15	NA	24	16800	7.62
		BGS-05	0.5 - 1	6/26/2007	NA	0.3 J	11.8	NA	NA	NA	0.9 J	*1.85*	NA	7	NA	31	13400	7.92
		BGS-06	0.5 - 1	6/27/2007	NA	0.2 J	*15.3*	NA	NA	NA	0.4 J	0.51	NA	15	NA	5	29800	4.86
		BGS-07	0.5 - 1	6/27/2007	NA	ND (0.2)	5	NA	NA	NA	0.6 J	*1.01*	NA	12	NA	30	13600	5.93
		BGS-08	0.5 - 1	6/27/2007	NA	0.3 J	*43.5*	NA	NA	NA	0.4 J	*1.11*	NA	70	NA	67	35300	7.3
Cap Martin	EA	TA-SUS-22	1.5	7/15/2003	12500	0.68 J	6.3	NA	NA	155	0.38 J	ND (0.03)	1940	5.2	8	3.3	16300	2.8
		WP-SUS-20	4	7/15/2003	15600	0.38 J	10.1	NA	NA	180	0.48	ND (0.027)	2850	8.4	9.1	5.5	19700	3.6
		WP-SUS-21	2.5	7/15/2003	10400	*2 J*	*198*	NA	NA	177	0.5	*14.1*	6320	5.5	7.4	43.5	20700	*44.1*
		WP-SUS-39	2	7/15/2003	14900	0.61 J	*17.5*	NA	NA	167	0.44	ND (0.025)	905	9.7	9.6	11	19600	4.2
	CES	CM-WR1-1	0.5	6/21/2007	NA	0.3 J	*19.6*	NA	NA	NA	ND (0.2)	0.17 J	NA	11	NA	4 J	20500	5.71
		CM-WR2-1	0.5	6/21/2007	NA	ND (0.2)	9.7	NA	NA	NA	ND (0.2)	0.33	NA	9	NA	3 J	15500	4.26
		CM-WR2-2	0.5	6/21/2007	NA	ND (0.2)	*26.5*	NA	NA	NA	ND (0.2)	0.2 J	NA	11	NA	4 J	12400	4.68
		CM-WR3-1	0.5	6/21/2007	NA	0.9 J	*131*	NA	NA	NA	0.7 J	0.27 J	NA	3 J	NA	3	16800	12.9
		CM-WR4-1	0.5	6/21/2007	NA	ND (1)	*257*	NA	NA	NA	0.3 J	*8.48*	NA	6	NA	12	28800	*105*
	TEI	CM-WRC-4	0.5 - 1	10/3/2024	NA	NA	*292 (0.42)*	33.1 (1.9)	650 (4.9)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Central	EA	TA-SUS-33	1.5	7/10/2003	11100	1.3 J	*27.4*	NA	NA	124	0.2 J	0.36 J	1380	9.8	7.2	12.6	16900	9.9
		WP-SSS-31	0.5	7/10/2003	11100	*5.9 J*	*295*	NA	NA	223	0.28 J	*3.4*	2110	10.4	8.5	56.2	31400	*358*
		WP-SUS-31	4.5	7/10/2003	10900	*2.3 J*	*150*	NA	NA	179	0.29 J	*2.2*	2270	8.4	8.1	30.6	26500	*53*
		WP-SUS-32	4	7/10/2003	17600	*1.8 J*	*106*	NA	NA	225	0.3 J	*1.1*	1900	13.3	9.9	16.3	28200	*22.9*
	TEI	CEM-WRA-2	0.5 - 1	10/5/2024	NA	NA	*299 (8.3)*	44.5 (2)	794 (5)	NA	NA	NA	NA	NA	NA	NA	NA	NA
		CEM-WRA-4-DS	0.5 - 1	10/2/2024	NA	NA	*32.6 (0.4)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		CEM-WRB-1	0.5 - 1	10/5/2024	NA	NA	*151 (8.6)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		CEM-WRC-1	0.5 - 1	10/5/2024	NA	NA	*110 (8)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

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					Aluminum	Antimony	Arsenic	Arsenic, IVBA	Arsenic, Total IVBA	Barium	Beryllium	Cadmium	Calcium	Chromium (total)	Cobalt	Copper	Iron	Lead
PRG for SAP					--	4895	82	--	--	--	24468	9113	--	--	3681	489424	--	--
Tailings PRG					--	--	110	--	--	--	--	--	--	--	--	--	--	--
Waste Rock/Soil PRG					--	--	190	--	--	--	--	--	--	--	--	--	--	--
ODEQ Blue Mountain Region Clean Fill					--	1.3	14	--	--	950	2.6	0.69	--	190	--	120	--	21
ODEQ Eco RBC Plant Direct Toxicity					--	11	18	--	--	110	2.5	32	--	--	13	70	--	120
ODEQ Eco RBC Inverts Direct Toxicity					--	78	6.8	--	--	330	40	140	--	--	--	80	--	1700
ODEQ Eco RBC Bird					--	--	15	--	--	630	--	0.29	--	23	76	14	--	11
ODEQ Eco RBC Mammal					--	0.27	19	--	--	1800	21	0.27	--	34	230	42	--	56
ODEQ Excavation Worker RCB					--	--	420	--	--	--	19000	9700	--	--	--	390000	--	800
Golden Fraction	CES	GF-WR-01	1	6/25/2007	NA	0.6 J	*28.7*	NA	NA	NA	0.3 J	*1*	NA	20	NA	12	26300	14.8
Golden Fraction	CES	GF-WR-2	0.5	6/25/2007	NA	*30 J*	***1340***	NA	NA	NA	ND (0.2)	*1.36*	NA	6	NA	114	97300	***2430***
Golden Fraction	CES	GF-WR2-1	0.5	6/21/2007	NA	*3.1*	*141*	NA	NA	NA	0.3 J	*4.07*	NA	12	NA	22	30500	*143*
Golden Fraction	CES	GF-WR-3	0.5	6/25/2007	NA	*1.5*	*89*	NA	NA	NA	0.3 J	*0.85*	NA	18	NA	15	35600	4.89
Golden Fraction	TEI	GF-DR-1	0.5 - 1	10/5/2024	NA	NA	*58.3 (8.4)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Golden Fraction	TEI	GF-WRA-1	0.5 - 1	10/5/2024	NA	NA	*332 (7.8)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Golden Fraction	TEI	GF-WRD-4-DS	0.5 - 1	10/5/2024	NA	NA	*55.2 (8.5)*	12.3 (2)	137 (4.9)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Golden Fraction	TEI	GF-WRD-6	0.5 - 1	10/5/2024	NA	NA	*66.6 (7.9)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Granite Creek #5	CES	GC5-WR-01	0.5	6/26/2007	NA	*1.4*	*155*	NA	NA	NA	0.3 J	*3.35*	NA	13	NA	34	27300	*35.8*
Granite Creek #5	CES	GC5-WR-02	0.5	6/26/2007	NA	*2.4*	*170*	NA	NA	NA	0.4 J	*4.77*	NA	18	NA	61	30600	*88.5*
Granite Creek #5	TEI	GC5-WRA-3	0.5 - 1	10/4/2024	NA	NA	***421 (8)***	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Granite Creek #5	TEI	GC5-WRA-4	0.5 - 1	10/4/2024	NA	NA	*160 (7.8)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Granite Creek #5	TEI	GC5-WRA-4-DS	0.5 - 1	10/4/2024	NA	NA	*81.3 (7.9)*	10.4 (1.9)	221 (5)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Granite Creek #6	CES	GC6-WR-01	0.5	6/24/2007	NA	ND (0.2)	9.3	NA	NA	NA	ND (0.2)	0.21	NA	9	NA	14	20700	1.49
Granite Creek #6	CES	GC6-WR-02	0.5	6/24/2007	NA	ND (0.2)	6.6	NA	NA	NA	0.3 J	0.24	NA	10	NA	6	21400	3.37
Granite Creek #6	CES	GC6-WR-03	0.5	6/24/2007	NA	ND (0.2)	1.7	NA	NA	NA	ND (0.2)	0.29 J	NA	ND (1)	NA	4 J	2650	0.85
Granite Creek #6	TEI	GC6-WRA-1	0.5 - 1	10/4/2024	NA	NA	*257 (8.5)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Granite Creek #6	TEI	GC6-WRA-2	0.5 - 1	10/4/2024	NA	NA	***504 (8.5)***	29.3 (2)	759 (4.9)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Granite Creek 7	CES	GC7-WR-01	0.5	6/24/2007	NA	*19*	*185*	NA	NA	NA	0.4 J	*1.84*	NA	6	NA	120	22600	*81.7*
Granite Creek 7	CES	GC7-WR-02	0.5	6/24/2007	NA	*2.5*	*142*	NA	NA	NA	0.6 J	0.5	NA	7	NA	17	28500	19
Granite Creek 7	CES	GC7-WR-03	0.5	6/24/2007	NA	*7.6*	*220*	NA	NA	NA	0.6 J	*0.76*	NA	3	NA	66	25100	17.1
Granite Creek 7	CES	GC7-WR-04	0.5	6/24/2007	NA	0.4 J	*22.9*	NA	NA	NA	0.3 J	0.27 J	NA	9	NA	9	22500	4.94
Granite Creek 7	TEI	GC7-WRA-3	0.5 - 1	10/4/2024	NA	NA	*26.9 (8.5)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Granite Creek 7	TEI	GC7-WRB-1	0.5 - 1	10/4/2024	NA	NA	7.43 (0.43)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Granite Creek Aq. St. 3	CES	GC3-WR-01	0.5	6/24/2007	NA	*7.2*	*337*	NA	NA	NA	0.3 J	*7.97*	NA	7	NA	57	29900	*152*

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					Aluminum	Antimony	Arsenic	Arsenic, IVBA	Arsenic, Total IVBA	Barium	Beryllium	Cadmium	Calcium	Chromium (total)	Cobalt	Copper	Iron	Lead
PRG for SAP					--	4895	82	--	--	--	24468	9113	--	--	3681	489424	--	--
Tailings PRG					--	--	110	--	--	--	--	--	--	--	--	--	--	--
Waste Rock/Soil PRG					--	--	190	--	--	--	--	--	--	--	--	--	--	--
ODEQ Blue Mountain Region Clean Fill					--	1.3	14	--	--	950	2.6	0.69	--	190	--	120	--	21
ODEQ Eco RBC Plant Direct Toxicity					--	11	18	--	--	110	2.5	32	--	--	13	70	--	120
ODEQ Eco RBC Inverts Direct Toxicity					--	78	6.8	--	--	330	40	140	--	--	--	80	--	1700
ODEQ Eco RBC Bird					--	--	15	--	--	630	--	0.29	--	23	76	14	--	11
ODEQ Eco RBC Mammal					--	0.27	19	--	--	1800	21	0.27	--	34	230	42	--	56
ODEQ Excavation Worker RCB					--	--	420	--	--	--	19000	9700	--	--	--	390000	--	800
Lwr Mon'tl	EA	ML-SSS-38	0.5	7/9/2003	1110	*78.3*	***4470***	NA	NA	51.7	0.033 J	0.22 J	308 J	2.3	0.6 J	26.6	16500	***856***
		WP-SSS-15	0.5	7/9/2003	3740	*5 J*	***573***	NA	NA	149	0.25 J	*1.4*	5570	3.5	6.4	14.6	18900	12.4
		WP-SUS-15	4	7/9/2003	4800	*5.3 J*	***544***	NA	NA	176	0.25 J	*1.1*	7180	4.4	6.6	18.2	20900	*25*
	CES	MMDGA-T-46	3.5	9/30/2009	NA	NA	***3340***	NA	NA	NA	NA	NA	NA	NA	NA	*152*	NA	*627*
		MMDGA-WR-18	3.5	9/29/2009	NA	NA	***2700***	NA	NA	NA	NA	NA	NA	NA	NA	45	NA	*589*
		MMDGA-WR-19	3	9/29/2009	NA	NA	*223*	NA	NA	NA	NA	NA	NA	NA	NA	9.4	NA	16.1
		MMDGA-WR-20	3	9/29/2009	NA	NA	***4610***	NA	NA	NA	NA	NA	NA	NA	NA	*220*	NA	***3210***
		MMDGA-WR-21	1	9/29/2009	NA	NA	*258*	NA	NA	NA	NA	NA	NA	NA	NA	13.9	NA	12
		MMDGA-WR-24	0.5	9/29/2009	NA	NA	***8150***	NA	NA	NA	NA	NA	NA	NA	NA	48	NA	*712*
		MMDGA-WR-25	0.5	9/29/2009	NA	NA	***9360***	NA	NA	NA	NA	NA	NA	NA	NA	60.5	NA	*453*
		MMDGA-WR-26	0.5	9/29/2009	NA	NA	***5690***	NA	NA	NA	NA	NA	NA	NA	NA	*135*	NA	*578*
	TEI	LMM-WRA-3	0.5 - 1	10/3/2024	NA	NA	*125 (0.44)*	16.6 (2)	328 (4.9)	NA	NA	NA	NA	NA	NA	NA	NA	NA
		LMM-WRA-3-DS	0.5 - 1	10/3/2024	NA	NA	*21.6 (0.44)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		LMM-WRA-4	0.5 - 1	10/3/2024	NA	NA	***2290 (8.8)***	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			0.5 - 1	10/3/2024	NA	NA	***2570 (8.5)***	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		LMM-WRB-1	0.5 - 1	10/3/2024	NA	NA	***1090 (0.42)***	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			0.5 - 1	10/3/2024	NA	NA	***802 (0.42)***	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		LMM-WRB-3-DS	0.5 - 1	10/3/2024	NA	NA	*29.1 (0.41)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sheridan	EA	TA-SUS-25	1.5	7/14/2003	17500	0.94 J	*26*	NA	NA	269	0.55	ND (0.027)	1930	8.6	10.5	10.2	20600	10.4
		WP-SUS-23	3.5	7/14/2003	11900	*6*	*81.8*	NA	NA	188	0.48	0.63	2920	6.7	8.6	30.5	20100	15.6
	CES	SM-WR2-1	0.5	6/21/2007	NA	ND (0.2)	*16.8*	NA	NA	NA	ND (0.2)	0.23 J	NA	9	NA	7	20700	11.1
	TEI	SH-WRB-2	0.5 - 1	10/4/2024	NA	NA	*80.8 (0.39)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		SH-WRC-1	0.5 - 1	10/4/2024	NA	NA	*14.4 (0.44)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tillicum	EA	TA-SSS-30	0.4	7/12/2003	11600	*1.6 J*	*58.6*	NA	NA	201	0.2 J	*6.2*	3480	8.8	8.8	10.4	22900	*40.9*
		WP-SSS-27	0.8	7/12/2003	9660	*2.4 J*	*88*	NA	NA	177	0.2 J	*3.4*	2600	5.9	8.2	27.5	20000	*375*
		WP-SSS-28	0.8	7/12/2003	3550	1.3 J	*183*	NA	NA	32.8	0.43 J	*2.8*	26500	1.4	4.7	14.4	19300	*52.2*
		WP-SUS-26	3	7/12/2003	8350	*1.7 J*	*156*	NA	NA	138	0.29 J	*7.5*	3120	4.3	6.7	32.3	23800	*120*
		WP-SUS-27	4.5	7/12/2003	11700	*1.8 J*	*35.7*	NA	NA	206	0.21 J	*1.9*	1830	6.8	8.2	15.2	21300	*27.8*
	CES	TILL-WR-01	0	6/26/2007	NA	*5.5*	*371*	NA	NA	NA	0.7 J	*15.6*	NA	2 J	NA	27	24600	*184*
	TEI	TL-WRA-1-DS-2	0.5 - 1	10/4/2024	NA	NA	*267 (0.44)*	14.4 (1.9)	550 (4.9)	NA	NA	NA	NA	NA	NA	NA	NA	NA
		TL-WRA-3	0.5 - 1	10/4/2024	NA	NA	***454 (0.42)***	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		TL-WRB-4	0.5 - 1	10/4/2024	NA	NA	*194 (0.42)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

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PRG for SAP					--	4895	82	--	--	--	24468	9113	--	--	3681	489424	--	--
Tailings PRG					--	--	110	--	--	--	--	--	--	--	--	--	--	--
Waste Rock/Soil PRG					--	--	190	--	--	--	--	--	--	--	--	--	--	--
ODEQ Blue Mountain Region Clean Fill					--	1.3	14	--	--	950	2.6	0.69	--	190	--	120	--	21
ODEQ Eco RBC Plant Direct Toxicity					--	11	18	--	--	110	2.5	32	--	--	13	70	--	120
ODEQ Eco RBC Inverts Direct Toxicity					--	78	6.8	--	--	330	40	140	--	--	--	80	--	1700
ODEQ Eco RBC Bird					--	--	15	--	--	630	--	0.29	--	23	76	14	--	11
ODEQ Eco RBC Mammal					--	0.27	19	--	--	1800	21	0.27	--	34	230	42	--	56
ODEQ Excavation Worker RCB					--	--	420	--	--	--	19000	9700	--	--	--	390000	--	800
Upr Mon'tl	EA	ML-SSS-12	0.7	7/9/2003	13300	*4 J*	*73*	NA	NA	322	0.32 J	0.65	3050	8.4	10.4	14.2	32000	*27.5*
		ML-SSS-16	0.5	7/10/2003	6180	*368*	***7500***	NA	NA	129	0.25 J	*8.1*	1610	7.7	1.6 J	80	16300	***1350***
		WP-SSS-13	1	7/9/2003	4220	*11.6*	***860***	NA	NA	189	0.087 J	ND (0.064)	523 J	3.6	3.6 J	12.5	21500	*31.3*
		WP-SSS-14	0.7	7/10/2003	3190	*2.5 J*	***616***	NA	NA	69.8	0.26 J	*8.5*	5980	2.3	5 J	7.4	13600	15
		WP-SSS-17	1	7/9/2003	10600	*241*	***11400***	NA	NA	73.2	0.3 J	*23.4*	3610	2.1	2.7 J	*698*	16300	***2120***
		WP-SUS-14	3.5	7/10/2003	4680	*5.8 J*	*355*	NA	NA	166	0.23 J	0.52	10100	3.3	6.4	8	18800	*36.9*
	CES	MMDGA-T-13	1	9/29/2009	NA	NA	***10200***	NA	NA	NA	NA	NA	NA	NA	NA	58.4	NA	***1200***
		MMDGA-T-34	0.25	9/30/2009	NA	NA	***1900***	NA	NA	NA	NA	NA	NA	NA	NA	119	NA	*478*
		MMDGA-T-34	2	9/30/2009	NA	NA	***9610***	NA	NA	NA	NA	NA	NA	NA	NA	*440*	NA	***2340***
		MMDGA-T-35	1	9/30/2009	NA	NA	***4770***	NA	NA	NA	NA	NA	NA	NA	NA	*247*	NA	***1240***
		MMDGA-T-37	0.25	9/30/2009	NA	NA	***1360***	NA	NA	NA	NA	NA	NA	NA	NA	*128*	NA	*334*
		MMDGA-T-40	2	9/30/2009	NA	NA	***6310***	NA	NA	NA	NA	NA	NA	NA	NA	*460*	NA	***1140***
		MMDGA-T-41	2	9/30/2009	NA	NA	***8750***	NA	NA	NA	NA	NA	NA	NA	NA	*700*	NA	***1680***
		MMDGA-T-9	1	9/29/2009	NA	NA	***2440***	NA	NA	NA	NA	NA	NA	NA	NA	75.3	NA	*549*
		MMDGA-WR-2	4	9/28/2009	NA	NA	*164*	NA	NA	NA	NA	NA	NA	NA	NA	15.2	NA	11.3
		MMDGA-WR-28	0.5	9/29/2009	NA	NA	***740***	NA	NA	NA	NA	NA	NA	NA	NA	8.1	NA	10.4
		MMDGA-WR-3	4	9/28/2009	NA	NA	***2240***	NA	NA	NA	NA	NA	NA	NA	NA	70.6	NA	*479*
		MMDGA-WR-5	1	9/28/2009	NA	NA	***2920***	NA	NA	NA	NA	NA	NA	NA	NA	51.1	NA	*231*
	TEI	UMM-TLA-6	0.5 - 1	10/2/2024	NA	NA	***3270 (8.1)***	1350 (2)	5560 (4.9)	NA	NA	NA	NA	NA	NA	NA	NA	*589 (0.81)*
		UMM-TLB-1	0.5 - 1	10/2/2024	NA	NA	***6130 (11)***	1840 (2)	4420 (4.9)	NA	NA	NA	NA	NA	NA	NA	NA	***1710 (1.1)***
		UMM-TLB-4	0.5 - 1	10/2/2024	NA	NA	***1540 (8)***	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-TLC-1	0.5 - 1	10/2/2024	NA	NA	***5290 (9.9)***	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-TLC-2	0.5 - 1	10/2/2024	NA	NA	***4980 (10)***	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-WRA-1	0.5 - 1	10/2/2024	NA	NA	***1300 (8.4)***	12.7 (2)	1590 (4.9)	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-WRA-1-DS	0.5 - 1	10/2/2024	NA	NA	*37.5 (0.41)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-WRA-3	0.5 - 1	10/2/2024	NA	NA	***1210 (0.45)***	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-WRB-1	0.5 - 1	10/2/2024	NA	NA	***14000 (41)***	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	***5210 (4.1)***
		UMM-WRB-2	0.5 - 1	10/2/2024	NA	NA	***1800 (8.2)***	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-WRB-2-DS	0.5 - 1	10/2/2024	NA	NA	*79.2 (0.45)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Upr Upr Mon'tl	TEI	UUMM-WRA-2	0.5 - 1	10/2/2024	NA	NA	***1940 (8.8)***	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UUMM-WRA-3	0.5 - 1	10/2/2024	NA	NA	***1710 (9.1)***	176 (1.9)	3440 (4.9)	NA	NA	NA	NA	NA	NA	NA	NA	NA
			0.5 - 1	10/2/2024	NA	NA	***1470 (8)***	162 (2)	3280 (5)	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UUMM-WRA-3-DS	0.5 - 1	10/2/2024	NA	NA	*16 (0.44)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UUMM-WRD-1	0.5 - 1	10/2/2024	NA	NA	*269 (0.45)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UUMM-WRF-1	0.5 - 1	10/2/2024	NA	NA	***715 (0.44)***	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

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					Lead, IVBA	**Lead, Total IVBA**	**Magnesium**	**Manganese**	**Mercury**	**Nickel**	**Potassium**	**Selenium**	**Silver**	**Sodium**	**Thallium**	**Vanadium**	**Zinc**
PRG for SAP					--	--	--	--	2153	244668	--	61175	61145	--	--	61218	--
Tailings PRG					--	--	--	--	--	--	--	--	--	--	--	--	--
Waste Rock/Soil PRG					--	--	--	--	--	--	--	--	--	--	--	--	--
ODEQ Blue Mountain Region Clean Fill					--	--	--	1800	1.4	92	--	0.93	0.51	--	--	400	160
ODEQ Eco RBC Plant Direct Toxicity					--	--	--	220	34	38	--	0.52	560	--	0.05	60	160
ODEQ Eco RBC Inverts Direct Toxicity					--	--	--	450	0.05	280	--	4.1	--	--	--	--	120
ODEQ Eco RBC Bird					--	--	--	1300	0.013	20	--	0.71	2.6	--	4.5	4.7	46
ODEQ Eco RBC Mammal					--	--	--	1400	1.7	10	--	0.63	14	--	0.42	280	79
ODEQ Excavation Worker RCB					--	--	--	230000	2900	190000	--	--	49000	--	--	--	--
Background	EA	BG-SSS-19	0.5	7/19/2003	NA	NA	2630	837	0.14	23.4	1570	0.76	0.26 J	806	0.97	47.8	105
		BG-SSS-34	0.5	7/15/2003	NA	NA	880	429	0.032 J	5.2	848	0.61	0.28 J	1220	ND (0.28)	24.9	50.2
		BG-SSS-35	0.5	7/15/2003	NA	NA	1560	156	0.035 J	5.6	1140	0.42 J	*0.62 J*	1450	ND (0.29)	26.5	43.2
		BG-SSS-36	0.5	7/15/2003	NA	NA	4930	610	0.027 J	23.4	3920	0.24 J	0.48 J	1180	ND (0.24)	47.2	61.3
	CES	BGS-01	0.5 - 1	6/26/2007	NA	NA	NA	716	0.06 J	7	NA	0.37	0.29	NA	NA	NA	71
		BGS-02	0.5 - 1	6/26/2007	NA	NA	NA	668	ND (0.04)	6	NA	0.28 J	0.51	NA	NA	NA	61
		BGS-03	0.5 - 1	6/26/2007	NA	NA	NA	644	0.05 J	8	NA	0.15 J	0.2	NA	NA	NA	71
		BGS-04	0.5 - 1	6/26/2007	NA	NA	NA	848	0.06 J	23	NA	0.36	*0.63*	NA	NA	NA	126
		BGS-05	0.5 - 1	6/26/2007	NA	NA	NA	319	0.06 J	10	NA	0.77	*0.58*	NA	NA	NA	44
		BGS-06	0.5 - 1	6/27/2007	NA	NA	NA	644	ND (0.04)	7	NA	0.24 J	0.32	NA	NA	NA	88
		BGS-07	0.5 - 1	6/27/2007	NA	NA	NA	606	0.07 J	13	NA	0.39	0.23	NA	NA	NA	60
		BGS-08	0.5 - 1	6/27/2007	NA	NA	NA	1060	0.08 J	70	NA	0.38	*0.53*	NA	NA	NA	145
Cap Martin	EA	TA-SUS-22	1.5	7/15/2003	NA	NA	5180	408	0.058	3.8 J	3720	0.24 J	0.28 J	982	ND (0.28)	40.6	41.8
		WP-SUS-20	4	7/15/2003	NA	NA	5320	270	0.026 J	4.3	4080	ND (0.31)	*0.63 J*	1100	ND (0.25)	52.2	48.6
		WP-SUS-21	2.5	7/15/2003	NA	NA	2980	504	0.3	4.1	3240	0.4 J	*4.2*	122 J	0.45 J	33.9	*495*
		WP-SUS-39	2	7/15/2003	NA	NA	4560	321	0.064	4.8	3560	0.4 J	*0.79 J*	1060	ND (0.23)	52.2	50.5
	CES	CM-WR1-1	0.5	6/21/2007	NA	NA	NA	312	0.06 J	3 J	NA	0.3	0.14	NA	NA	NA	39
		CM-WR2-1	0.5	6/21/2007	NA	NA	NA	234	ND (0.04)	3 J	NA	0.23 J	0.08 J	NA	NA	NA	34
		CM-WR2-2	0.5	6/21/2007	NA	NA	NA	198	0.07 J	4 J	NA	0.23 J	0.19	NA	NA	NA	25
		CM-WR3-1	0.5	6/21/2007	NA	NA	NA	69.4	0.09 J	2 J	NA	0.58	*0.92*	NA	NA	NA	50
		CM-WR4-1	0.5	6/21/2007	NA	NA	NA	657	0.06 J	5 J	NA	0.46	*1.42*	NA	NA	NA	*330*
	TEI	CM-WRC-4	0.5 - 1	10/3/2024	2.95 (0.19)	10.3 (0.49)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Central	EA	TA-SUS-33	1.5	7/10/2003	NA	NA	4650	378	0.12	6.9	2750	0.52	ND (0.21)	805	0.34 J	44.2	63.2
		WP-SSS-31	0.5	7/10/2003	NA	NA	4860	1260	0.27	9.6	2840	*1.6*	*2.7*	787	3.3	96.1	*203*
		WP-SUS-31	4.5	7/10/2003	NA	NA	3450	833	0.19	8	1770	*1*	*1.9*	425 J	2.5	59.4	137
		WP-SUS-32	4	7/10/2003	NA	NA	6300	697	0.12	9.7	4030	*1*	0.28 J	1040	1.3	73.7	96.2
	TEI	CEM-WRA-2	0.5 - 1	10/5/2024	21.9 (0.2)	78.5 (0.5)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		CEM-WRA-4-DS	0.5 - 1	10/2/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		CEM-WRB-1	0.5 - 1	10/5/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		CEM-WRC-1	0.5 - 1	10/5/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

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AOI	**Company**	**Location**	**Collection Depth** (ft bgs)	**Sample Date**	**Lead, IVBA**	**Lead, Total IVBA**	**Magnesium**	**Manganese**	**Mercury**	**Nickel**	**Potassium**	**Selenium**	**Silver**	**Sodium**	**Thallium**	**Vanadium**	**Zinc**
PRG for SAP					--	--	--	--	2153	244668	--	61175	61145	--	--	61218	--
Tailings PRG					--	--	--	--	--	--	--	--	--	--	--	--	--
Waste Rock/Soil PRG					--	--	--	--	--	--	--	--	--	--	--	--	--
ODEQ Blue Mountain Region Clean Fill					--	--	--	1800	1.4	92	--	0.93	0.51	--	--	400	160
ODEQ Eco RBC Plant Direct Toxicity					--	--	--	220	34	38	--	0.52	560	--	0.05	60	160
ODEQ Eco RBC Inverts Direct Toxicity					--	--	--	450	0.05	280	--	4.1	--	--	--	--	120
ODEQ Eco RBC Bird					--	--	--	1300	0.013	20	--	0.71	2.6	--	4.5	4.7	46
ODEQ Eco RBC Mammal					--	--	--	1400	1.7	10	--	0.63	14	--	0.42	280	79
ODEQ Excavation Worker RCB					--	--	--	230000	2900	190000	--	--	49000	--	--	--	--
Golden Fraction	CES	GF-WR-01	1	6/25/2007	NA	NA	NA	692	NDH (0.04)	6	NA	0.23 J	*0.58*	NA	NA	NA	*191*
		GF-WR-2	0.5	6/25/2007	NA	NA	NA	97.5	*2.61*	1	NA	*3.26*	*52*	NA	NA	NA	*305*
		GF-WR2-1	0.5	6/21/2007	NA	NA	NA	718	0.19 J	7	NA	0.39	*7.95*	NA	NA	NA	*201*
		GF-WR-3	0.5	6/25/2007	NA	NA	NA	544	NDH (0.04)	8	NA	0.34	*0.64*	NA	NA	NA	94
	TEI	GF-DR-1	0.5 - 1	10/5/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		GF-WRA-1	0.5 - 1	10/5/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		GF-WRD-4-DS	0.5 - 1	10/5/2024	8.94 (0.2)	25.6 (0.49)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		GF-WRD-6	0.5 - 1	10/5/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Granite Creek #5	CES	GC5-WR-01	0.5	6/26/2007	NA	NA	NA	821	0.08 JH	8	NA	0.4	*1.2*	NA	NA	NA	*221*
		GC5-WR-02	0.5	6/26/2007	NA	NA	NA	929	0.07 JH	8	NA	0.55	*5.05*	NA	NA	NA	*250*
	TEI	GC5-WRA-3	0.5 - 1	10/4/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		GC5-WRA-4	0.5 - 1	10/4/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		GC5-WRA-4-DS	0.5 - 1	10/4/2024	26.4 (0.19)	70.4 (0.5)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Granite Creek #6	CES	GC6-WR-01	0.5	6/24/2007	NA	NA	NA	497	1.21 H	4 J	NA	0.25 J	0.08 J	NA	NA	NA	59
		GC6-WR-02	0.5	6/24/2007	NA	NA	NA	367	0.09 JH	4 J	NA	0.26 J	0.09 J	NA	NA	NA	62
		GC6-WR-03	0.5	6/24/2007	NA	NA	NA	25.3	NDH (0.05)	ND (1)	NA	0.17 J	0.08 J	NA	NA	NA	4 J
	TEI	GC6-WRA-1	0.5 - 1	10/4/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		GC6-WRA-2	0.5 - 1	10/4/2024	150 (0.2)	360 (0.49)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Granite Creek 7	CES	GC7-WR-01	0.5	6/24/2007	NA	NA	NA	661	0.24 H	5 J	NA	0.35	*20.4*	NA	NA	NA	134
		GC7-WR-02	0.5	6/24/2007	NA	NA	NA	593	0.24	5	NA	0.4	*1.79*	NA	NA	NA	84
		GC7-WR-03	0.5	6/24/2007	NA	NA	NA	608	0.42	0.4	NA	0.45	*4.08*	NA	NA	NA	83
		GC7-WR-04	0.5	6/24/2007	NA	NA	NA	443	NDH (0.04)	4 J	NA	0.26	0.34	NA	NA	NA	61
	TEI	GC7-WRA-3	0.5 - 1	10/4/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		GC7-WRB-1	0.5 - 1	10/4/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Granite Creek Aq. St. 3	CES	GC3-WR-01	0.5	6/24/2007	NA	NA	NA	1070	0.29 H	4 J	NA	0.27 J	*19.1*	NA	NA	NA	*377*

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PRG for SAP					--	--	--	--	2153	244668	--	61175	61145	--	--	61218	--
Tailings PRG					--	--	--	--	--	--	--	--	--	--	--	--	--
Waste Rock/Soil PRG					--	--	--	--	--	--	--	--	--	--	--	--	--
ODEQ Blue Mountain Region Clean Fill					--	--	--	1800	1.4	92	--	0.93	0.51	--	--	400	160
ODEQ Eco RBC Plant Direct Toxicity					--	--	--	220	34	38	--	0.52	560	--	0.05	60	160
ODEQ Eco RBC Inverts Direct Toxicity					--	--	--	450	0.05	280	--	4.1	--	--	--	--	120
ODEQ Eco RBC Bird					--	--	--	1300	0.013	20	--	0.71	2.6	--	4.5	4.7	46
ODEQ Eco RBC Mammal					--	--	--	1400	1.7	10	--	0.63	14	--	0.42	280	79
ODEQ Excavation Worker RCB					--	--	--	230000	2900	190000	--	--	49000	--	--	--	--
Lwr Mon'tl	EA	ML-SSS-38	0.5	7/9/2003	NA	NA	212 J	30.9	0.37	2.2 J	836	0.86	*48*	193 J	ND (0.46)	5.1 J	65
		WP-SSS-15	0.5	7/9/2003	NA	NA	3690	757	0.14	4.8	2010	0.9	*7.1*	385 J	1.5	24.7	107
		WP-SUS-15	4	7/9/2003	NA	NA	4940	776	0.33	6	2730	*0.99*	*6.4*	478	1.8	30.3	130
	CES	MMDGA-T-46	3.5	9/30/2009	NA	NA	NA	208	*95*	NA	NA	NA	*54.9*	NA	NA	NA	*1500*
		MMDGA-WR-18	3.5	9/29/2009	NA	NA	NA	51.1	0.42	NA	NA	NA	*48.8*	NA	NA	NA	152
		MMDGA-WR-19	3	9/29/2009	NA	NA	NA	277	0.17 J	NA	NA	NA	*1.14*	NA	NA	NA	63
		MMDGA-WR-20	3	9/29/2009	NA	NA	NA	185	1.28	NA	NA	NA	*343*	NA	NA	NA	*1140*
		MMDGA-WR-21	1	9/29/2009	NA	NA	NA	784	0.36	NA	NA	NA	*2.6*	NA	NA	NA	132
		MMDGA-WR-24	0.5	9/29/2009	NA	NA	NA	342	*2.99*	NA	NA	NA	*21.9*	NA	NA	NA	78
		MMDGA-WR-25	0.5	9/29/2009	NA	NA	NA	207	0.53	NA	NA	NA	*9.47*	NA	NA	NA	69
		MMDGA-WR-26	0.5	9/29/2009	NA	NA	NA	713	0.84	NA	NA	NA	*40*	NA	NA	NA	*2030*
	TEI	LMM-WRA-3	0.5 - 1	10/3/2024	10.8 (0.2)	32 (0.49)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		LMM-WRA-3-DS	0.5 - 1	10/3/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		LMM-WRA-4	0.5 - 1	10/3/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			0.5 - 1	10/3/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		LMM-WRB-1	0.5 - 1	10/3/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			0.5 - 1	10/3/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		LMM-WRB-3-DS	0.5 - 1	10/3/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sheridan	EA	TA-SUS-25	1.5	7/14/2003	NA	NA	6310	444	0.048	5.3	4900	0.24 J	*1.4*	1330	ND (0.26)	58.5	66.9
		WP-SUS-23	3.5	7/14/2003	NA	NA	5200	782	0.36	5.2	3320	0.48	*32.5*	676	0.76 J	50.8	87.8
	CES	SM-WR2-1	0.5	6/21/2007	NA	NA	NA	278	0.15 J	5 J	NA	0.25 J	0.16	NA	NA	NA	67
	TEI	SH-WRB-2	0.5 - 1	10/4/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		SH-WRC-1	0.5 - 1	10/4/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tillicum	EA	TA-SSS-30	0.4	7/12/2003	NA	NA	6290	579	0.12	5.7	3490	0.45 J	0.29 J	927	0.98 J	51.6	*297*
		WP-SSS-27	0.8	7/12/2003	NA	NA	4330	556	0.38	4.3	2610	0.84	*1.8*	590	1.8	36.5	*322*
		WP-SSS-28	0.8	7/12/2003	NA	NA	1740	890	0.21	4	1410	0.78	*1.2*	38.5 J	2	11.7	*183*
		WP-SUS-26	3	7/12/2003	NA	NA	3220	660	0.1	3.9 J	1980	*1.1*	*2.2*	271 J	2.3	34.5	*356*
		WP-SUS-27	4.5	7/12/2003	NA	NA	5880	603	0.029 J	5.2	3820	*0.95*	ND (0.24)	947	1.6	51.8	157
	CES	TILL-WR-01	0	6/26/2007	NA	NA	NA	1020	0.46 H	4 J	NA	0.84	*3.34*	NA	NA	NA	*525*
	TEI	TL-WRA-1-DS-2	0.5 - 1	10/4/2024	83.3 (0.19)	218 (0.49)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		TL-WRA-3	0.5 - 1	10/4/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		TL-WRB-4	0.5 - 1	10/4/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

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PRG for SAP					--	--	--	--	2153	244668	--	61175	61145	--	--	61218	--
Tailings PRG					--	--	--	--	--	--	--	--	--	--	--	--	--
Waste Rock/Soil PRG					--	--	--	--	--	--	--	--	--	--	--	--	--
ODEQ Blue Mountain Region Clean Fill					--	--	--	1800	1.4	92	--	0.93	0.51	--	--	400	160
ODEQ Eco RBC Plant Direct Toxicity					--	--	--	220	34	38	--	0.52	560	--	0.05	60	160
ODEQ Eco RBC Inverts Direct Toxicity					--	--	--	450	0.05	280	--	4.1	--	--	--	--	120
ODEQ Eco RBC Bird					--	--	--	1300	0.013	20	--	0.71	2.6	--	4.5	4.7	46
ODEQ Eco RBC Mammal					--	--	--	1400	1.7	10	--	0.63	14	--	0.42	280	79
ODEQ Excavation Worker RCB					--	--	--	230000	2900	190000	--	--	49000	--	--	--	--
Upr Mon'tl	EA	ML-SSS-12	0.7	7/9/2003	NA	NA	5730	730	*56*	7.3	4270	*1.1*	*1.8*	1080	2.5	66.2	*211*
		ML-SSS-16	0.5	7/10/2003	NA	NA	678	100	*3.1*	2.5 J	2550	*1.6*	*156*	370 J	1.1 J	15.6	*432*
		WP-SSS-13	1	7/9/2003	NA	NA	2270	115	0.5	2.6 J	2950	0.83	*21.2*	557	0.57 J	26.1	55
		WP-SSS-14	0.7	7/10/2003	NA	NA	2450	691	0.51	4.7	1650	0.7	*1.5*	ND (23.6)	1.2	15	*857*
		WP-SSS-17	1	7/9/2003	NA	NA	3200	321	*784*	3.2 J	3480	0.75	*319*	3240	1.6	14.9	*2410*
		WP-SUS-14	3.5	7/10/2003	NA	NA	4100	511	0.61	4.6	2920	0.61	*11.6*	516	1.7	25.4	107
	CES	MMDGA-T-13	1	9/29/2009	NA	NA	NA	381	*8*	NA	NA	NA	*35*	NA	NA	NA	*674*
		MMDGA-T-34	0.25	9/30/2009	NA	NA	NA	398	*190*	NA	NA	NA	*85*	NA	NA	NA	*816*
		MMDGA-T-34	2	9/30/2009	NA	NA	NA	400	*770*	NA	NA	NA	*229*	NA	NA	NA	*3490*
		MMDGA-T-35	1	9/30/2009	NA	NA	NA	281	*270*	NA	NA	NA	*144*	NA	NA	NA	*1760*
		MMDGA-T-37	0.25	9/30/2009	NA	NA	NA	781	*101*	NA	NA	NA	*51.1*	NA	NA	NA	*764*
		MMDGA-T-40	2	9/30/2009	NA	NA	NA	565	*254*	NA	NA	NA	*214*	NA	NA	NA	*3030*
		MMDGA-T-41	2	9/30/2009	NA	NA	NA	575	*222*	NA	NA	NA	*303*	NA	NA	NA	*4900*
		MMDGA-T-9	1	9/29/2009	NA	NA	NA	246	*12*	NA	NA	NA	*80.1*	NA	NA	NA	*294*
		MMDGA-WR-2	4	9/28/2009	NA	NA	NA	1200	0.88	NA	NA	NA	*0.82*	NA	NA	NA	116
		MMDGA-WR-28	0.5	9/29/2009	NA	NA	NA	197	0.15 J	NA	NA	NA	*2.58*	NA	NA	NA	52
		MMDGA-WR-3	4	9/28/2009	NA	NA	NA	865	1.09	NA	NA	NA	*48.1*	NA	NA	NA	*844*
		MMDGA-WR-5	1	9/28/2009	NA	NA	NA	313	0.4	NA	NA	NA	*39.8*	NA	NA	NA	*248*
	TEI	UMM-TLA-6	0.5 - 1	10/2/2024	69.2 (0.2)	1110 (0.49)	NA	NA	*9.23 (0.19)*	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-TLB-1	0.5 - 1	10/2/2024	241 (0.2)	840 (0.49)	NA	NA	*387 (11)*	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-TLB-4	0.5 - 1	10/2/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-TLC-1	0.5 - 1	10/2/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-TLC-2	0.5 - 1	10/2/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-WRA-1	0.5 - 1	10/2/2024	66 (0.2)	249 (0.49)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-WRA-1-DS	0.5 - 1	10/2/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-WRA-3	0.5 - 1	10/2/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-WRB-1	0.5 - 1	10/2/2024	NA	NA	NA	NA	0.663 (0.098)	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-WRB-2	0.5 - 1	10/2/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-WRB-2-DS	0.5 - 1	10/2/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Upr Upr Mon'tl	TEI	UUMM-WRA-2	0.5 - 1	10/2/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UUMM-WRA-3	0.5 - 1	10/2/2024	12.6 (0.19)	340 (0.49)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			0.5 - 1	10/2/2024	7.14 (0.2)	340 (0.5)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UUMM-WRA-3-DS	0.5 - 1	10/2/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UUMM-WRD-1	0.5 - 1	10/2/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UUMM-WRF-1	0.5 - 1	10/2/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 1
Summary of Soil Notes Analytical Results
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

AOI	Company	Location	Collection Depth (ft bgs)	Sample Date	Metals													
					Aluminum	Antimony	Arsenic	Arsenic, IVBA	Arsenic, Total IVBA	Barium	Beryllium	Cadmium	Calcium	Chromium (total)	Cobalt	Copper	Iron	Lead
PRG for SAP					--	4895	82	--	--	--	24468	9113	--	--	3681	489424	--	--
Tailings PRG					--	--	110	--	--	--	--	--	--	--	--	--	--	--
Waste Rock/Soil PRG					--	--	190	--	--	--	--	--	--	--	--	--	--	--
ODEQ Blue Mountain Region Clean Fill					--	1.3	14	--	--	950	2.6	0.69	--	190	--	120	--	21
ODEQ Eco RBC Plant Direct Toxicity					--	11	18	--	--	110	2.5	32	--	--	13	70	--	120
ODEQ Eco RBC Inverts Direct Toxicity					--	78	6.8	--	--	330	40	140	--	--	--	80	--	1700
ODEQ Eco RBC Bird					--	--	15	--	--	630	--	0.29	--	23	76	14	--	11
ODEQ Eco RBC Mammal					--	0.27	19	--	--	1800	21	0.27	--	34	230	42	--	56
ODEQ Excavation Worker RCB					--	--	420	--	--	--	19000	9700	--	--	--	390000	--	800

Note:
1. All concentrations reported in mg/kg (ppm); detection limits in parentheses.
2. ODEQ does not provide a Eco Soil RBC for aluminum, but states that it is toxic if soil has a pH < 5.5.
3. Iron is a narrative criterion.
4. Underlined concentrations exceed the PRG for SAP.
5. Double underlined concentrations for results from Tailings exceed the Tailings PRG.
6. Double underlined concentrations for results from Waste Rock/Soil exceed the Waste Rock/Soil PRG.
7. Italicized concentrations exceed the ODEQ Blue Mountain Region Clean Fill.
8. Grey shaded concentrations exceed one or more of the ODEQ Eco RBC (i.e., plant, inverts, bird, or mammal).
9. Boldfaced concentrations exceed the ODEQ Excavation Worker RCB.

CES - Cascade Earth Scienes
EA - EA Engineering, Science, and Technology, Inc.
Eco - Ecological
J - Estimated Concentration
H - Storage and Preservation Times were Not Met
Mon’tl - Monumental
ND - Not Detected
NA - Not Analyzed
ODEQ - Oregon Department of Environmental Quality
PRG - Preliminary Remediation Goal
RBC - Risk-Based Concentration
SAP - Sampling and Analysis Plan
St - Station
TEI - Terraphase Engineering Inc.

Table 2
Summary of Sediment Analytical Results
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

AOI	Company	Location	Sample Date	Metals											
				Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium (total)	Cobalt	Copper	Iron	Lead
PRG for SAP				--	4895	82	--	24468	9113	--	--	3681	489424	--	--
Tailings PRG				--	--	110	--	--	--	--	--	--	--	--	--
ODEQ Blue Mountain Region Clean Fill				--	1.3	14	950	2.6	0.69	--	190	--	120	--	21
ODEQ Eco RBC FW				--	3	6	--	--	0.6	--	37	--	36	--	35
USEPA R4 Eco SV FW Non-Narcotic Mode of Action				25000	2	9.8	20	--	1	--	43.4	50	31.6	20000	35.8
USEPA R4 Eco SV FW Aquatic Non-Narcotic Mode of Action				--	--	--	--	--	--	--	--	--	--	--	--
USEPA R4 Eco SV FW Wildlife Non-Narcotic Mode of Action				--	--	--	--	--	--	--	--	--	--	--	--
Granite Creek	EA	ST-PSD-03	7/15/2003	4360	1.2 J	*13.8*	76.3	0.32 J	ND (0.053)	2050	*45.6*	6.4	2.5	40000	4.4
		ST-PSD-04	7/15/2003	6260	**1.5 J**	***19.5***	127	0.38 J	ND (0.053)	1650	5.2	6.3	3.1	11600	4.9
		ST-PSD-05	7/14/2003	6670	ND (0.39)	***18.7***	126	0.27 J	ND (0.062)	1820	7	5.7	2.4 J	14500	6.4
		ST-PSD-06	7/14/2003	9210	ND (0.41)	***18.6***	170	0.36 J	ND (0.065)	2130	8.1	8.2	3	18800	4.9
		ST-PSD-07	7/12/2003	6980	ND (0.36)	***21.9***	127	0.3 J	ND (0.057)	2040	11.5	5.7	10.6	19100	5.3
		ST-PSD-08	7/12/2003	11700	ND (0.55)	***25.9***	217	0.47 J	ND (0.086)	2990	10.7	9.6	7.8	24600	6.7
		ST-PSD-09	7/11/2003	3990	ND (0.42)	*9.6*	52.3	0.11 J	0.069 J	1240	2.3	1.9 J	1.5 J	5650	2.2
		ST-PSD-10	7/10/2003	6680	0.74 J	***22.5***	109	0.29 J	0.12 J	1710	9	5.1 J	12.2	16100	8
		ST-PSD-53	7/19/2003	10200	**2 J**	***<u>130</u>***	139	0.24 J	***0.96***	2180	10.4	6.9	18.1	21600	***38.2***
		ST-PSD-54	7/17/2003	8910	***5.1 J***	***<u>303</u>***	144	0.26 J	***2.8***	2740	10.9	6.5	28	18900	***148***
		ST-RSD-03	7/15/2003	3820	ND (0.4)	***17.4***	68.2	0.2 J	ND (0.062)	1430	12.9	3.7 J	1.3 J	15400	4.1
		ST-RSD-04	7/15/2003	5940	ND (0.41)	***44.2***	92.5	0.23 J	0.074 J	2070	6.1	4.7 J	2.1 J	12400	6.3
		ST-RSD-05	7/14/2003	6030	ND (0.4)	***23***	105	0.24 J	ND (0.063)	1950	9.7	4.6 J	2.9	15200	3.8
		ST-RSD-06	7/14/2003	4640	0.92 J	*9.3*	92.1	0.32 J	ND (0.059)	1900	24.9	6	2.4 J	29900	4.4
		ST-RSD-07	7/12/2003	9650	ND (0.42)	***19.3***	174	0.39 J	ND (0.066)	2330	10.1	8	3.5	22000	4.3
		ST-RSD-08	7/12/2003	8350	ND (0.4)	***14.8***	158	0.39 J	ND (0.063)	2310	15.3	8.2	7.7	25300	5.7
		ST-RSD-09	7/11/2003	6190	0.56 J	***57.9***	101	0.27 J	*0.62*	1820	10	5.2	7.7	16900	***52.4***
		ST-RSD-10	7/10/2003	6850	1 J	***29***	116	0.36 J	ND (0.068)	2300	24.3	7.9	8.9	33700	9.5
		ST-RSD-53	7/19/2003	9670	***2.3 J***	***<u>126</u>***	127	0.25 J	***1.2***	2230	9.9	6.2	18.6	19000	***44.3***
		ST-RSD-54	7/17/2003	7770	***5.1 J***	***<u>246</u>***	126	0.21 J	***1.8***	1750	8.3	6.4	30	18300	***121***
	CES	GC-ABS-01	6/26/2007	NA	1.2	***27.9***	NA	0.2 J	0.44	NA	25	NA	4 J	36000	12.5
		GC-ABS-02	6/26/2007	NA	1.2	***<u>127</u>***	NA	ND (0.2)	***0.9***	NA	12	NA	7	26600	***45.3***
		GC-ABS-03	6/26/2007	NA	0.7 J	***25***	NA	ND (0.2)	***0.85***	NA	*42*	NA	3 J	54600	15.1
		GC-ABS-04	6/27/2007	NA	**1.7**	***67.4***	NA	0.3 J	***1.49***	NA	18	NA	10	29400	***45.8***
		GC-SS-01	6/25/2007	NA	ND (0.2)	*7.5*	NA	0.3 J	0.22 J	NA	9	NA	3 J	9320	1.89
		GC-SS-02	6/25/2007	NA	0.3 J	*6.3*	NA	0.6 J	0.12 J	NA	9	NA	2 J	13700	2.04
		GC-SS-03	6/25/2007	NA	0.3 J	***36.5***	NA	0.8 J	0.17 J	NA	10	NA	3 J	16600	2.63
	TEI	CS-SD-1	10/5/2024	NA	0.26 (0.13)	5.8 (1.3)	NA	NA	0.234 (0.053)	NA	7.81 (0.53)	NA	NA	NA	4.12 (0.13)
		CS-SD-2	10/3/2024	NA	0.038 J (0.054)	4.52 (0.54)	NA	NA	0.038 (0.022)	NA	2.49 (0.22)	NA	NA	NA	0.927 (0.054)
		CS-SD-3	10/3/2024	NA	0.069 (0.063)	*11.7 (0.63)*	NA	NA	0.062 (0.025)	NA	4.9 (0.25)	NA	NA	NA	1.53 (0.063)
		CS-SD-4	10/3/2024	NA	0.892 (0.058)	***32.7 (0.58)***	NA	NA	***1.09 (0.023)***	NA	9.05 (0.23)	NA	NA	NA	**25.6 (0.058)**
		CS-SD-5	10/4/2024	NA	0.146 (0.051)	***14.1 (0.51)***	NA	NA	0.169 (0.02)	NA	5.03 (0.2)	NA	NA	NA	2.79 (0.051)
		CS-SD-6	10/4/2024	NA	0.147 (0.045)	***16.6 (0.45)***	NA	NA	0.146 (0.018)	NA	4.76 (0.18)	NA	NA	NA	2.74 (0.045)
		CS-SD-7	10/4/2024	NA	0.355 (0.048)	***24.2 (0.48)***	NA	NA	0.538 (0.019)	NA	10.6 (0.19)	NA	NA	NA	12.1 (0.048)
		CS-SD-7 (DUP)	10/4/2024	NA	0.334 (0.054)	***24.3 (0.54)***	NA	NA	0.446 (0.022)	NA	9.1 (0.22)	NA	NA	NA	12.8 (0.054)
		CS-SD-8	10/5/2024	NA	0.406 (0.058)	***35.2 (0.58)***	NA	NA	0.316 (0.023)	NA	9.13 (0.23)	NA	NA	NA	10.7 (0.058)

Table 2
Summary of Sediment Analytical Results
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

				Metls										
AOI	**Company**	**Location**	**Sample Date**	**Magnesium**	**Manganese**	**Mercury**	**Nickel**	**Potassium**	**Selenium**	**Silver**	**Sodium**	**Thallium**	**Vanadium**	**Zinc**
PRG for SAP				--	--	2153	244668	--	61175	61145	--	--	61218	--
Tailings PRG				--	--	--	--	--	--	--	--	--	--	--
ODEQ Blue Mountain Region Clean Fill				--	1800	1.4	92	--	0.93	0.51	--	--	400	160
ODEQ Eco RBC FW				--	1100	0.2	18	--	--	4.5	--	--	--	123
USEPA R4 Eco SV FW Non-Narcotic Mode of Action				--	460	--	22.7	--	0.72	1	--	--	--	121
USEPA R4 Eco SV FW Aquatic Non-Narcotic Mode of Action				--	--	0.18	--	--	--	--	--	--	--	--
USEPA R4 Eco SV FW Wildlife Non-Narcotic Mode of Action				--	--	0.17	--	--	0.8	--	--	--	--	--
Granite Creek	EA	ST-PSD-03	7/15/2003	1520	162	ND (0.019)	5.5	950	0.88	0.22 J	ND (41.6)	1.8	154	23
		ST-PSD-04	7/15/2003	3330	159	ND (0.02)	4.3	2020	0.34 J	**0.58 J**	ND (41.9)	ND (0.25)	28.5	43.7
		ST-PSD-05	7/14/2003	3530	187	ND (0.021)	3.2 J	2190	0.5 J	**0.64 J**	ND (48.9)	ND (0.29)	36.6	41.9
		ST-PSD-06	7/14/2003	5550	343	0.027 J	4.4	3000	0.57	**0.54 J**	ND (50.9)	0.5 J	45.3	63.3
		ST-PSD-07	7/12/2003	3080	202	0.087	3.6 J	2100	0.4 J	**0.83 J**	ND (44.8)	0.3 J	57.5	62.6
		ST-PSD-08	7/12/2003	6100	342	0.12	5.7 J	3870	0.73	**0.63 J**	ND (68)	0.44 J	61.9	94.2
		ST-PSD-09	7/11/2003	1370	100	ND (0.019)	1.1 J	762	0.29 J	ND (0.1)	230 J	ND (0.31)	13	20.7
		ST-PSD-10	7/10/2003	2840	177	0.07	3.2 J	2000	0.63	0.49 J	79.7 J	ND (0.33)	46	50.2
		ST-PSD-53	7/19/2003	4790	364	0.11	6.2	2840	0.44 J	**1.8**	ND (45.2)	0.69 J	52.1	*150*
		ST-PSD-54	7/17/2003	3460	611	*0.32*	7.6	2400	0.8	***7.9***	70.2 J	ND (0.67)	43	***186***
		ST-RSD-03	7/15/2003	1600	171	ND (0.019)	2.2 J	1070	0.43 J	ND (0.094)	96.8 J	ND (0.29)	50.2	21.8
		ST-RSD-04	7/15/2003	3390	203	ND (0.021)	2.7 J	1320	0.35 J	**0.86 J**	120 J	ND (0.31)	29.5	34
		ST-RSD-05	7/14/2003	2600	169	ND (0.023)	3.1 J	1630	0.41 J	ND (0.094)	76 J	ND (0.29)	45.9	38.7
		ST-RSD-06	7/14/2003	2220	156	0.037 J	4.3	1420	0.63	0.24 J	ND (46.8)	1.1	113	35.6
		ST-RSD-07	7/12/2003	5160	277	0.05	4.4	3500	0.37 J	**1.9**	ND (52.2)	0.59 J	58.5	57.7
		ST-RSD-08	7/12/2003	5210	283	0.058	4.8	3330	0.34 J	**0.73 J**	ND (49.8)	0.69 J	76.2	58.1
		ST-RSD-09	7/11/2003	3130	177	0.031 J	3.2 J	1920	0.4 J	**1**	ND (44.1)	0.51 J	51.2	75.1
		ST-RSD-10	7/10/2003	3490	193	0.034 J	5.2	2410	0.58	**0.92 J**	ND (53.2)	1.4	117	64.9
		ST-RSD-53	7/19/2003	4030	360	0.12	6.5	2550	0.42 J	***4.9***	45.9	0.73 J	45.9	*148*
		ST-RSD-54	7/17/2003	3380	560	0.12	7.3	2340	0.63	***6.3***	79.5 J	0.76 J	38.3	*151*
	CES	GC-ABS-01	6/26/2007	NA	243	*0.23*	3 J	NA	0.28 J	**1.15**	NA	NA	NA	77
		GC-ABS-02	6/26/2007	NA	376	0.12 J	4 J	NA	0.28 J	**3.27**	NA	NA	NA	99
		GC-ABS-03	6/26/2007	NA	320	0.09 J	3 J	NA	0.38	**0.68**	NA	NA	NA	84
		GC-ABS-04	6/27/2007	NA	414	ND (0.05)	5	NA	0.64	**2.4**	NA	NA	NA	120
		GC-SS-01	6/25/2007	NA	165	0.07 J	1 J	NA	0.31	0.12	NA	NA	NA	25
		GC-SS-02	6/25/2007	NA	213	ND (0.04)	ND (1)	NA	0.09 J	0.05 J	NA	NA	NA	36
		GC-SS-03	6/25/2007	NA	298	0.1 JH	ND (1)	NA	0.15 J	0.13	NA	NA	NA	36
	TEI	CS-SD-1	10/5/2024	NA	NA	0.031 J (0.053)	NA	NA	NA	0.282 (0.053)	NA	NA	NA	45 (1.3)
		CS-SD-2	10/3/2024	NA	NA	ND (0.024)	NA	NA	NA	0.043 (0.022)	NA	NA	NA	16.9 (0.54)
		CS-SD-3	10/3/2024	NA	NA	*0.923 (0.027)*	NA	NA	NA	0.112 (0.025)	NA	NA	NA	29.7 (0.63)
		CS-SD-4	10/3/2024	NA	NA	0.011 J (0.029)	NA	NA	NA	**0.961 (0.023)**	NA	NA	NA	47.2 (0.58)
		CS-SD-5	10/4/2024	NA	NA	0.056 (0.025)	NA	NA	NA	**0.582 (0.02)**	NA	NA	NA	32.7 (0.51)
		CS-SD-6	10/4/2024	NA	NA	0.033 (0.021)	NA	NA	NA	0.2 (0.018)	NA	NA	NA	37.1 (0.45)
		CS-SD-7	10/4/2024	NA	NA	0.097 (0.023)	NA	NA	NA	**1.1 (0.019)**	NA	NA	NA	***168 (0.48)***
		CS-SD-7 (DUP)	10/4/2024	NA	NA	0.099 (0.024)	NA	NA	NA	**1.62 (0.022)**	NA	NA	NA	102 (0.54)
		CS-SD-8	10/5/2024	NA	NA	0.096 (0.026)	NA	NA	NA	**1.26 (0.023)**	NA	NA	NA	103 (0.58)

Table 2
Summary of Sediment Notes Analytical Results
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

AOI	Company	Location	Sample Date	Metals											
				Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium (total)	Cobalt	Copper	Iron	Lead
PRG for SAP				--	4895	82	--	24468	9113	--	--	3681	489424	--	--
Tailings PRG				--	--	110	--	--	--	--	--	--	--	--	--
ODEQ Blue Mountain Region Clean Fill				--	1.3	14	950	2.6	0.69	--	190	--	120	--	21
ODEQ Eco RBC FW				--	3	6	--	--	0.6	--	37	--	36	--	35
USEPA R4 Eco SV FW Non-Narcotic Mode of Action				25000	2	9.8	20	--	1	--	43.4	50	31.6	20000	35.8
USEPA R4 Eco SV FW Aquatic Non-Narcotic Mode of Action				--	--	--	--	--	--	--	--	--	--	--	--
USEPA R4 Eco SV FW Wildlife Non-Narcotic Mode of Action				--	--	--	--	--	--	--	--	--	--	--	--

Note:
1. All concentrations reported in mg/kg (ppm); detection limits in parentheses.
2. Underlined concentrations exceed the PRG for SAP.
3. Double underlined concentrations exceed the Tailings PRG.
4. Boldfaced concentrations exceed the ODEQ Blue Mountain Region Clean Fill.
5. Italicized concentrations exceed the ODEQ Eco RBC FW.
6. Grey shaded concentrations exceed the USEPA R4 Eco SV FW Non-Narcotic Mode of Action.
7. Blue shaded concentrations exceed the USEPA R4 Eco SV FW Aquatic Non-Narcotic Mode of Action.
8. Red colored concentrations exceed the USEPA R4 Eco SV FW Wildlife Non-Narcotic Mode of Action.

CES = Cascade Earth Scienes
EA = EA Engineering, Science, and Technology, Inc.
Eco = Ecological
FW = Freshwater
ND = Not Detected
NA = Not Analyzed
J = Estimated Concentration
ODEQ = Oregon Department of Environmental Quality
PRG = Preliminary Remediation Goal
RBC = Risk-Based Concentration
SAP = Sampling and Analysis Plan
SV = Screening Value
TEI = Terraphase Engineering Inc.
USEPA R4 = United States Environmental Protection Agency Region 4

Table 3
Summary of Surface Water Analytical Results
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

AOI	Company	Location	Sample Date	Physical Properties	Metals								
				Hardness (total)	Aluminum	Antimony	Arsenic	Barium	Cadmium	Calcium	Chromium (total)	Copper	Iron
Eco RBC FW Aquatic Chronic Exposure				--	0.32	0.19	0.15	0.22	0.000094	120	11	0.0014	1
Eco RBC FW Aquatic Acute Exposure				--	0.69	0.9	0.34	2	0.00049	--	16	0.0023	--
Eco RBC FW Wildlife Chronic Exposure				--	--	--	--	--	--	--	--	--	--
Eco RBC FW Wildlife Acute Exposure				--	--	--	--	--	--	--	--	--	--
Cap Martin	CES	CM-AS-01	6/21/2007	NA	NA	ND (0.0004)	ND (0.0005)	NA	ND (0.0001)	9.8	ND (0.01)	ND (0.0005)	0.65
		CM-AS-02	6/21/2007	NA	NA	ND (0.0004)	0.0013	NA	0.0001 J	9.9	ND (0.01)	ND (0.0005)	2.03
Granite Creek	EA	ST-SFW-03	7/15/2003	NA	ND (0.0236)	ND (0.0047)	ND (0.0048)	0.0349 J	ND (0.0006)	5.56	ND (0.0014)	ND (0.0024)	ND (0.0333)
		ST-SFW-04	7/15/2003	NA	0.126 J	ND (0.0047)	ND (0.0048)	0.0415 J	ND (0.0006)	7.06	ND (0.0014)	ND (0.0024)	0.0941 J
		ST-SFW-05	7/13/2003	NA	ND (0.0236)	ND (0.0047)	ND (0.0048)	0.0385 J	ND (0.0006)	7.13	ND (0.0014)	ND (0.0024)	ND (0.0333)
		ST-SFW-06	7/13/2003	NA	ND (0.0236)	ND (0.0047)	ND (0.0048)	0.0456 J	ND (0.0006)	8.45	ND (0.0014)	ND (0.0024)	ND (0.0333)
		ST-SFW-07	7/12/2003	NA	ND (0.0631)	ND (0.005)	ND (0.006)	0.0455 J	ND (0.0012)	8.7	ND (0.0019)	ND (0.0033)	ND (0.0667)
		ST-SFW-08	7/12/2003	NA	ND (0.0236)	ND (0.0047)	ND (0.0048)	0.0485 J	ND (0.0006)	9.01	ND (0.0014)	ND (0.0024)	ND (0.0333)
		ST-SFW-09	7/11/2003	NA	ND (0.0631)	ND (0.005)	ND (0.006)	0.0509 J	ND (0.0012)	9.69	ND (0.0019)	ND (0.0033)	ND (0.0667)
		ST-SFW-10	7/10/2003	NA	ND (0.0631)	ND (0.005)	ND (0.006)	0.0529 J	ND (0.0012)	9.91	ND (0.0019)	ND (0.0033)	ND (0.0667)
		ST-SFW-53	7/17/2003	NA	0.0793 J	ND (0.0047)	0.0131	0.055 J	ND (0.0006)	15.3	ND (0.0014)	ND (0.0024)	ND (0.0168)
		ST-SFW-54	7/17/2003	NA	0.0264 J	ND (0.0038)	0.0096 J	0.051 J	ND (0.0003)	15.9	0.00074 J	ND (0.0014)	0.0323 J
	CES	GC-SW-01	6/25/2007	NA	NA	ND (0.0004)	0.0006 J	NA	ND (0.0001)	4.5	ND (0.01)	ND (0.0005)	0.03 J
		GC-SW-02	6/25/2007	NA	NA	ND (0.0004)	ND (0.0005)	NA	ND (0.0001)	4.5	ND (0.01)	ND (0.0005)	0.04 J
		GC-SW-03	6/5/2007	NA	NA	ND (0.0004)	0.0006 J	NA	ND (0.0001)	4.7	ND (0.01)	ND (0.0005)	0.1
	TEI	CS-SW-1	10/5/2024	18.1 (0.09)	NA	0.000036 J (0.00005)	0.00036 J (0.0005)	NA	ND (0.00002)	5.59 (0.02)	0.00011 J (0.0002)	NA	NA
		CS-SW-2	10/3/2024	19.7 (0.09)	NA	0.000025 J (0.00005)	0.00067 (0.0005)	NA	ND (0.00002)	6.07 (0.02)	0.00011 J (0.0002)	NA	NA
		CS-SW-2 (DUP)	10/3/2024	19.3 (0.09)	NA	0.000031 J (0.00005)	0.00061 (0.0005)	NA	ND (0.00002)	5.92 (0.02)	0.00011 J (0.0002)	NA	NA
		CS-SW-3	10/3/2024	21 (0.09)	NA	0.000038 J (0.00005)	0.00087 (0.0005)	NA	ND (0.00002)	6.49 (0.02)	0.00012 J (0.0002)	NA	NA
		CS-SW-4	10/3/2024	27.5 (0.09)	NA	0.000036 J (0.00005)	0.00092 (0.0005)	NA	ND (0.00002)	8.41 (0.02)	0.00014 J (0.0002)	NA	NA
		CS-SW-5	10/4/2024	31.8 (0.09)	NA	0.000098 (0.00005)	0.00178 (0.0005)	NA	0.00001 J (0.00002)	9.55 (0.02)	0.00011 J (0.0002)	NA	NA
		CS-SW-6	10/4/2024	32.3 (0.09)	NA	0.000076 (0.00005)	0.00204 (0.0005)	NA	ND (0.00002)	9.71 (0.02)	0.00011 J (0.0002)	NA	NA
		CS-SW-7	10/4/2024	36.3 (0.09)	NA	0.000104 (0.00005)	0.00199 (0.0005)	NA	0.000019 J (0.00002)	10.9 (0.02)	0.00009 J (0.0002)	NA	NA
		CS-SW-8	10/5/2024	36.7 (0.09)	NA	0.000108 (0.00005)	0.00221 (0.0005)	NA	0.00002 J (0.00002)	10.9 (0.02)	0.00011 J (0.0002)	NA	NA
Granite Creek #5	CES	GC5-AS-01	6/24/2007	NA	NA	0.0009 J	0.0046	NA	0.0007	22.7	ND (0.01)	0.0038	1.74
Golden Fraction	CES	GF-AS-01	6/25/2007	NA	NA	0.0007 J	0.0119	NA	ND (0.0001)	28.2	ND (0.01)	0.0007 J	1.87
Lwr Mon'tl	EA	SP-SFW-19	7/19/2003	NA	ND (0.0631)	ND (0.005)	0.0214	0.0995 J	ND (0.0012)	22.6	ND (0.0019)	ND (0.0033)	ND (0.0667)
	CES	MMDGA-AS-01	9/28/2009	NA	NA	NA	0.0218	NA	NA	NA	NA	NA	0.13
		MMDGA-SP-02	9/28/2009	NA	NA	NA	0.0199	NA	NA	NA	NA	NA	0.06
		MMDGA-SW-02	9/28/2009	NA	NA	NA	0.0242	NA	NA	NA	NA	NA	ND (0.02)
Upr Mon'tl	EA	SP-SFW-18	7/9/2003	NA	ND (0.0631)	ND (0.005)	0.0818	0.0677 J	ND (0.0012)	17.4	ND (0.0019)	ND (0.0033)	ND (0.0667)
	EA	SP-SFW-51	7/10/2003	NA	ND (0.0631)	ND (0.005)	ND (0.006)	0.0756 J	ND (0.0012)	17.8	ND (0.0019)	ND (0.0033)	ND (0.0667)
	CES	MMDGA-AS-02	9/28/2009	NA	NA	NA	0.0272	NA	NA	NA	NA	NA	0.33
	CES	MMDGA-SP-01	9/28/2009	NA	NA	NA	0.105	NA	NA	NA	NA	NA	5.61
	CES	MMDGA-SW-01	9/28/2009	NA	NA	NA	0.051	NA	NA	NA	NA	NA	4.22

Table 3
Summary of Surface Water Analytical Results
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

				Metals								
AOI	**Company**	**Location**	**Sample Date**	**Lead**	**Magnesium**	**Manganese**	**Mercury**	**Potassium**	**Selenium**	**Silver**	**Sodium**	**Zinc**
Eco RBC FW Aquatic Chronic Exposure				0.00054	82	0.093	0.000012	53	0.0046	0.0001	680	0.036
Eco RBC FW Aquatic Acute Exposure				0.014	--	1.7	0.0014	--	0.02	0.0003	--	0.036
Eco RBC FW Wildlife Chronic Exposure				--	--	--	0.0000013	--	--	--	--	--
Eco RBC FW Wildlife Acute Exposure				--	--	--	0.000012	--	--	--	--	--
Cap Martin	CES	CM-AS-01	6/21/2007	0.0001 J	2	0.021 J	0.00000095	NA	ND (0.0001)	ND (0.00005)	NA	<u>1.31</u>
		CM-AS-02	6/21/2007	0.0001 J	2.1	0.026 J	**0.00000574**	NA	ND (0.0001)	ND (0.00005)	NA	ND (0.01)
Granite Creek	EA	ST-SFW-03	7/15/2003	ND (0.0013)	0.998 J	ND (0.0007)	ND (0.0001)	1.21 J	ND (0.0034)	ND (0.0022)	2.81 J	0.002 J
		ST-SFW-04	7/15/2003	ND (0.0013)	1.32 J	0.0057 J	ND (0.0001)	1.75 J	ND (0.0034)	ND (0.0022)	3.16 J	0.0026 J
		ST-SFW-05	7/13/2003	ND (0.0013)	1.33 J	0.00088 J	ND (0.0001)	2.34 J	ND (0.0034)	ND (0.0022)	3.26 J	0.0025 J
		ST-SFW-06	7/13/2003	ND (0.0013)	1.72 J	0.00072 J	ND (0.0001)	1.99 J	ND (0.0034)	ND (0.0022)	3.22 J	0.0023 J
		ST-SFW-07	7/12/2003	0.0017 J	1.76 J	ND (0.0019)	ND (0.0001)	1.59 J	ND (0.0017)	ND (0.0029)	3.16 J	0.0029 J
		ST-SFW-08	7/12/2003	ND (0.0013)	1.82 J	0.0011 J	ND (0.0001)	2.67 J	ND (0.0034)	ND (0.0022)	3.42 J	0.003 J
		ST-SFW-09	7/11/2003	ND (0.0015)	2.01 J	ND (0.0019)	ND (0.0001)	1.62 J	ND (0.0017)	ND (0.0029)	3.24 J	0.0033 J
		ST-SFW-10	7/10/2003	ND (0.0015)	2.07 J	ND (0.0019)	ND (0.0001)	1.63 J	ND (0.0017)	ND (0.0029)	3.14 J	0.0035 J
		ST-SFW-53	7/17/2003	ND (0.0013)	3.54 J	0.0103 J	***0.0002 J***	1.87 J	ND (0.0017)	ND (0.0022)	3.38 J	0.0031 J
		ST-SFW-54	7/17/2003	ND (0.0013)	4.04 J	0.0067 J	***0.0001 J***	2.49 J	ND (0.0017)	ND (0.0009)	3.65 J	ND (0.0057)
	CES	GC-SW-01	6/25/2007	0.0001 J	0.7 J	ND (0.005)	ND (0.0000001)	NA	ND (0.0001)	ND (0.00005)	NA	ND (0.01)
		GC-SW-02	6/25/2007	ND (0.0001)	0.8 J	ND (0.005)	0.00000048	NA	ND (0.0001)	ND (0.00005)	NA	0.01 J
		GC-SW-03	6/5/2007	0.0001 J	0.9 J	ND (0.005)	0.00000048	NA	ND (0.0001)	ND (0.00005)	NA	0.01 J
	TEI	CS-SW-1	10/5/2024	0.000013 J (0.00002)	0.996 (0.01)	NA	ND (0.0002)	NA	NA	ND (0.00002)	NA	ND (0.002)
		CS-SW-2	10/3/2024	0.000012 J (0.00002)	1.11 (0.01)	NA	ND (0.0002)	NA	NA	ND (0.00002)	NA	ND (0.002)
		CS-SW-2 (DUP)	10/3/2024	0.000007 J (0.00002)	1.09 (0.01)	NA	ND (0.0002)	NA	NA	ND (0.00002)	NA	ND (0.002)
		CS-SW-3	10/3/2024	0.000012 J (0.00002)	1.17 (0.01)	NA	ND (0.0002)	NA	NA	ND (0.00002)	NA	ND (0.002)
		CS-SW-4	10/3/2024	ND (0.00002)	1.59 (0.01)	NA	ND (0.0002)	NA	NA	ND (0.00002)	NA	ND (0.002)
		CS-SW-5	10/4/2024	0.000018 J (0.00002)	1.93 (0.01)	NA	ND (0.0002)	NA	NA	ND (0.00002)	NA	0.0018 J (0.002)
		CS-SW-6	10/4/2024	0.000013 J (0.00002)	1.96 (0.01)	NA	ND (0.0002)	NA	NA	ND (0.00002)	NA	0.0007 J (0.002)
		CS-SW-7	10/4/2024	0.000022 (0.00002)	2.2 (0.01)	NA	ND (0.0002)	NA	NA	ND (0.00002)	NA	0.0008 J (0.002)
		CS-SW-8	10/5/2024	0.000084 (0.00002)	2.31 (0.01)	NA	ND (0.0002)	NA	NA	ND (0.00002)	NA	0.0008 J (0.002)
Granite Creek #5	CES	GC5-AS-01	6/24/2007	0.009	4.9	0.01 J	***0.000141***	NA	0.0005 J	0.00009 J	NA	0.02 J
Golden Fraction	CES	GF-AS-01	6/25/2007	0.0002 J	6.7	0.374	**0.00000194**	NA	ND (0.0001)	ND (0.00005)	NA	ND (0.01)
Lwr Mon'tl	EA	SP-SFW-19	7/19/2003	0.0023 J	7.15	0.0067 J	ND (0.0001)	2.72 J	0.0026 J	ND (0.0029)	3.31 J	0.0156 J
	CES	MMDGA-AS-01	9/28/2009	ND (0.0001)	NA	NA	NA	NA	NA	NA	NA	0.004 J
		MMDGA-SP-02	9/28/2009	ND (0.0001)	NA	NA	NA	NA	NA	NA	NA	0.004 J
		MMDGA-SW-02	9/28/2009	0.0003 J	NA	NA	NA	NA	NA	NA	NA	0.009 J
Upr Mon'tl	EA	SP-SFW-18	7/9/2003	ND (0.0015)	4.66 J	0.0029 J	ND (0.0000001)	2.44 J	ND (0.0017)	ND (0.0029)	2.94 J	0.0276
	EA	SP-SFW-51	7/10/2003	0.0021 J	4.53 J	0.0554	ND (0.0000001)	1.61 J	ND (0.0017)	ND (0.0029)	2.63 J	0.005 J
	CES	MMDGA-AS-02	9/28/2009	0.0004 J	NA	NA	NA	NA	NA	NA	NA	0.014
	CES	MMDGA-SP-01	9/28/2009	<u>0.0294</u>	NA	NA	NA	NA	NA	NA	NA	<u>0.12</u>
	CES	MMDGA-SW-01	9/28/2009	0.0118	NA	NA	NA	NA	NA	NA	NA	0.028

Table 3
Summary of Surface Water Analytical Results
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

				Physical Properties	Metals									
AOI	Company	Location	Sample Date	Hardness (total)	Aluminum	Antimony	Arsenic	Barium	Cadmium	Calcium	Chromium (total)	Copper	Iron
Eco RBC FW Aquatic Chronic Exposure				--	0.32	0.19	0.15	0.22	0.000094	120	11	0.0014	1
Eco RBC FW Aquatic Acute Exposure				--	0.69	0.9	0.34	2	0.00049	--	16	0.0023	--
Eco RBC FW Wildlife Chronic Exposure				--	--	--	--	--	--	--	--	--	--
Eco RBC FW Wildlife Acute Exposure				--	--	--	--	--	--	--	--	--	--

Note:
1. All concentrations reported in mg/L; detection limits in parentheses.
2. Only compounds with at least one detection are shown.
3. The numbers presented for Chromium (total) are the criteria established by ODEQ for Chromium VI.
4. Grey-shaded concentrations exceed the Eco RBC FW Aquatic Chronic Exposure.
5. Underlined concentrations exceed the Eco RBC FW Aquatic Acute Exposure.
6. Boldfaced concentrations exceed the Eco RBC FW Wildlife Chronic Exposure.
7. Italicized concentrations exceed the Eco RBC FW Wildlife Acute Exposure.
CES = Cascade Earth Scienes
EA = EA Engineering, Science, and Technology, Inc.
Eco = Ecological
FW = Freshwater
ND = Not Detected
NA = Not Analyzed
J = Estimated Concentration
Mon'tl = Monumental
ODEQ =Oregon Department of Environmental Quality
RBC = Risk-Based Concentration
TEI = Terraphase Engineering Inc.

Table 4
Chemical-Specific Potential Applicable or Relevant and Appropriate Requirements
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines
Wallowa Whitman National Forest, Oregon

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate?
FEDERAL			
Safe Drinking Water Act	**42 USC § 300**		
National Primary Drinking Water Regulations	40 CFR 141	Establishes health-based standards (primary maximum contaminant levels) for public water systems.	Not an ARAR; surface water and groundwater are not used as drinking water in the area surrounding the Site.
National Secondary Drinking Water Regulations	40 CFR 143, Subpart A	Establishes aesthetic standards (secondary maximum contaminant levels) for public water systems.	Not an ARAR; these are not enforceable standards and are outside scope of removal action.
Clean Water Act	**33 USC §§ 1251-1387**		
National Ambient Water Quality Criteria	40 CFR 131	Establishes water quality standards based on toxicity to aquatic organisms and human health.	Not an ARAR; the State of Oregon has been delegated this program (see State of Oregon ARARs).
Clean Air Act	**42 USC § 7409**		
National Primary and Secondary Ambient Air Quality Standards	40 CFR 50	Establishes air quality levels that protect public health.	Not an ARAR; only “major” sources are subject to requirements related to National Ambient Air Quality Standards, defer to State (see State of Oregon ARARs).
Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites	**USEPA Regions 3, 6, and 9**	RSLs are tools for evaluating and cleaning up contaminated sites. They are risk-based concentrations that are intended to assist risk assessors and others in initial screening-level evaluations of environmental measurements. The RSLs contained in the 2024 Table are generic; they are calculated without site specific information. However, they may be re-calculated using site specific data. RSLs should be viewed as Agency guidelines, not legally enforceable standards. They are used for site "screening" and as initial cleanup goals, if applicable.	Potentially Relevant and Appropriate Requirement
Resource Conservation and Recovery Act	**42 USC § 6905**		
Lists of Hazardous Wastes	40 CFR 261, Subparts C and D	Characterizes and defines solid wastes which are subject to regulation as hazardous wastes under 40 CFR Parts 262-265 and Parts 124, 270, and 271.	Not an ARAR; mine waste is not a listed hazardous waste, Bevill exempt. Even if Toxicity Characteristic Leaching Procedure testing confirmed a characteristic waste (Subpart C), it is still exempt. Parts of the RCRA regulations may be potentially relevant and appropriate, however, and are discussed under action-specific requirements.
STATE OF OREGON			
Hazardous Substance Remedial Action Rules	**OAR 340-122-0040, 0084, and 0115**	Establishes ODEQ guidelines and requirements for assessing human and ecological risk assessments from contamination according to ODEQ risk guidelines and levels. Also specifies the use of risk-based cleanup concentrations and the use of background concentrations.	Potentially Applicable Requirement
Hazardous Substance Occupational Exposure	**OAR 437, Division 2, Subdivision Z**	Establishes Oregon-Occupational Safety and Health Administration Permissible Exposure Limits. Oregon-Occupational Safety and Health Administration exposure limits mirror the federal chemical specific limits (refer to National Institute for Occupational Safety and Health Pocket Guide to Chemical Hazards for details on individual chemicals).	Potentially Applicable Requirement
Numeric Soil Cleanup Levels for Motor Fuel and Heating Oil	**OAR 340-122-305 through 360**	Establishes cleanup standards for contamination of soil by motor fuel and heating oil.	To Be Considered
Oregon Soil Cleanup Rules for Simple Sites	**OAR 340-122-047**	Establishes ODEQ rules for streamlined cleanup processes and cleanup standards at simple sites.	To Be Considered
Oregon Water Pollution Control Statutes	**ORS 468B.005- ORS 468B.197**	Address effluent standards, permit requirements for discharges to US waters and minimum Federal water quality criteria. Applicable to the protection of surface water during removal activities.	Potentially Relevant and Appropriate Requirement
Groundwater Quality Protection Program	**OAR Chapter 340 Division 40**	Establishes the mandatory minimum groundwater quality protection requirements for federal and state agencies, cities, industries, and citizens.	Potentially Relevant and Appropriate Requirement
State of Oregon is authorized by the USEPA to implement the Clean Water Act in Oregon	**ORS 468B.050 OAR Chapter 340 Division 41, Table 20**	Establishes acceptable contaminant levels for ingestion of aquatic organisms and for intake by aquatic organisms in surface water.	Potentially Applicable Requirement
Oregon Air Pollution Laws	**ORS 468A.005- ORS 468A.085**	Provides a state program with laws governing air pollution control, abatement, and prevention.	Potentially Relevant and Appropriate Requirement, during Removal Action.

Table 4
Chemical-Specific Potential Applicable or Relevant and Appropriate Requirements
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines
Wallowa Whitman National Forest, Oregon

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate?
STATE OF OREGON (continued)			
Ambient Air Quality Standards and PSD Increments	**OAR Chapter 340 Division 202**	Establish concentrations, exposure time, and frequency of occurrence of an air contaminant in the ambient air that must not be exceeded.	Potentially Relevant and Appropriate Requirement, during Removal Action.
Asbestos Removal	**OAR 340-32-5620 through 5650**	Establishes ODEQ requirements for licensing and certification for asbestos workers. All workers who handle asbestos-containing materials must meet certain training and certification requirements.	Potentially Applicable Requirement

Note:
ARAR = Applicable/Relevant and Appropriate Requirement
CFR = The Code of Federal Regulations
OAR = Oregon Administrative Rules
ODEQ = Oregon Department of Environmental Quality
ORS = Oregon Revised Statutes
RSL = Regional Screening Level
USC = United States Code
USEPA = United States Environmental Protection Agency

Table 5
Location-Specific Potential Applicable or Relevant and Appropriate Requirements
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines, Wallowa -Whitman National Forest, Oregon

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate?
FEDERAL			
Resource Conservation and Recovery Act	**42 USC § 6905**		
Hazardous and Solid Waste Regulations	40 CFR 264.18	Location standards and restrictions for hazardous waste treatment, storage, and disposal facilities.	Potentially Relevant and Appropriate Requirement
	40 CFR § 257.3-1 through 257.3-4	Location standards and restrictions for municipal solid waste facilities.	Potentially Relevant and Appropriate Requirement
National Historic Preservation Act	**16 USC § 470; 36 CFR 800; 40 CFR 6.301(b)**	Requires Federal Agencies to take into account the effect of any Federally assisted undertaking or licensing on any property with historic, architectural, archeological, or cultural value that is included in or eligible for inclusion in the National Register of Historic Places.	Potentially Applicable Requirement
Archeological and Historic Preservation Act	**16 USC § 469; 40 CFR 6.301(c)**	Establishes procedures to provide for preservation of significant scientific, prehistoric, historic, and archeological data that might be destroyed through alteration of terrain as a result of a Federal construction project or a Federally licensed activity or program.	Potentially Relevant and Appropriate Requirement
The Archaeological Resources Protection Act of 1979	**43 CFR 7**	Regulates requirements for authorized removal of archaeological resources from public or tribal lands.	Potentially Relevant and Appropriate Requirement
Executive Order 11593	**16 USC § 469; 40 CFR § 6.301(c)**	Provides for the inventory and nomination of historical and archeological sites.	Potentially Relevant and Appropriate Requirement
Federal Land Policy and Management Act of 1976	**43 USC 1701**	Provides for multiple use and inventory, protection, and planning for cultural resources on public lands.	Potentially Relevant and Appropriate Requirement
Native American Graves Protection and Repatriation Act	**25 USC 3001-3013; 43 CFR 10**	Regulations that pertain to the identification, protection, and appropriate disposition of human remains, funerary objects, sacred objects, or objects of cultural patrimony.	Potentially Relevant and Appropriate Requirement
Federal Land Policy and Management Act of 1976	**43 USC 1701**	Provides for multiple use and inventory, protection, and planning for cultural resources on public lands.	Potentially Relevant and Appropriate Requirement
Protection of Wetlands Executive Order No. 11990	**40 CFR Part 6, Appendix A; 40 CFR 6.302(a)**	Avoid adverse impacts associated with the destruction or loss of wetlands and avoid support of new construction in wetlands if a practicable alternative exists.	Potentially Relevant and Appropriate Requirement
Dredge and Fill Regulations	**33 USC § 1344, 33 CFR 323.1 et. seq.**	Prohibits discharge of dredged or fill material into waters of the United States without a permit	Potentially Relevant and Appropriate Requirement
Fish and Wildlife Coordination Act	**16 USC Chapter 49, §§ 2901-2912; 40 CFR 6.302(g)**	Requires consultation when Federal department or agency proposes or authorizes any modification of any stream or other water body to assure adequate protection of fish and wildlife resources.	Potentially Relevant and Appropriate Requirement
Floodplain Management Executive Order No. 11988	**40 CFR Part 6, Appendix A; 40 CFR 6.302(b)**	Requires Federal agencies to evaluate the potential effects of actions they may take in a floodplain to avoid the adverse impacts associated with direct and indirect development of a floodplain to the extent possible.	Potentially Applicable Requirement
Endangered Species Act	**16 USC §§ 1531-1543; 40 CFR 6.302 (h); 50 CFR Part 402**	Activities may not jeopardize the continued existence of any threatened or endangered species or destroy or adversely modify a critical habitat.	Potentially Applicable Requirement
Migratory Bird Treaty Act	**16 USC §§ 703 et seq.**	Establishes federal responsibility for the protection of the international migratory bird resource and requires continued consultation with the USFWS during remedial design and remedial construction to ensure that the cleanup of the site does not unnecessarily impact migratory birds.	Potentially Applicable Requirement

Table 5
Location-Specific Potential Applicable or Relevant and Appropriate Requirements
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines, Wallowa-Whitman National Forest, Oregon

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate?
FEDERAL (continued)			
Bald Eagle Protection Act	**16 USC §§ 668 et seq.**	Requires continued consultation with the USFWS during remedial design and remedial construction to ensure that any cleanup of the site does not unnecessarily adversely affect the bald or golden eagle.	Potentially Applicable Requirement
STATE OF OREGON			
Plants: Wildflowers and Endangered, Threatened and Candidate Species	**OAR 603 Division 73**	Provides for protection of certain plants, wildflowers, and shrubs; guidelines on the listing, reclassification, and delisting of plant species as threatened or endangered.	Potentially Applicable Requirement
Wildlife Diversity Program	**OAR 635 Division 100**	Provides rules for maintaining Oregon's wildlife diversity by protecting and enhancing populations and habitats of native wildlife at self-sustaining levels throughout geographic ranges.	Potentially Relevant and Appropriate Requirement

Note:
ARAR = Applicable/Relevant and Appropriate Requirement
CFR = The Code of Federal Regulations
OAR = Oregon Administrative Rules
USC = United States Code
USFWS = United States Fish and Wildlife Service

Table 6
Action-Specific Potential Applicable or Relevant and Appropriate Requirements
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines, Wallowa Whitman National Forest, Oregon

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate?
FEDERAL			
Clean Water Act	**33 USC § 1342**		
National Pollutant Discharge Elimination System	40 CFR § 122.26	In general, Part 122 provides permit requirements for the discharge of pollutants from any point source into waters of the United States. Part 122.26 requires permits for storm-water discharges.	Potentially Relevant and Appropriate Requirement.
Surface Mining Control and Reclamation Act	**30 USC §§ 1201-1328**	Performance standards for surface mining activities.	Potentially Relevant and Appropriate Requirement
Hazardous Materials Transportation Act	**49 USC §§ 1801-1813** **49 CFR 10, and 171-177**	Regulates transportation of hazardous materials.	Potentially Applicable Requirement, if any hazardous materials are transported offsite.
Resource Conservation and Recovery Act	**42 USC § 6905**		
Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal (TSD) Facilities	40 CFR § 264.13.14	Requirements for proper handling, treatment, storage, and disposal of hazardous wastes.	Potentially Relevant and Appropriate Requirement
Land Disposal Restrictions (LDRs)	40 CFR 268	LDRs place specific restrictions (concentration levels or treatment) on RCRA hazardous wastes prior to their placement in a land disposal unit. Relevant and appropriate LDR requirements will be met if any material accumulations are treated *ex situ* .	Potentially Relevant and Appropriate Requirement
Disposal of Solid Waste	RCRA 42 U.S.C. § 6901 *et seq* ; 40 CFR 257	Facility or practices in floodplains will not restrict flow of basic flood, reduce the temporary water storage capacity of the floodplain or otherwise result in a wash-out of solid waste.	Potentially Relevant and Appropriate Requirement
Closure Requirements	RCRA/HWMA 40 CFR 264, Subpart G	Closure of hazardous waste repositories must meet protective standards. Regulations to minimize contaminant migration, provide leachate collection and prevent contaminant exposure will be met.	Potentially Relevant and Appropriate Requirement
Landfill Design and Construction	RCRA/HWMA 40 CFR 264, Subpart N	Hazardous waste landfills must meet minimum design standards. Protectiveness will be achieved through capping and institutional controls.	Potentially Relevant and Appropriate Requirement
Ground Water Monitoring	RCRA/HWMA 40 CFR 264, Subpart F 40 CFR 264, Subpart X	Establishes standards for detection and compliance monitoring. Site wide monitoring will accommodate specific ground water monitoring requirements.	Potentially Relevant and Appropriate Requirement
Criteria for Classification of Solid Waste Disposal Facilities and Practices	**40 CFR 257**	Establishes criteria for determining which solid waste disposal practices pose threats to human health and the environment.	Potentially Relevant and Appropriate Requirement
Occupational Exposure to Asbestos	**29 CFR 1910 and 1926**	Establishes OSHA requirements for asbestos-related work in the construction and demolition industry. Requirements on exposure limits, work practices and engineering controls to provide worker safety in handling, removal, disposal, or other workplace exposure to asbestos.	To Be Considered
Fugitive Dust Emissions	**40 CFR § 50.6**	Establishes standards for particulate matter with a diameter of 10 microns or less.	Potentially Relevant and Appropriate Requirement

Table 6
Action-Specific Potential Applicable or Relevant and Appropriate Requirements
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines, Wallowa Whitman National Forest, Oregon

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate?
STATE OF OREGON			
Regulations pertaining to National Pollutant Discharge Elimination System and Water Pollution Control Facility Permits	OAR 340 Division 45	Prescribes limitations on discharge of wastes and the requirements and procedures for obtaining National Pollutant Discharge Elimination System and Water Pollution Control Facility permits from the ODEQ	Potentially Relevant and Appropriate Requirement
Groundwater Quality Protection Program	OAR 340 Division 40	Establishes the mandatory minimum groundwater quality protection requirements for federal and state agencies, cities, counties, industries, and citizens.	Potentially Relevant and Appropriate Requirement
Solid Waste: Land Disposal Sites other than Municipal Solid Waste Landfills	OAR 340 Division 95	Regulates the siting, operation and maintenance of any non-municipal land disposal site.	Potentially Relevant and Appropriate Requirement
Storage, Treatment and Disposal of Hazardous Waste	ORS Chapter 466	Regulates the transportation and disposal of hazardous waste.	Potentially Relevant and Appropriate Requirement
Reduction of use of Toxic Substances and Hazardous Waste Generation	ORS 465.200 -.455 and 465.900	Establishes ODEQ removal and remedial action program	Potentially Relevant and Appropriate Requirement
Asbestos Removal	OAR 340-32-5620 through 5650	Establish ODEQ requirements for licensing and certification for asbestos workers. All workers who handle asbestos-containing materials must meet certain training, licensing and certification requirements.	Potentially Applicable Requirement
	OAR 340-248-005 through 130	Establish ODEQ requirements for handling asbestos-containing materials. Handling, removing, transporting and disposing of asbestos material in a manner that prevents it from becoming friable and releasing asbestos fibers.	Potentially Applicable Requirement

Note:
ARAR = Applicable/Relevant and Appropriate Requirement
CFR = The Code of Federal Regulations
LDR = Land Disposal Restrictions
OAR = Oregon Administrative Rules
ODEQ = Oregon Department of Environmental Quality
ORS = Oregon Revised Statutes
OSHA = Occupational Safety and Health Administration
RCRA = Resource Conservation and Recovery Act
USC = United States Code

Table 7
Cost Estimate for Alternative 2 - Onsite Containment
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

Task		Quantity	Units	Unit Cost	Cost
Mobilization		1	LS	$ 10,000	$ 10,000
Improvements to existing roads- FS 7345, FS 720, FS 280, and unnamed roads		8	PM	$ 5,000	$ 40,000
Creation of new roads to access Granite Creek #6 and Cap Martin Mines, and upper waste rock pile at Golden Fraction Mine		2	PM	$ 80,000	$ 160,000
Grubbing and Scraping		3	PA	$ 10,000	$ 30,000
Erosion Control - Silt Fences - Spring Diversion		1	LS	$ 10,000	$ 10,000
Grading	Upper Upper Monumental Mine	470	CY	$ 10.0	$ 4,700
	Upper Monumental Mine	8,405	CY	$ 10.0	$ 84,050
	Lower Monumental Mine	5,910	CY	$ 10.0	$ 59,100
	Granite Creek Aquatic Station 03	80	CY	$ 10.0	$ 800
	Cap Martin Mine	735	CY	$ 10.0	$ 7,350
	Granite Creek #6 Mine	45	CY	$ 10.0	$ 450
	Tillicum Mine	205	CY	$ 10.0	$ 2,050
	Granite Creek #5 Mine	285	CY	$ 10.0	$ 2,850
	Golden Fraction Mine	295	CY	$ 10.0	$ 2,950
	Central Mine	80	CY	$ 10.0	$ 800
Cover Placement - assumes local cover except at Upper Monumental Mine (assumes sourced from Granite Creek Saddle)	Upper Upper Monumental Mine	1,200	SF	$ 10.0	$ 12,000
	Upper Monumental Mine	6,700	SF	$ 20.0	$ 134,000
	Lower Monumental Mine	5,700	SF	$ 10.0	$ 57,000
	Granite Creek Aquatic Station 03	259	SF	$ 10.0	$ 2,590
	Cap Martin Mine	3,000	SF	$ 10.0	$ 30,000
	Granite Creek #6 Mine	150	SF	$ 10.0	$ 1,500
	Tillicum Mine	425	SF	$ 10.0	$ 4,250
	Granite Creek #5 Mine	1,000	SF	$ 10.0	$ 10,000
	Golden Fraction Mine	400	SF	$ 10.0	$ 4,000
	Central Mine	441	SF	$ 10.0	$ 4,410

Table 7
Cost Estimate for Alternative 2 - Onsite Containment
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

Task		Quantity	Units	Unit Cost	Cost
Water Engineering Controls	Upper Monumental Mine - Adit seep pipe construction	1	LS	$ 5,000	$ 5,000
	Upper Monumental Mine - settling pond diversion	1	LS	$ 15,000	$ 15,000
	Lower Monumental Mine - adit and settling pond diversion channel	1	LS	$ 25,000	$ 25,000
	HDPE Culvert Under Access Roads	2	Each	$ 5,000	$ 10,000
Revegetation	Seed/Fertilization	5	PA	$ 2,000	$ 10,000
	Mulch	5	PA	$ 3,000	$ 15,000
Road Decommissioning		1	LS	$ 10,000	$ 10,000
Confirmation sampling analytical cost and XRF rental		1	LS	$ 30,000	$ 30,000
Demobilization		1	LS	$ 10,000	$ 10,000
				Subtotal Capital Costs	**$ 804,850**
Design Expenses (10%)					$ 80,485
Construction Oversight (15%)					$ 120,728
Post Construction Monitoring (6 years)		6	PY	$ 15,000	$ 90,000
				Subtotal Indirect Capital Costs	$ 291,213
Contingency (10%)					$ 29,121
				TOTAL PRESENT WORTH COST	**$ 1,125,184**

Note:
CY = cubic yards
LS = lump sum
PA = per acre
PM = per mile
SF = square foot
PY = per year

Table 8

Cost Estimate for Alternative 3 - Excavation and Disposal in Onsite Repository

Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis

Upper Granite Creek Watershed Mines

Wallowa-Whitman National Forest, Oregon

Task		Quantity	Units	Unit Cost	Cost
Mobilization		1	LS	$ 10,000	$ 10,000
Improvements to existing roads- FS 7345, FS 720, FS 280, and unnamed roads		8	PM	$ 5,000	$ 40,000
Creation of new roads to access Granite Creek #6 and Cap Martin Mines, and upper waste rock pile at Golden Fraction Mine		2	PM	$ 80,000	$ 160,000
Grubbing and Scraping		3	PA	$ 10,000	$ 30,000
Erosion Control - Silt Fences - Spring Diversion		1	LS	$ 10,000	$ 10,000
Waste Rock Excavation and Hauling (rates increase with number of trucks and distance due to hauling costs)	Upper Upper Monumental Mine	470	CY	$ 14.0	$ 6,580
	Upper Monumental Mine	8,405	CY	$ 14.0	$ 117,670
	Lower Monumental Mine	5,910	CY	$ 17.0	$ 100,470
	Granite Creek Aquatic Station 03	80	CY	$ 32.0	$ 2,560
	Cap Martin Mine	735	CY	$ 52.0	$ 38,220
	Granite Creek #6 Mine	45	CY	$ 37.0	$ 1,665
	Tillicum Mine	205	CY	$ 25.0	$ 5,125
	Granite Creek #5 Mine	285	CY	$ 25.0	$ 7,125
	Golden Fraction Mine	295	CY	$ 20.0	$ 5,900
	Central Mine	80	CY	$ 15.0	$ 1,200
Regrading After Excavation	Upper Upper Monumental Mine	1,200	SF	$ 10.0	$ 12,000
	Upper Monumental Mine	6,700	SF	$ 10.0	$ 67,000
	Lower Monumental Mine	5,700	SF	$ 10.0	$ 57,000
	Granite Creek Aquatic Station 03	259	SF	$ 10.0	$ 2,590
	Cap Martin Mine	3,000	SF	$ 10.0	$ 30,000
	Granite Creek #6 Mine	150	SF	$ 10.0	$ 1,500
	Tillicum Mine	425	SF	$ 10.0	$ 4,250
	Granite Creek #5 Mine	1,000	SF	$ 10.0	$ 10,000
	Golden Fraction Mine	400	SF	$ 10.0	$ 4,000
	Central Mine	441	SF	$ 10.0	$ 4,410
Tailings Excavation	Upper and Lower Monumental Mine (Vacuum Truck)	10	Day	$ 2000.0	$ 20,000
	Wetland Rehabilitation	1	LS	$ 50000.0	$ 50,000

Table 8

Cost Estimate for Alternative 3 - Excavation and Disposal in Onsite Repository

Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis

Upper Granite Creek Watershed Mines

Wallowa-Whitman National Forest, Oregon

Task		Quantity	Units	Unit Cost	Cost
Repository Construction	Subgrade Excavation	1	LS	$ 10,000	$ 10,000
	Capping, grading, liner installation, engineering controls	1	LS	$ 100,000	$ 100,000
	Revegetation	2	PA	$ 5,000	$ 10,000
Water Engineering Controls	Upper Monumental Mine - Adit seep pipe construction	1	LS	$ 5,000	$ 5,000
	Upper Monumental Mine - settling pond diversion	1	LS	$ 15,000	$ 15,000
	Lower Monumental Mine - adit and settling pond diversion channel	1	LS	$ 25,000	$ 25,000
	HDPE Culvert Under Access Roads	2	Each	$ 5,000	$ 10,000
Revegetation	Seed/Fertilization	5	PA	$ 2,000	$ 10,000
	Mulch	5	PA	$ 3,000	$ 15,000
Road Decommissioning		1	LS	$ 10,000	$ 10,000
Confirmation sampling analytical cost and XRF rental		1	LS	$ 30,000	$ 30,000
Demobilization		1	LS	$ 10,000	$ 10,000
				Subtotal Capital Costs	**$ 1,049,265**
Design Expenses (20% to account for additional design and permitting of the landfill)					$ 209,853
Construction Oversight (15%)					$ 157,390
Post Construction Monitoring (20 years - longer to account for the presence of the landfill)		20	PY	$ 15,000	$ 300,000
				Subtotal Indirect Capital Costs	$ 667,243
Contingency (10%)					$ 66,724
				TOTAL PRESENT WORTH COST	**$ 1,783,232**

Note:

CY = cubic yards

LS = lump sum

PA = per acre

PM = per mile

Table 9

Cost Estimate for Alternative 4 - Excavation and Offsite Disposal

Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis

Upper Granite Creek Watershed Mines

Wallowa-Whitman National Forest, Oregon

Task		Quantity	Units	Unit Cost	Cost
Mobilization		1	LS	$ 10,000	$ 10,000
Improvements to existing roads- FS 7345, FS 720, FS 280, and unnamed roads		8	PM	$ 5,000	$ 40,000
Creation of new roads to access Granite Creek #6 and Cap Martin Mines, and upper waste rock pile at Golden Fraction Mine		2	PM	$ 80,000	$ 160,000
Grubbing and Scraping		3	PA	$ 10,000	$ 30,000
Erosion Control - Silt Fences - Spring Diversion		1	LS	$ 10,000	$ 10,000
Waste Rock Excavation	Upper Upper Monumental Mine	470	CY	$ 14.0	$ 6,580
	Upper Monumental Mine	8,405	CY	$ 14.0	$ 117,670
	Lower Monumental Mine	5,910	CY	$ 17.0	$ 100,470
	Granite Creek Aquatic Station 03	80	CY	$ 32.0	$ 2,560
	Cap Martin Mine	735	CY	$ 52.0	$ 38,220
	Granite Creek #6 Mine	45	CY	$ 37.0	$ 1,665
	Tillicum Mine	205	CY	$ 25.0	$ 5,125
	Granite Creek #5 Mine	285	CY	$ 25.0	$ 7,125
	Golden Fraction Mine	295	CY	$ 20.0	$ 5,900
	Central Mine	80	CY	$ 15.0	$ 1,200
Waste Rock Hauling to Subtitle D Landfill (costs assume 4 round trips to the landfill per truck day + tipping fees)	Upper Upper Monumental Mine	470	CY	$ 100.0	$ 47,000
	Upper Monumental Mine	7,965	CY	$ 100.0	$ 796,500
	Lower Monumental Mine	5,730	CY	$ 100.0	$ 573,000
	Granite Creek Aquatic Station 03	80	CY	$ 100.0	$ 8,000
	Cap Martin Mine	735	CY	$ 100.0	$ 73,500
	Granite Creek #6 Mine	45	CY	$ 100.0	$ 4,500
	Tillicum Mine	205	CY	$ 100.0	$ 20,500
	Granite Creek #5 Mine	285	CY	$ 100.0	$ 28,500
	Golden Fraction Mine	295	CY	$ 100.0	$ 29,500
	Central Mine	80	CY	$ 100.0	$ 8,000

Table 9
Cost Estimate for Alternative 4 - Excavation and Offsite Disposal
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

Task		Quantity	Units	Unit Cost	Cost
Regrading After Excavation	Upper Upper Monumental Mine	1,200	SF	$ 10.0	$ 12,000
	Upper Monumental Mine	6,700	SF	$ 10.0	$ 67,000
	Lower Monumental Mine	5,700	SF	$ 10.0	$ 57,000
	Granite Creek Aquatic Station 03	259	SF	$ 10.0	$ 2,590
	Cap Martin Mine	3,000	SF	$ 10.0	$ 30,000
	Granite Creek #6 Mine	150	SF	$ 10.0	$ 1,500
	Tillicum Mine	425	SF	$ 10.0	$ 4,250
	Granite Creek #5 Mine	1,000	SF	$ 10.0	$ 10,000
	Golden Fraction Mine	400	SF	$ 10.0	$ 4,000
	Central Mine	441	SF	$ 10.0	$ 4,410
Tailings Excavation +Hauling	Onsite Vacuum Truck	10	Day	$ 2000.0	$ 20,000
	Haul to Subtitle C Landfill and Tipping Fees	620	CY	$ 320.0	$ 198,400
	Wetland Rehabilitation and Clean Soil Cover	1	LS	$ 50000.0	$ 50,000
Water Engineering Controls	Upper Monumental Mine - Adit seep pipe construction	1	LS	$ 5,000	$ 5,000
	Upper Monumental Mine - settling pond diversion	1	LS	$ 15,000	$ 15,000
	Lower Monumental Mine - adit and settling pond diversion channel	1	LS	$ 25,000	$ 25,000
	HDPE Culvert Under Access Roads	2	Each	$ 5,000	$ 10,000
Revegetation	Seed/Fertilization	5	PA	$ 2,000	$ 10,000
	Mulch	5	PA	$ 3,000	$ 15,000
Road Decommissioning		1	LS	$ 10,000	$ 10,000
Confirmation sampling analytical cost and XRF rental		1	LS	$ 30,000	$ 30,000
Demobilization		1	LS	$ 10,000	$ 10,000
				Subtotal Capital Costs	**$ 2,716,665**

Table 9
Cost Estimate for Alternative 4 - Excavation and Offsite Disposal
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

Task		Quantity	Units	Unit Cost	Cost
Design Expenses (Equal to Alternative 2)					$ 80,485
Construction Oversight (Twice Alternative 3 to account for longer implementation time)					$ 314,780
Post Construction Monitoring (6 years)		6	PY	$ 15,000	$ 90,000
				Subtotal Indirect Capital Costs	$ 485,265
Contingency (10%)					$ 48,526
				TOTAL PRESENT WORTH COST	**$ 3,250,456**

Note:
CY = cubic yards
LS = lump sum
PA = per acre
PM = per mile

Table 10
Cost Estimate for Recommended Alternative
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

Task		Quantity	Units	Unit Cost	Cost
Mobilization		1	LS	$ 10,000	$ 10,000
Improvements to existing roads- FS 7345, FS 720, and unnamed roads		5	PM	$ 5,000	$ 25,000
Grubbing and Scraping		2	PA	$ 10,000	$ 20,000
Erosion Control - Silt Fences - Spring Diversion		1	LS	$ 10,000	$ 10,000
Grading	Upper Upper Monumental Mine	470	CY	$ 10.0	$ 4,700
	Upper Monumental Mine	8,405	CY	$ 10.0	$ 84,050
	Lower Monumental Mine	5910	CY	$ 10.0	$ 59,100
	Granite Creek Aquatic Station 03	80	CY	$ 10.0	$ 800
	Central Mine	80	CY	$ 10.0	$ 800
Cover Placement - assumes local cover except at Upper Monumental Mine (assumes sourced from Granite Creek Saddle)	Upper Upper Monumental Mine	1,200	SF	$ 10.0	$ 12,000
	Upper Monumental Mine	6,700	SF	$ 20.0	$ 134,000
	Lower Monumental Mine	5700	SF	$ 10.0	$ 57,000
	Granite Creek Aquatic Station 03	259	SF	$ 10.0	$ 2,590
	Central Mine	441	SF	$ 10.0	$ 4,410
Water Engineering Controls	Upper Monumental Mine - Adit seep pipe construction	1	LS	$ 5,000	$ 5,000
	Upper Monumental Mine - settling pond diversion	1	LS	$ 15,000	$ 15,000
	Lower Monumental Mine - adit and settling pond diversion channel	1	LS	$ 25,000	$ 25,000
	HDPE Culvert Under Access Roads	2	Each	$ 5,000	$ 10,000
Tailings Excavation +Hauling	Onsite Vacuum Truck	10	Day	$ 2000.0	$ 20,000
	Haul to Subtitle C Landfill and Tipping Fees	620	CY	$ 320.0	$ 198,400
	Wetland Rehabilitation and Clean Soil Cover	1	LS	$ 50000.0	$ 50,000
Repository Construction	Subgrade Excavation	1	LS	$ 10,000	$ 10,000
	Capping, Grading, Engineering Controls (no Liner)	1	LS	$ 50,000	$ 50,000
	Revegetation	2	PA	$ 5,000	$ 10,000
Revegetation	Seed/Fertilization	2	PA	$ 2,000	$ 4,000
	Mulch	2	PA	$ 3,000	$ 6,000

Table 10
Cost Estimate for Recommended Alternative
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

Task		Quantity	Units	Unit Cost	Cost
Road Decommissioning		1	LS	$ 10,000	$ 10,000
Confirmation sampling analytical cost and XRF rental		1	LS	$ 30,000	$ 30,000
Demobilization		1	LS	$ 10,000	$ 10,000
				Subtotal Capital Costs	**$ 877,850**
Design Expenses (10%)					$ 87,785
Construction Oversight (15%)					$ 131,678
Post Construction Monitoring (6 years)		6	PY	$ 15,000	$ 90,000
				Subtotal Indirect Capital Costs	$ 309,463
Contingency (10%)					$ 30,946
				TOTAL PRESENT WORTH COST	**$ 1,218,259**

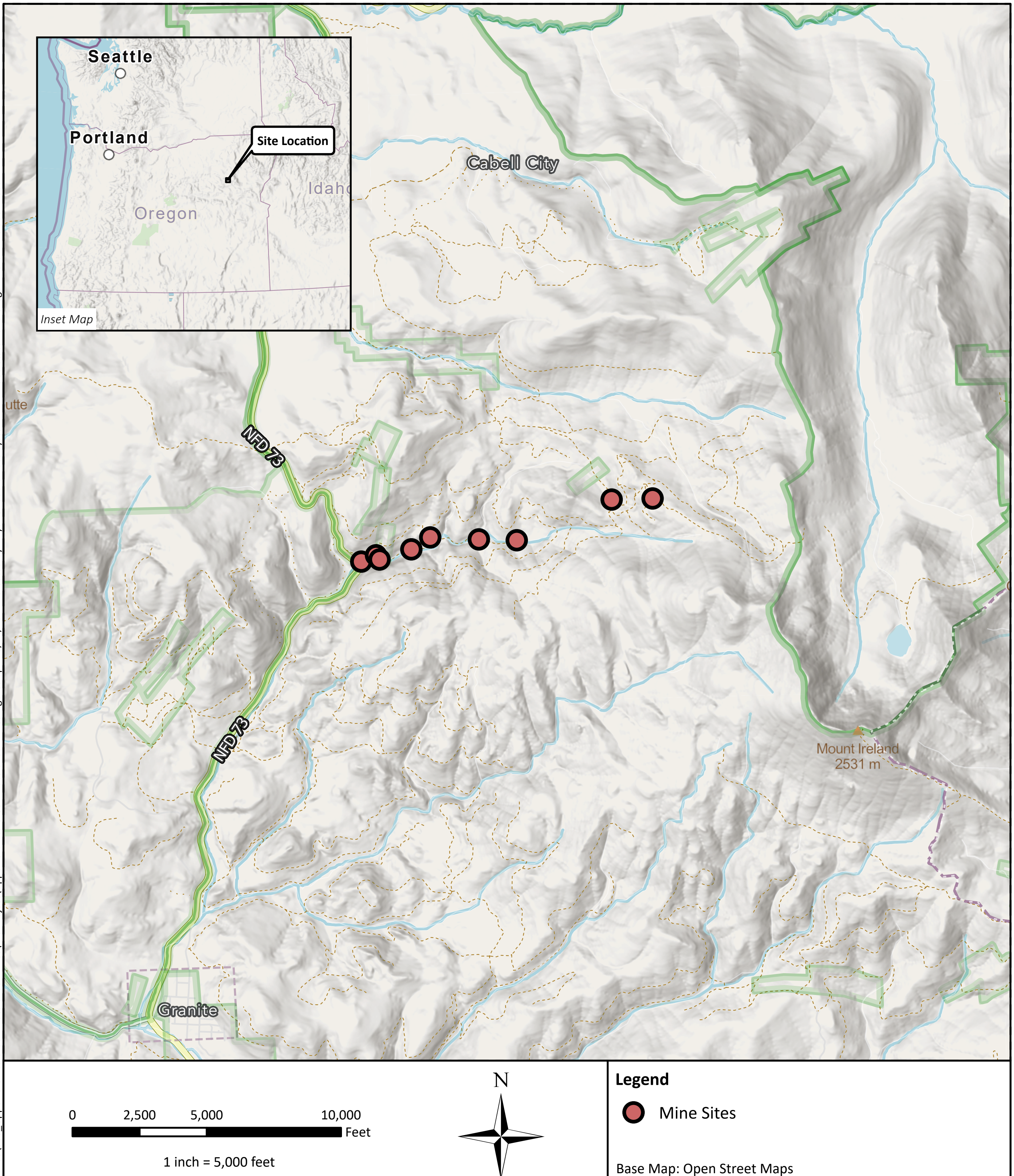
Note:
CY = cubic yards
LS = lump sum
PA = per acre
PM = per mile
SF = square foot
PY = per year

Table 11
Recommended Removal Action Summary
Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

Mine	Waste Rock Pile	Volume (cubic yards)	Recommended Alternative
Upper-Upper Monumental	WRA	395	Alternative 2 - Onsite Containment
	WRB	5	Alternative 1 - No Action
	WRC	5	Alternative 1 - No Action
	WRD	10	Alternative 2 - Onsite Containment
	WRE	5	Alternative 1 - No Action
	WRF	10	Alternative 2 - Onsite Containment
	WRG	10	*To be determined (requires characterization)*
	WRH	25	*To be determined (requires characterization)*
	WRI	5	*To be determined (requires characterization)*
	WRJ	15	*To be determined (requires characterization)*
Upper Monumental	TLA	125	Alternative 4 - Offsite Disposal
	TLB	305	Alternative 4 - Offsite Disposal
	TLC	10	Alternative 4 - Offsite Disposal
	WRA	7,905	Alternative 2 - Onsite Containment / Alternative 3 - Disposal in Onsite Repository
	WRB	60	Alternative 2 - Onsite Containment
Lower Monumental	TLA	180	Alternative 4 - Offsite Disposal
	WRA	5,560	Alternative 2 - Onsite Containment
	WRB	170	Alternative 2 - Onsite Containment
Granite Creek Aq. Station 03	WRA	15	Alternative 1 - No Action
	WRB	80	Alternative 2 - Onsite Containment
Cap Martin	WRA	370	Alternative 1 - No Action
	WRB	10	Alternative 1 - No Action
	WRC	735	Alternative 1 - No Action
Sheridan	WRA	65	Alternative 1 - No Action
	WRB	30	Alternative 1 - No Action
	WRC	5	Alternative 1 - No Action
Granite Creek #6	WRA	45	Alternative 1 - No Action
	WTP	140	Alternative 1 - No Action
Granite Creek #7	WRA	195	Alternative 1 - No Action
	WRB	125	Alternative 1 - No Action
Tillicum	WRA	205	Alternative 1 - No Action
	WRB	145	Alternative 1 - No Action
	WRC	210	Alternative 1 - No Action
Granite Creek #5	WRA	285	Alternative 1 - No Action
	WRB	10	Alternative 1 - No Action
Golden Fraction	WRA	295	Alternative 1 - No Action
	WRB	145	Alternative 1 - No Action
	WRC	295	Alternative 1 - No Action
	WRD	1,105	Alternative 1 - No Action
Central	WRA	80	Alternative 2 - Onsite Containment
	WRB	25	Alternative 1 - No Action
	WRC	105	Alternative 1 - No Action
	WRD	25	Alternative 1 - No Action
Total Volume for Alternative 1 - No Action			5,400 cubic yards
Total Volume for Alternative 2 - Onsite Containment			10,257.5 cubic yards
Total Volume for Alternative 3 - Disposal in Onsite Repository			3952.5 cubic yards
Total Volume for Alternative 4 - Offsite Disposal			620 cubic yards

Notes:
All waste rock volume estimates have been rounded to the nearest 5 cubic yards, with 5 cubic yards being the minimum volume.
Total volumes assume half of Upper Monumental Mine waste rock pile A would require disposal in an onsite repository.

Figures



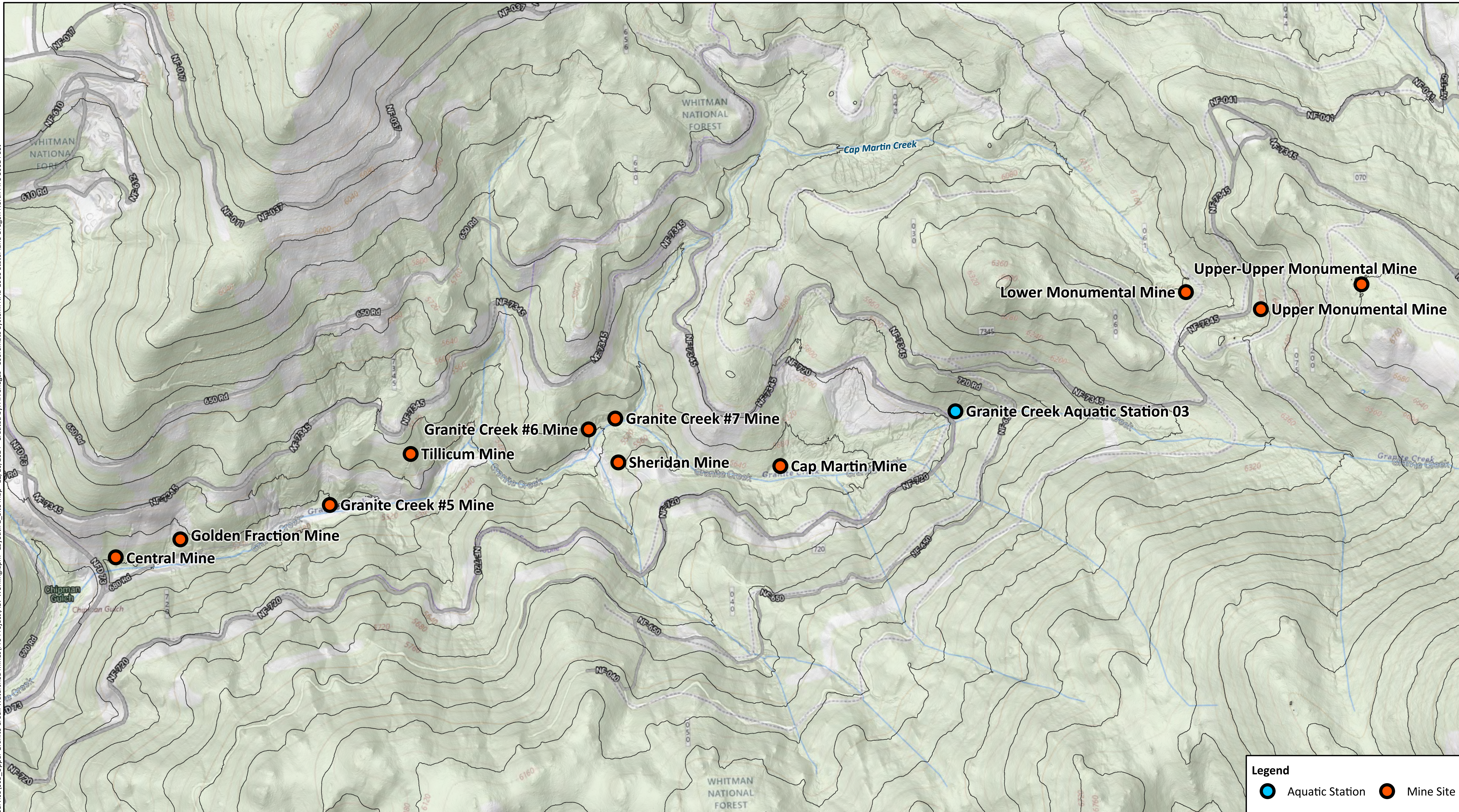
Legend

Mine Sites

Base Map: Open Street Maps

SAFETY FIRST	CLIENT: USDA Forest Service	**Site Location**
terraphase engineering	PROJECT: Upper Granite Creek Watershed Mines Granite, Oregon	
	PROJECT NUMBER: O031.005	**FIGURE 1**

File: N:\GIS\Prj\O031_USDA Forest Service\005_Upper Granite Creek Watershed Mines\Pro Project\Upper Granite Creek Watershed Mines Figures.aprx 8/21/2024 Created by: BryanO Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet



Basemap Source: USGS Topo

0 400 800 1,600 Feet

1 inch = 800 feet

N

SAFETY FIRST

terraphase engineering

CLIENT: USDA Forest Service

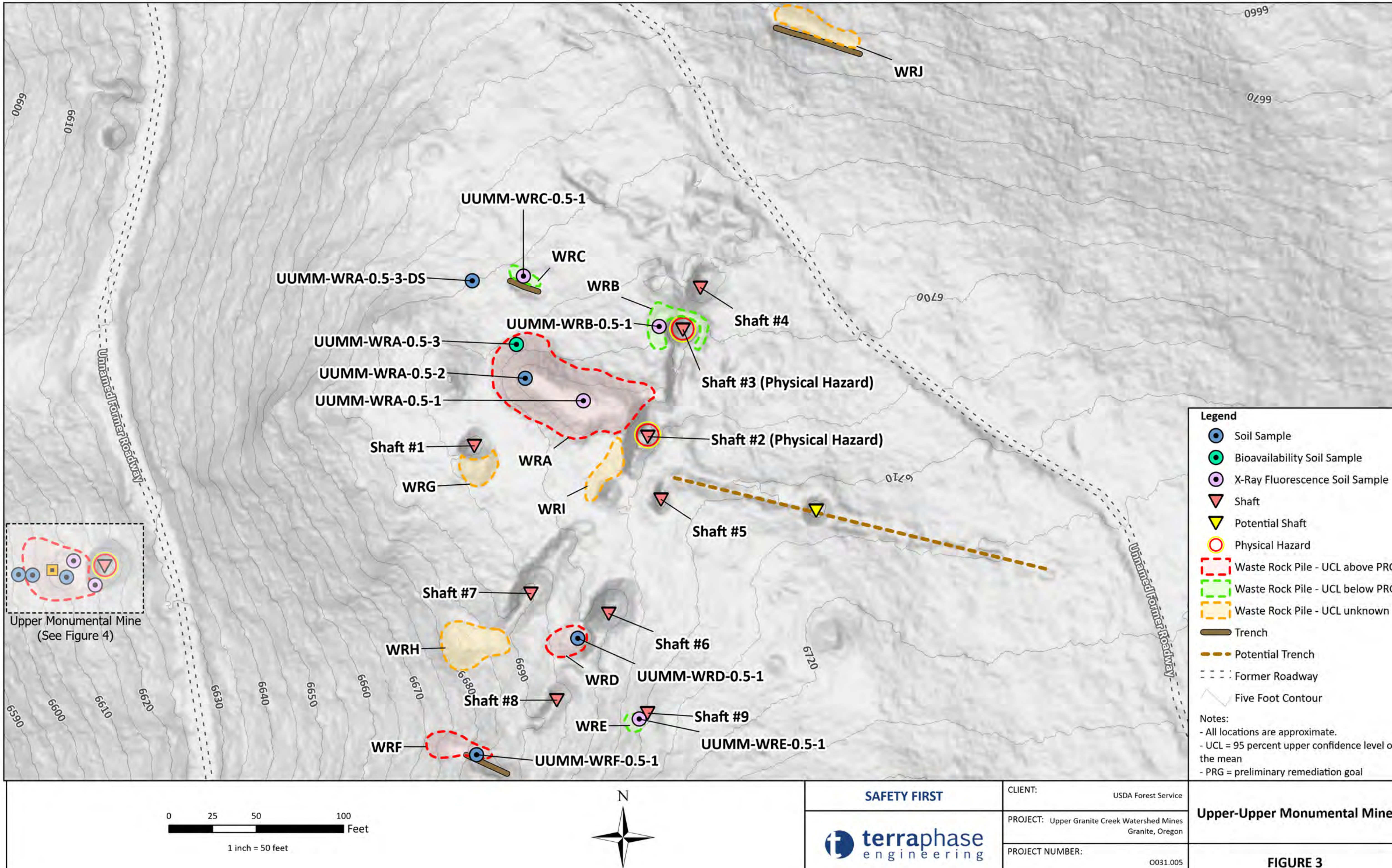
PROJECT: Upper Granite Creek Watershed Mines Granite, Oregon

PROJECT NUMBER: O031.005

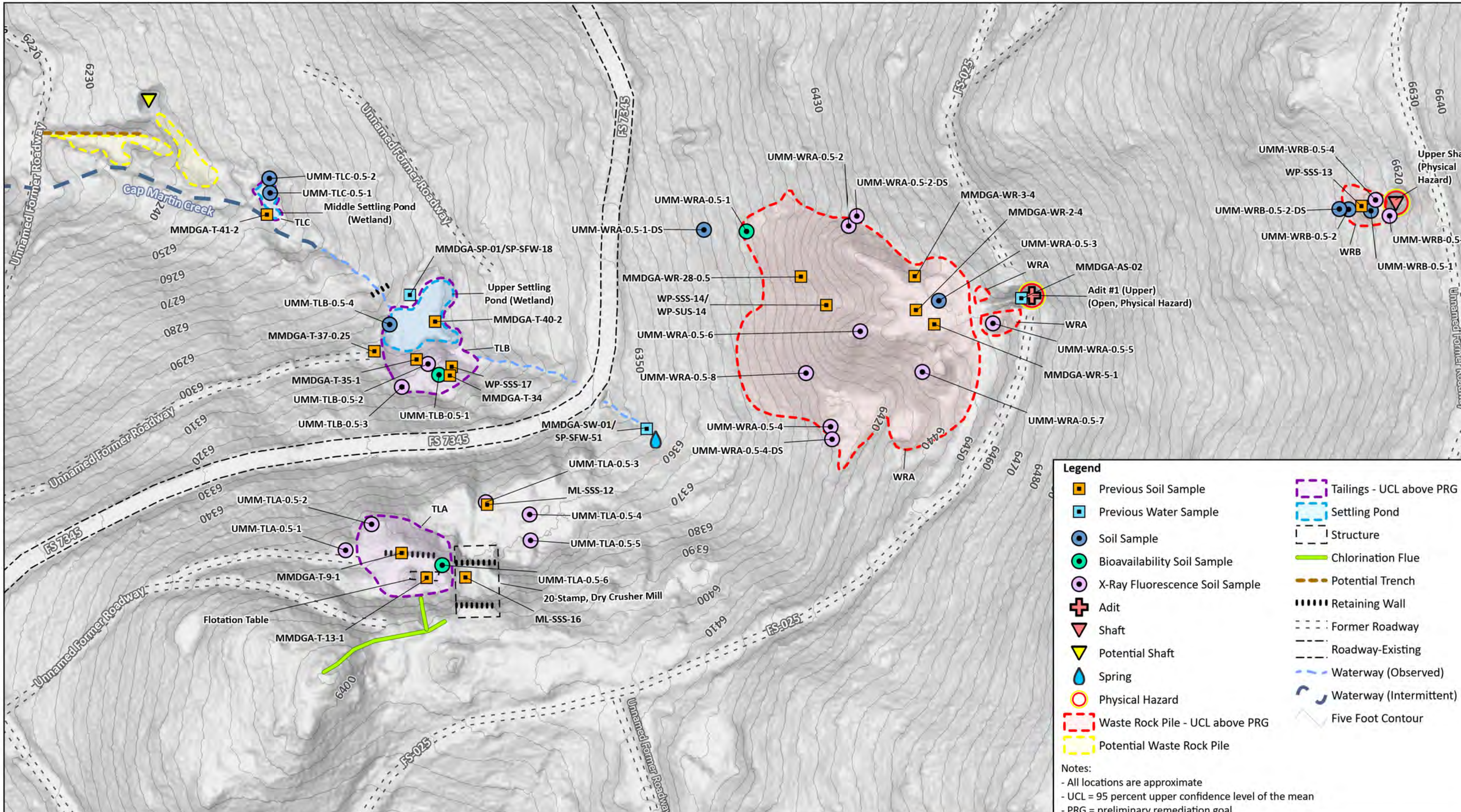
Site Layout

FIGURE 2

File: N:\GIS\Prj\O031_USDA Forest Service\005_Upper Granite Creek Watershed Mines\Pro Project\ALV Working.aprx Layout:F2_Site Map 12/10/2024 Created by: A.Venegas Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet



SAFETY FIRST	CLIENT: USDA Forest Service	Upper-Upper Monumental Mine
terraphase engineering	PROJECT: Upper Granite Creek Watershed Mines, Granite, Oregon	
	PROJECT NUMBER: O031.005	FIGURE 3



0 40 80 160 Feet

1 inch = 80 feet

N

SAFETY FIRST

terraphase engineering

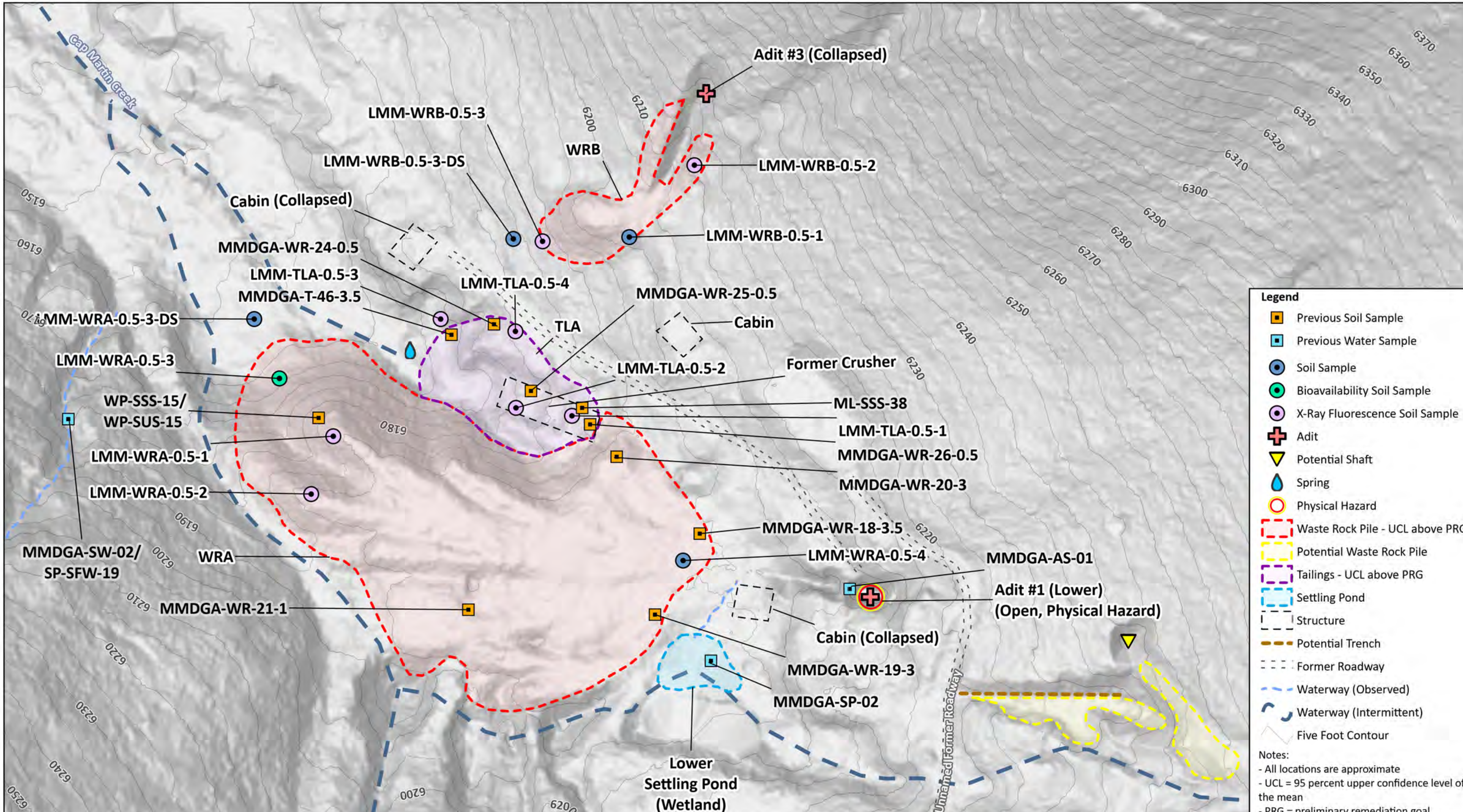
CLIENT: USDA Forest Service

PROJECT: Upper Granite Creek Watershed Mines, Granite, Oregon

PROJECT NUMBER: O031.005

Upper Monumental Mine

FIGURE 4



SAFETY FIRST

terraphase engineering

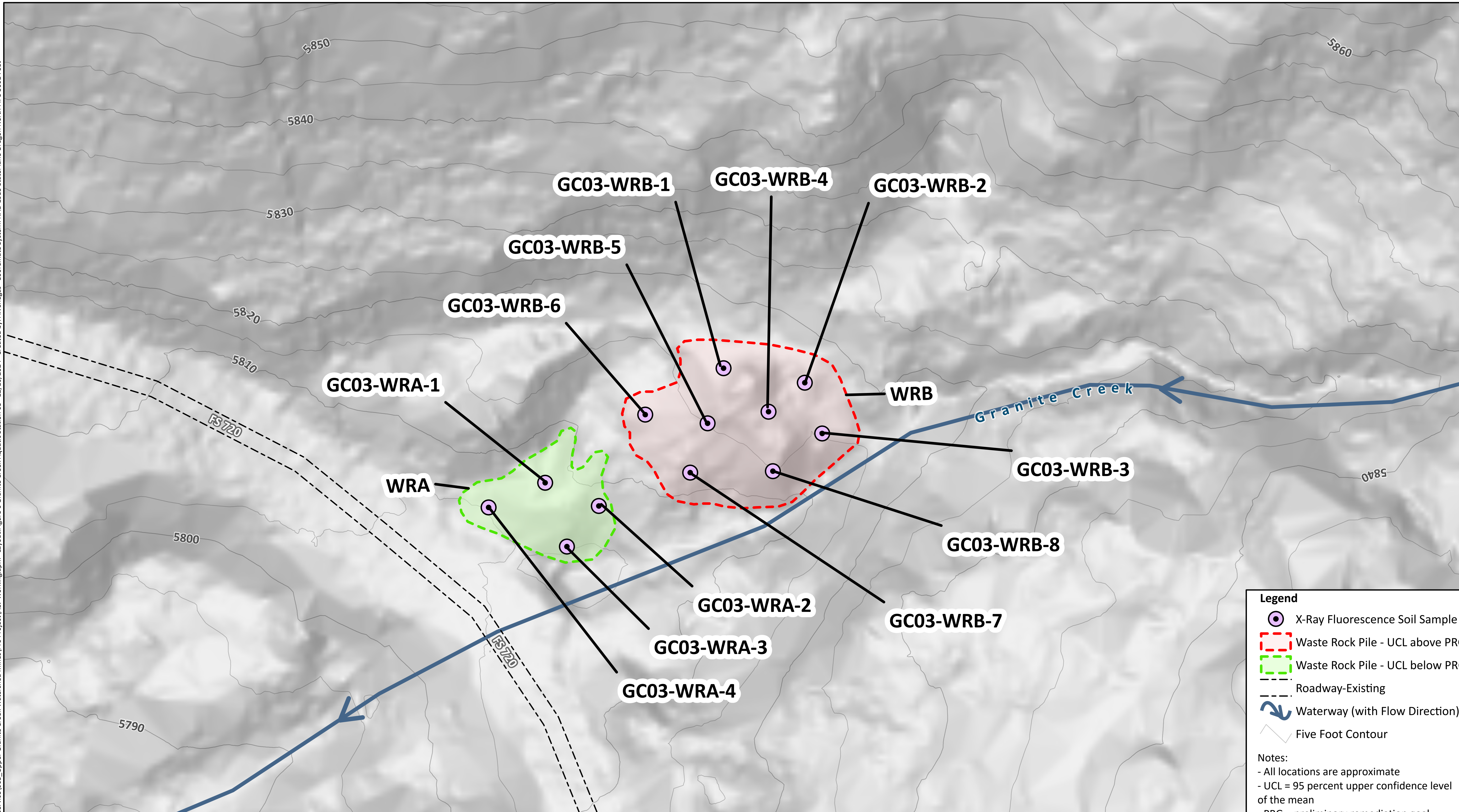
CLIENT: USDA Forest Service

PROJECT: Upper Granite Creek Watershed Mines Granite, Oregon

PROJECT NUMBER: O031.005

Lower Monumental Mine

FIGURE 5



0 10 20 40 Feet

1 inch = 20 feet

N

SAFETY FIRST

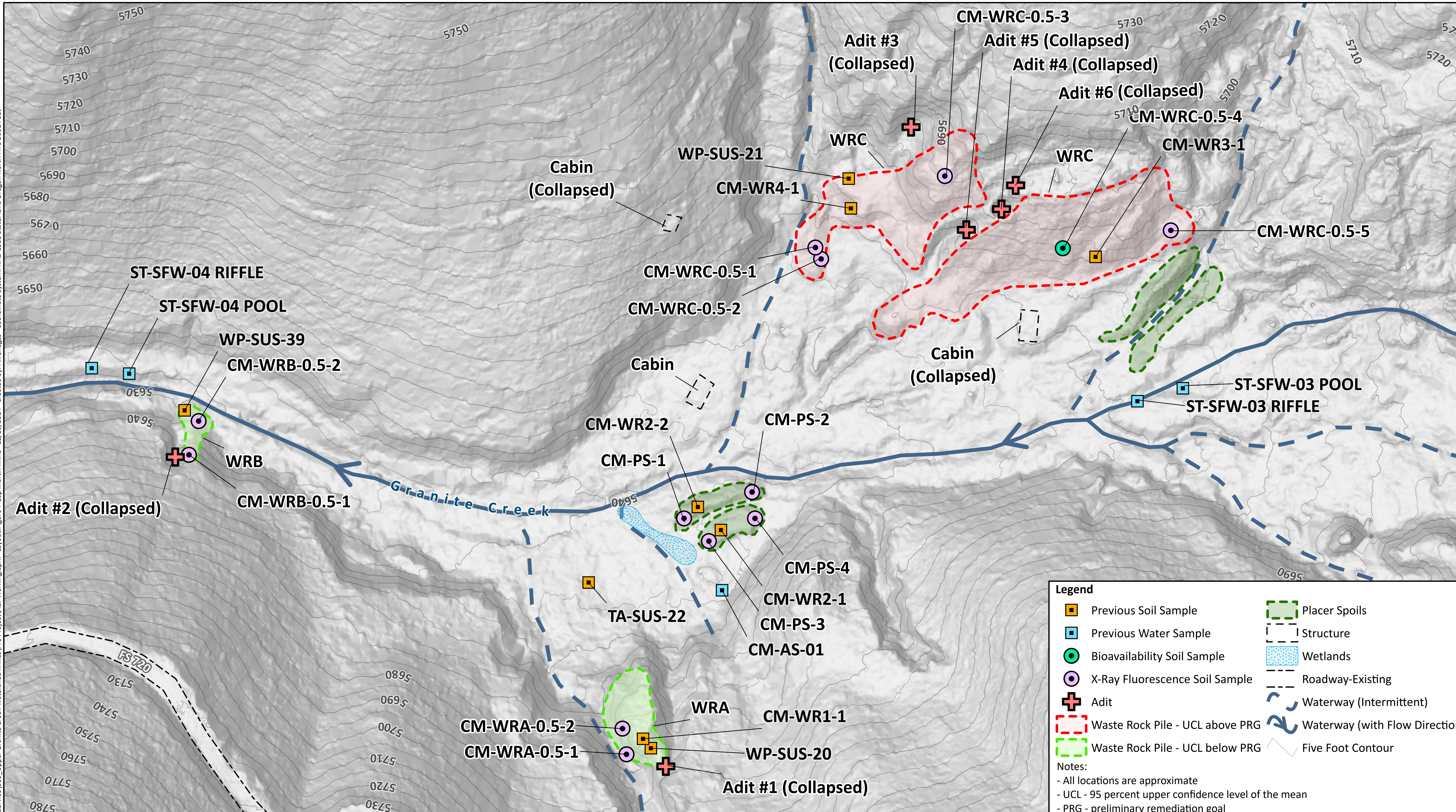
terraphase engineering

CLIENT:	USDA Forest Service
PROJECT:	Upper Granite Creek Watershed Mines Granite, Oregon
PROJECT NUMBER:	O031.005

Granite Creek Aquatic Station 03

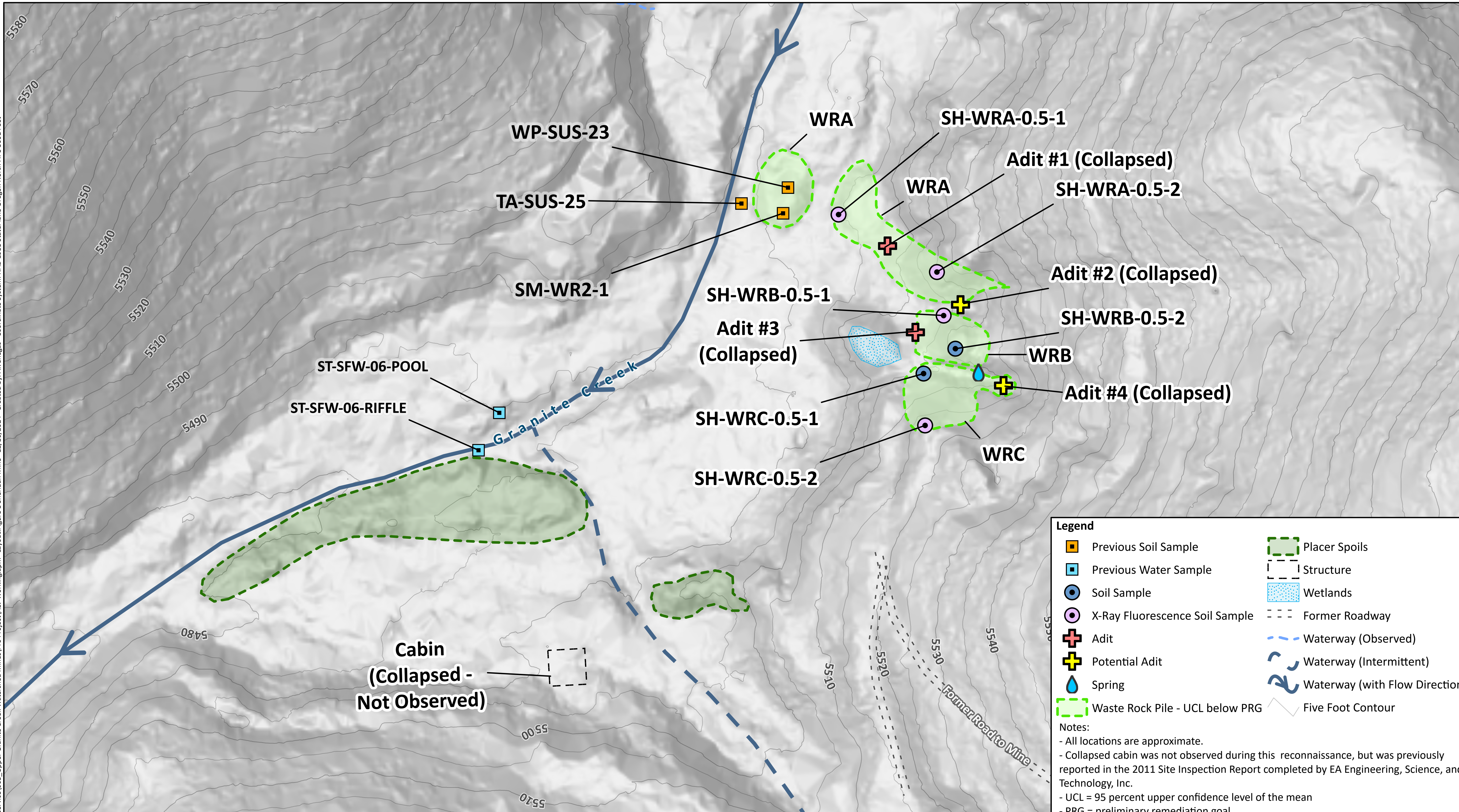
FIGURE 6

File: N:\GIS\Prj\O031_USDA Forest Service\005_Upper Granite Creek Watershed Mines\Pro Project\ALV Working.aprx Layout:Figure 6 Granite Creek Aquatic Station 03 12/10/2024 Created by: A.Venegas Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet



File: N:\GIS\Prj\O031_USDA Forest Service\005_Upper Granite Creek Watershed Mines\Pro Project\ALV Working.aprx Layout:Figure 7 Cap Martin Mine 12/10/2024 Created by: A.Venegas Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet

SAFETY FIRST	CLIENT: USDA Forest Service	Cap Martin Mine
terraphase engineering	PROJECT: Upper Granite Creek Watershed Mines, Granite, Oregon	
	PROJECT NUMBER: O031.005	FIGURE 7



0 20 40 80 Feet

1 inch = 40 feet

N

SAFETY FIRST

terraphase engineering

CLIENT: USDA Forest Service

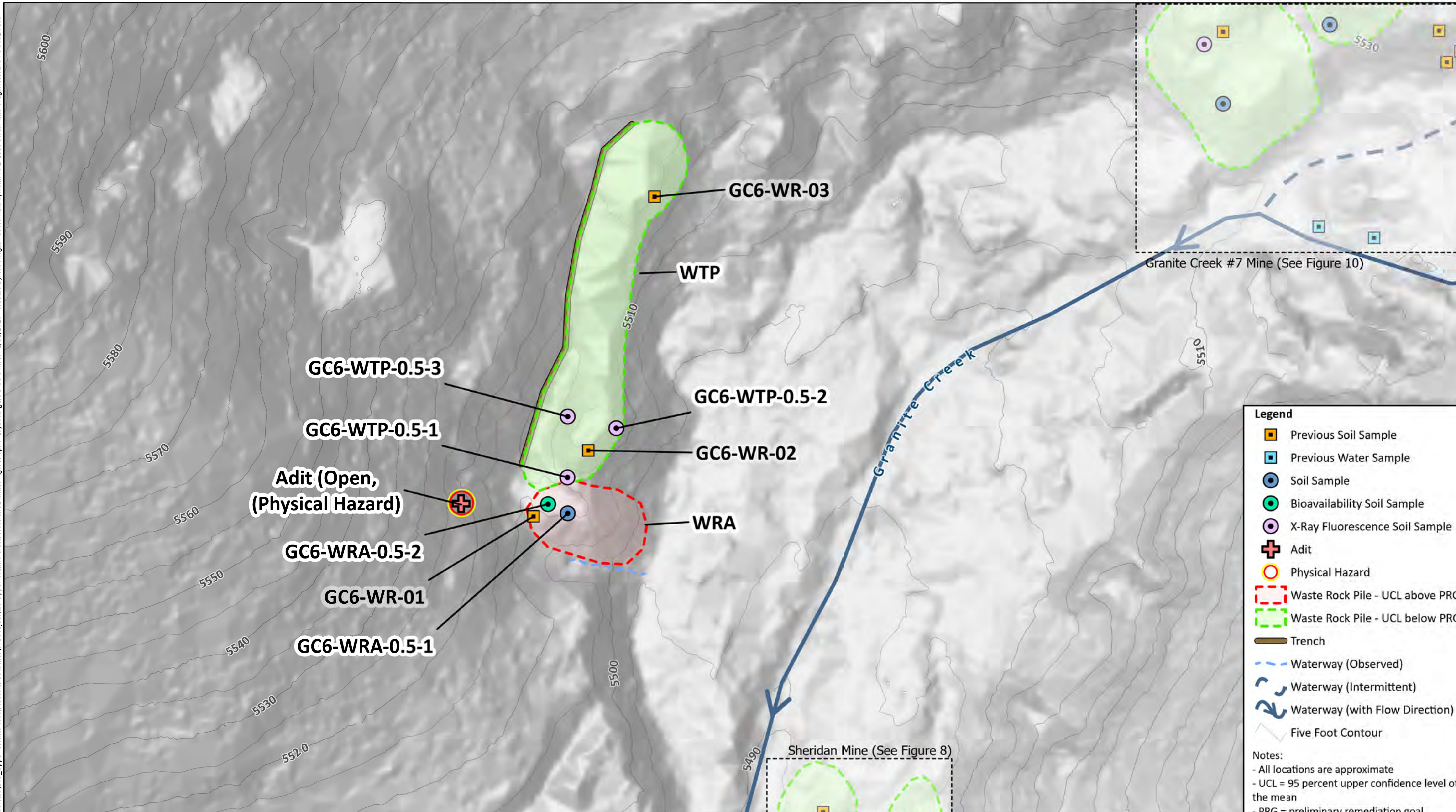
PROJECT: Upper Granite Creek Watershed Mines, Granite, Oregon

PROJECT NUMBER: O031.005

Sheridan Mine

FIGURE 8

File: N:\GIS\Prj\O031_USDA Forest Service\005_Upper Granite Creek Watershed Mines\Pro Project\ALV Working.aprx Layout:Figure 8 Sheridan Mine 12/10/2024 Created by: A.Venegas Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet



0 15 30 60 Feet

1 inch = 30 feet

N

SAFETY FIRST

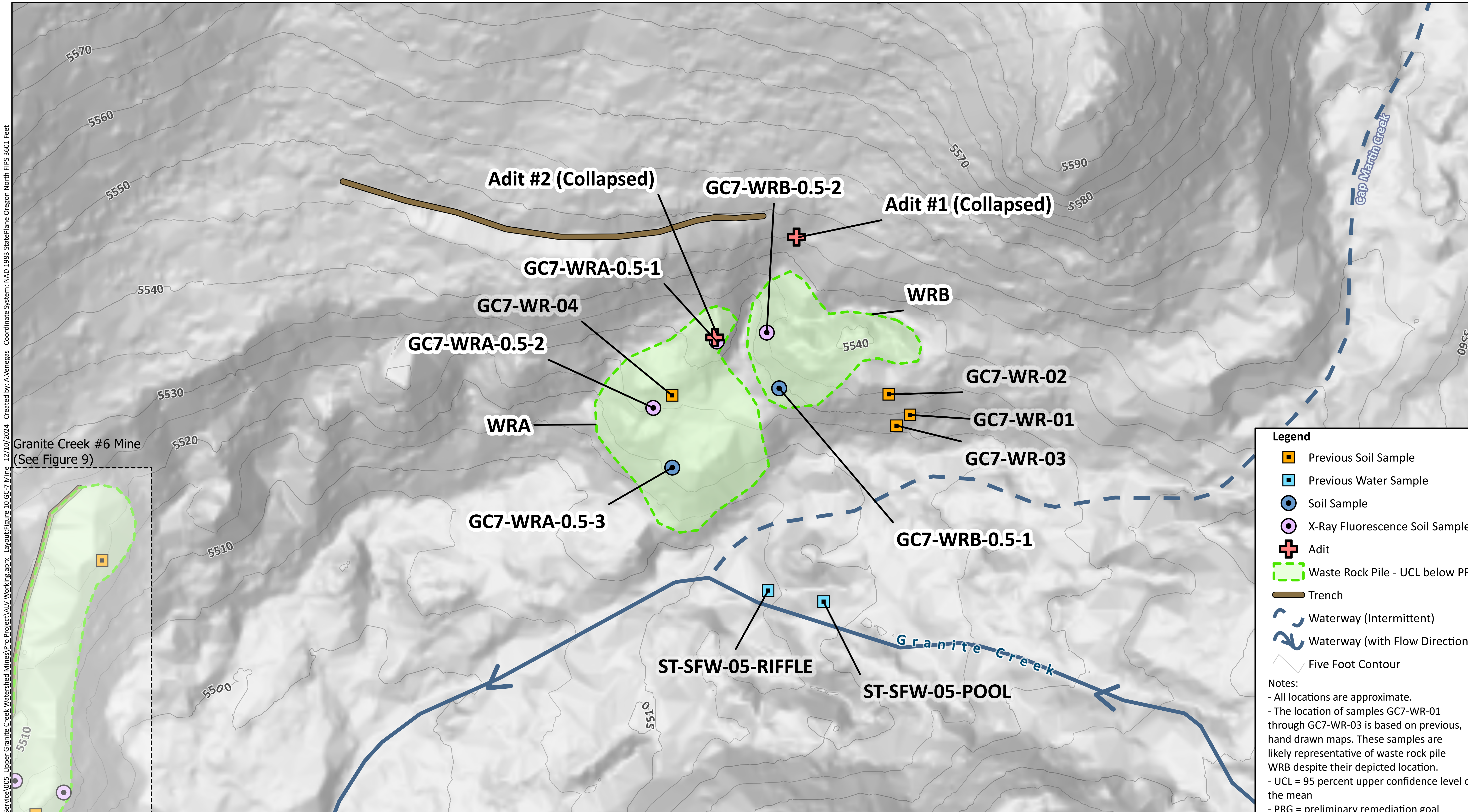
terraphase engineering

CLIENT:	USDA Forest Service
PROJECT:	Upper Granite Creek Watershed Mines Granite, Oregon
PROJECT NUMBER:	O031.005

Granite Creek #6 Mine

FIGURE 9

File: N:\GIS\Prj\O031_USDA Forest Service\005_Upper Granite Creek Watershed Mines\Pro Project\alv-Upper Granite Creek Watershed Mines Figures.aprx Layout:Figure 9 GC-6 Mine 1/31/2025 Created by: A.Venegas Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet



0 15 30 60 Feet

1 inch = 30 feet

N

SAFETY FIRST

terraphase engineering

CLIENT: USDA Forest Service

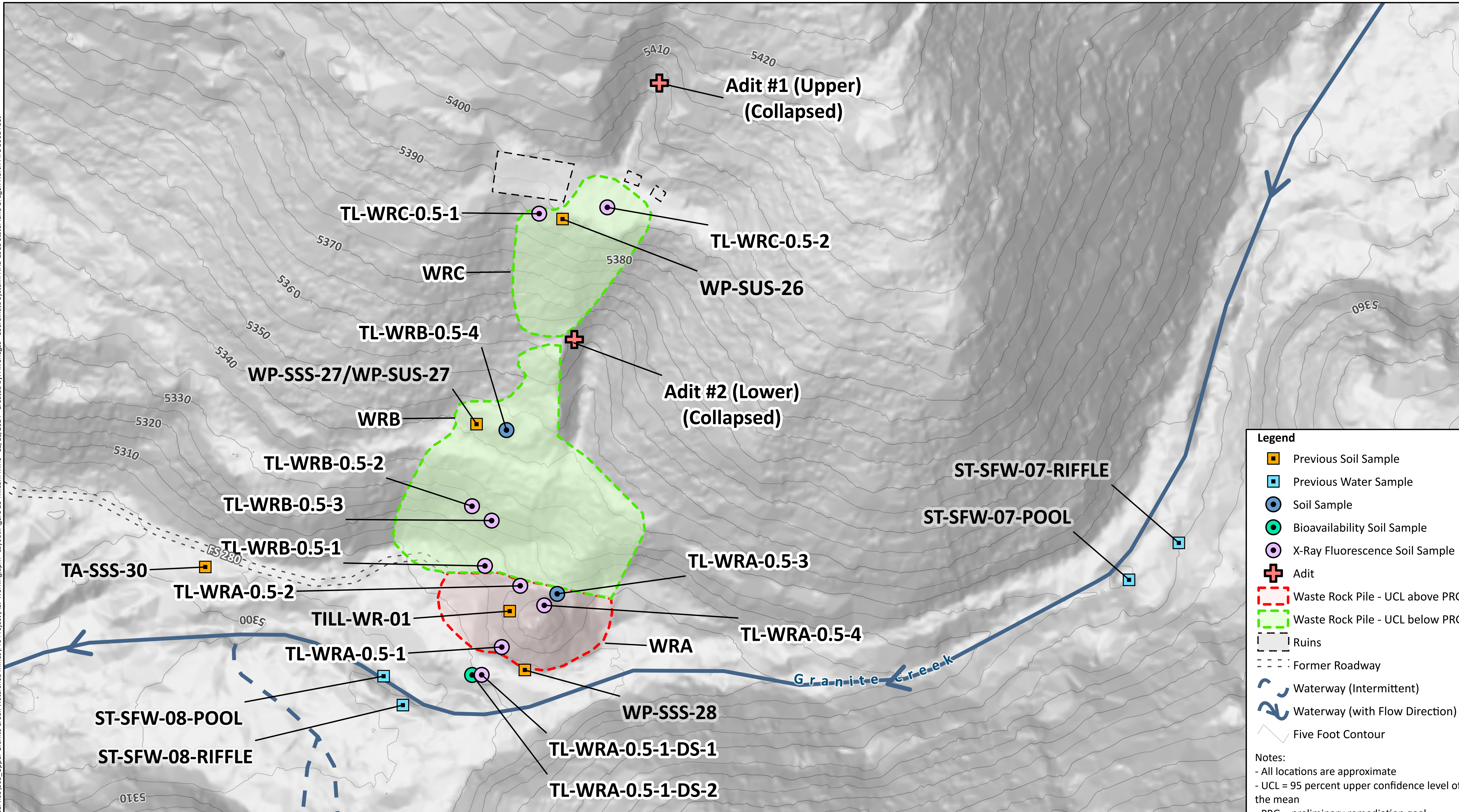
PROJECT: Upper Granite Creek Watershed Mines, Granite, Oregon

PROJECT NUMBER: O031.005

Granite Creek #7 Mine

FIGURE 10

File: N:\GIS\Prj\O031_USDA Forest Service\005_Upper Granite Creek Watershed Mines\Pro Project\ALV Working.aprx Layout: Figure 10 GC7 Mine 12/10/2024 Created by: A.Venegas Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet



0 20 40 80 Feet

1 inch = 40 feet

N

SAFETY FIRST

terraphase engineering

CLIENT: USDA Forest Service

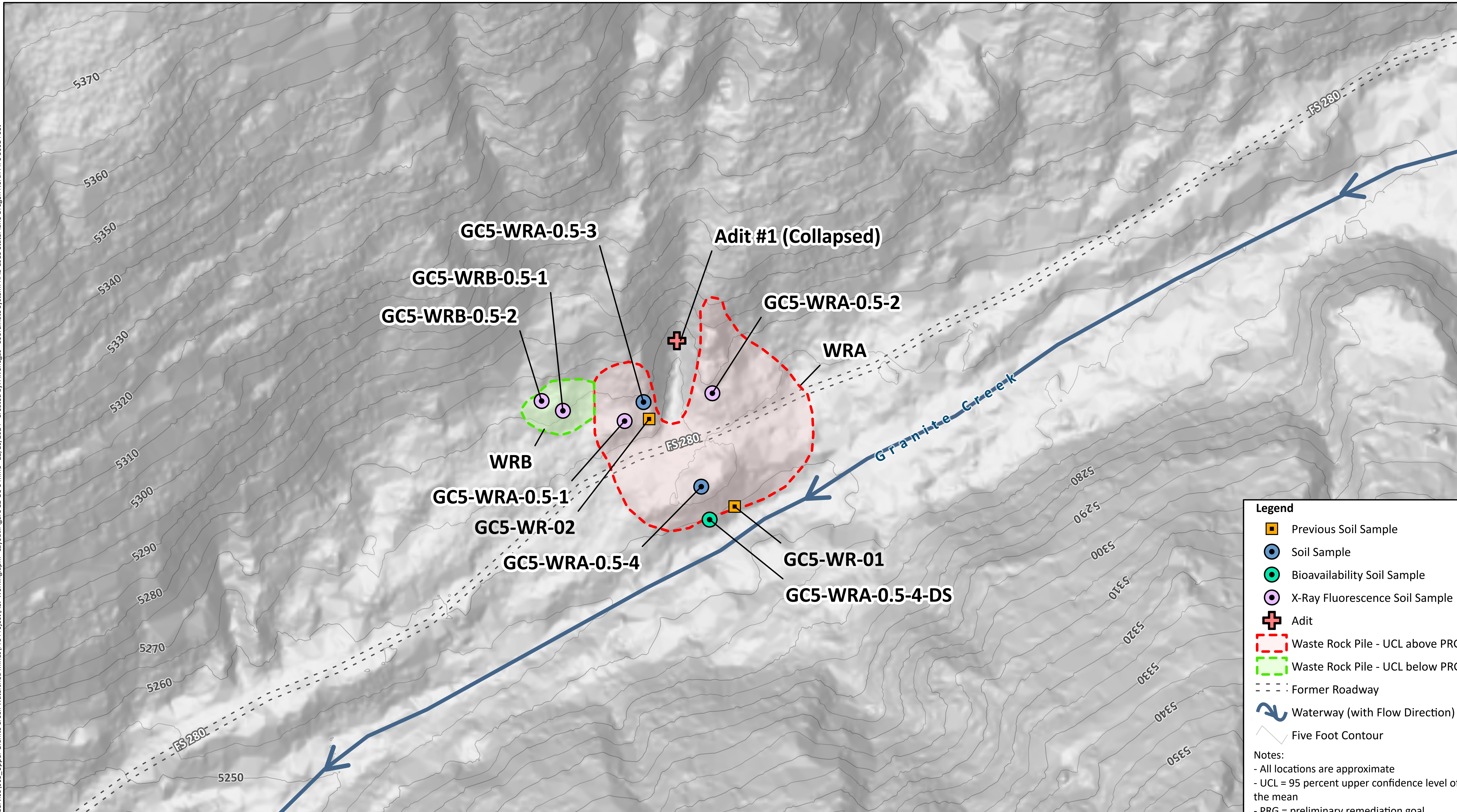
PROJECT: Upper Granite Creek Watershed Mines, Granite, Oregon

PROJECT NUMBER: O031.005

Tillicum Mine

FIGURE 11

File: N:\GIS\Prj\O031_USDA Forest Service\005_Upper Granite Creek Watershed Mines\Pro Project\ALV Working.aprx Layout:Figure 11 Tillicum Mine 12/11/2024 Created by: A.Venegas Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet



0 20 40 80 Feet

1 inch = 40 feet

N

SAFETY FIRST

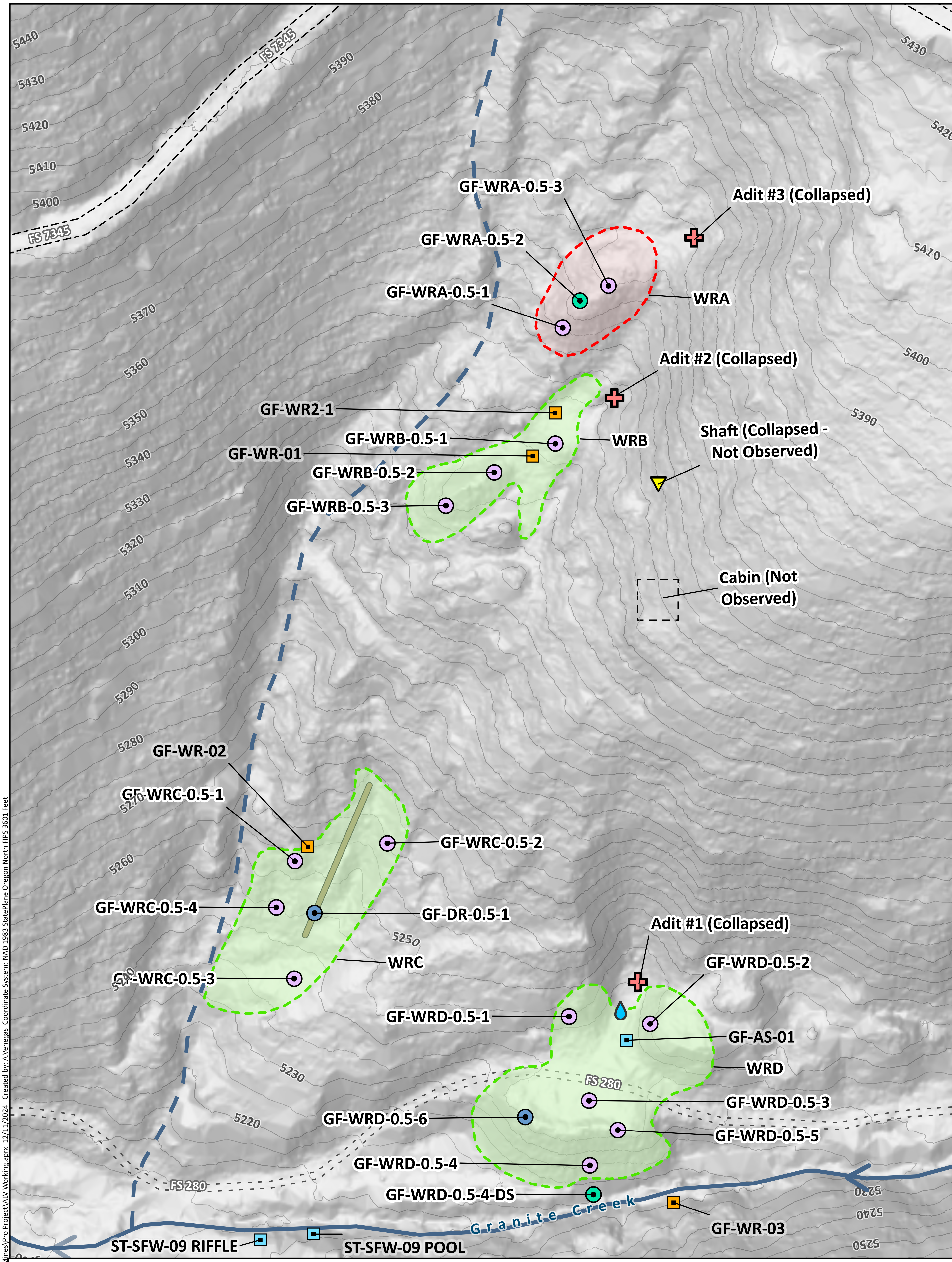
terraphase engineering

CLIENT:	USDA Forest Service
PROJECT:	Upper Granite Creek Watershed Mines Granite, Oregon
PROJECT NUMBER:	O031.005

Granite Creek #5 Mine

FIGURE 12

File: N:\GIS\Prj\O031_USDA Forest Service\005_Upper Granite Creek Watershed Mines\Pro Project\ALV Working.aprx Layout:Figure 12 GC-5 Mine 12/10/2024 Created by: A.Venegas Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet



Legend

- Previous Soil Sample
- Previous Water Sample
- Soil Sample
- Bioavailability Soil Sample
- X-Ray Fluorescence Soil Sample
- Adit
- Potential Shaft
- Spring
- Waste Rock Pile - UCL above PRG
- Waste Rock Pile - UCL below PRG
- Structure
- Trench
- Former Roadway
- Roadway-Existing
- Waterway (with Flow Direction)
- Waterway (Intermittent)
- Five Foot Contour

Notes:
- All locations are approximate.
- Cabin and collapsed adit were not observed during this reconnaissance, but were previously reported in the 2011 Site Inspection Report completed by EA Engineering, Science, and Technology, Inc.
- UCL = 95 percent upper confidence level of the mean
- PRG = preliminary remediation goal

N

0 20 40 80 Feet

1 inch = 50 feet

SAFETY FIRST

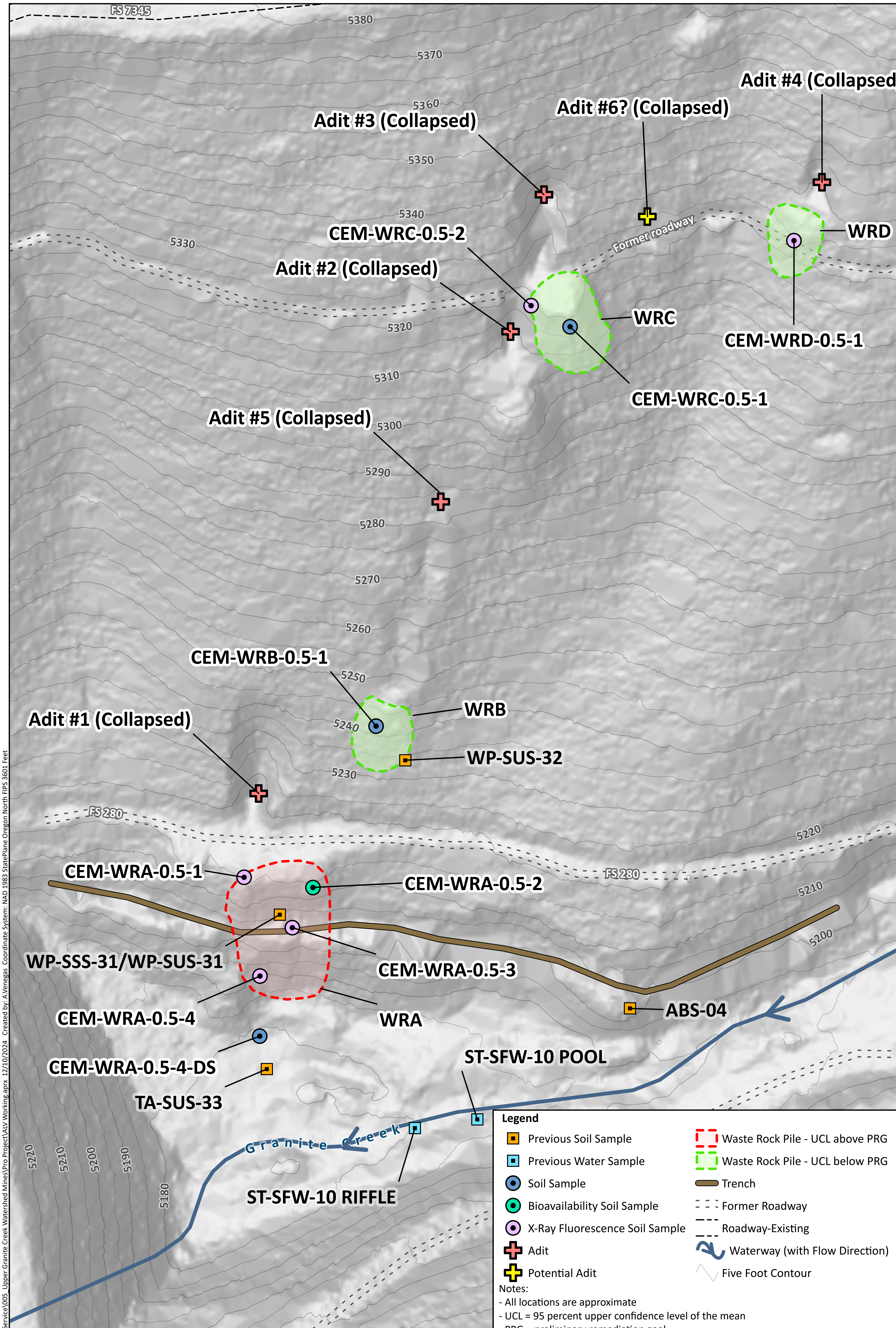
terraphase engineering

CLIENT:	USDA Forest Service
PROJECT:	Upper Granite Creek Watershed Mines Granite, Oregon
PROJECT NUMBER:	O031.005

Golden Fraction Mine

FIGURE 13

File: N:\GIS\Prj\O031_USDA Forest Service\005_Upper Granite Creek Watershed Mines\Pro Project\ALV Working.aprx 12/11/2024 Created by: A.Venegas Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet



File: N:\GIS\Prj\O031_USDA Forest Service\005_Upper Granite Creek Watershed Mines\Pro Project\ALV Working.aprx 12/10/2024 Created by: A.Venegas Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet

N

0 15 30 60 Feet

1 inch = 40 feet

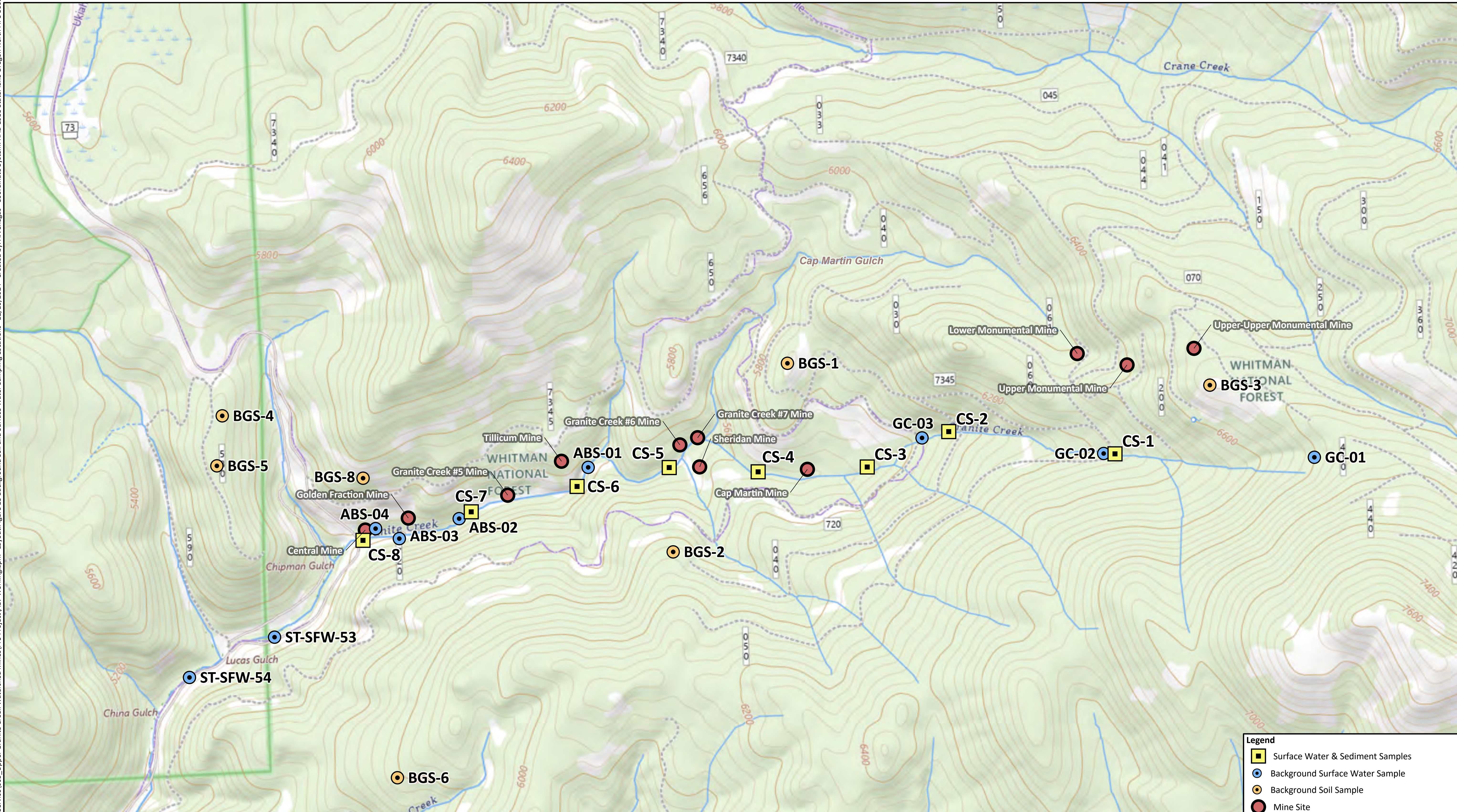
SAFETY FIRST

terraphase engineering

CLIENT:	USDA Forest Service
PROJECT:	Upper Granite Creek Watershed Mines Granite, Oregon
PROJECT NUMBER:	O031.005

Central Mine

FIGURE 14



Basemap Source: USGS Topo

0 600 1,200 2,400 Feet

1 inch = 1,200 feet

N

SAFETY FIRST

terraphase engineering

CLIENT:	USDA Forest Service
PROJECT:	Upper Granite Creek Watershed Mines Granite, Oregon
PROJECT NUMBER:	O031.005

Background Soil and Surface Water Sampling Locations

FIGURE 15

Appendix A

Wetland Delineation Report

Wetland Delineation Report
Monumental Mine Data Gap Assessment
Grant County, Oregon

May 2011

Project Number 2723018-007

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3511 Pacific Boulevard SW
Albany, OR 97321
(541) 926-7737
www.cascade-earth.com

Wetland Delineation Report
Monumental Mine Data Gap Assessment
Grant County, Oregon

Prepared For: Mr. Pete Jones
Region 6 On-Scene Coordinator, Oregon
645 Washington Street
Ashland, Oregon 97520

Prepared By: Cascade Earth Sciences
3511 Pacific Boulevard SW
Albany, Oregon 97321
(541) 926-7737

Principal Author: Ryan Tobias, Project Biologist

Reviewed By: Dustin Wasley, PE, Principal Engineer
Rone Brewer, Senior Ecologist

Report Date: May 2011

Project Number: 2723018-007

Submitted By:

Ryan Tobias, Project Biologist

CONTENTS

APPENDICES

EXECUTIVE SUMMARY

Cascade Earth Sciences (CES) has prepared the following wetland delineation report in preparation of the remediation of mine-related contamination at the U.S. Forest Service (Forest Service) Monumental Mine (Site).

- This delineation was conducted in concurrence with the Engineering Evaluation / Cost Analysis (EE/CA) for completing a Non-Time-Critical Removal Action related to hazardous substances in the Upper Granite Creek Watershed near Granite, Oregon (Site).
- The purpose of this delineation was to identify wetland boundaries, characteristics, functions, values, and area, and provide mitigation recommendations for wetlands disturbed during Site remediation.
- Typically, the Oregon Department of State Land and U.S. Army Corps of Engineers (Corps) would have jurisdiction of any impacts to onsite wetlands. However, this delineation was conducted within the authority of a federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) cleanup. As such, the U.S. Environmental Protection Agency (USEPA) has jurisdiction over Site wetlands (40 Code of Federal Regulation [CFR] 300.400(e); USEPA, 1992).
- Per Executive Orders 12580 and 13106, the President of the United States has delegated authority to the U.S. Department of Agriculture (USDA) to conduct CERCLA actions for projects administered inside National Forest System (Forest Service) lands. Thus, the Forest Service is the lead agency for CERCLA actions at the Site.
- While the local, regional, and national wetland regulations are not applicable, they are relevant and appropriate. Therefore, efforts reported herein were conducted to comply with appropriate state and federal wetland regulations.
- The wetland delineation was conducted using criteria outlined in the 2008 Interim Regional Supplement to the Corps Wetland Delineation Manual. Results of the delineation identified one wetland area at the Site, approximately 0.08 acres in size.

Proposed remedial actions at the Site may include removal of mine-contaminated tailings within the delineated wetland. Loss of wetlands resulting from removal of the tailings material should be mitigated by restoring the disturbed portion of the wetland or creating a new area of wetland.

- Compensatory mitigation is required for fill or excavation activities within a wetland.
- The proposed remedial action may require excavation of the upper and middle tailings ponds portions of the wetland (about 0.04 acres). Wetland restoration and creation replacement ratios are as follows:
    - Restoration ratio is 1:1 (1 acre restored for every 1 acre lost).
    - Creation ration is 1.5:1 (1.5 acres created for every 1 acre lost).
- Restoration/creation of approximately 0.04 to 0.06 acres is recommended to compensate for wetlands excavated during possible Site remedial actions.
- The actual acreage of filled wetlands (if necessary) and subsequent final determination of mitigation acreage can be verified following development of the final remedial design.

1.0 INTRODUCTION AND PURPOSE

Cascade Earth Sciences (CES) has prepared the following Wetland Delineation report in concurrence with the Engineering Evaluation / Cost Analysis (EE/CA) for completing a Non-Time-Critical Removal Action (RA) related to hazardous substances at the abandoned Monumental Mine (Site) in Grant County, Oregon. The Site consists of an abandoned underground gold mine located in the Wallowa-Whitman National Forest, about 8 aerial miles north of Granite, Oregon, along Forest Road (FR) 7345 (Appendix A; Figure 1).

This Wetland Delineation was completed in general accordance with the Interim Regional Supplement to the Corps of Engineers (Corps) Wetland Delineation Manual (Corps, 2008). The purpose of the delineation is to document acreage and functions of onsite wetlands for the purposes of possible mitigation following removal of hazardous substances. This delineation was conducted within the authority of a federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) cleanup. As such, no federal, state, or local permits are required to perform on-site repose actions pursuant to CERCLA Sections 104, 106, 120, 121, or 122 (40 CFR 300.400(e)). Although procedural (permit or permit equivalency) approval is not and applicable or relevant and appropriate requirements under CERCLA Section 121(d)(2) and the National Oil and Hazardous Substances Pollution Contingency Plan (USEPA, 1992), the efforts reported herein were conducted to comply with appropriate state and federal wetland regulations.

Proposed Removal Alternatives outlined in the EE/CA report include excavation and disposal of hazardous substances from areas at the Site with wetland characteristics. Therefore, a delineation is required to identify appropriate mitigation activities to be completed as part of the RA. Moreover, a functional assessment was performed to document current functions and values of wetlands located in the footprint of proposed RA areas.

2.0 SITE SETTING AND LAND USE

The wetland Assessment Area (AA) is located near the headwaters of an unnamed tributary to Granite Creek at an elevation of approximately 6,300 feet above mean sea level (amsl; USGS, 1982).

- The Monumental Mine, millsite, adits, settling ponds, tailings, and waste rock piles are approximately 10 acres in size (EA, 2003).
- The AA is about 0.1 acres in size, and includes two settling ponds and connecting riparian area located downslope from the former mill.
- This AA was selected because wetland characteristics and contaminated mine tailings were identified in this area of the Site. Therefore, RA activities at the Site could impact wetland functions and values.
- Additional wetlands are potentially located within boundaries of the 10-acre Site. These areas were not delineated as part this assessment since it in not anticipated they will be impacted during the RA.
- Slopes vary within the Site, but are moderately to relatively steep, with depositional areas near the headwaters of the unnamed tributary.
- These depositional areas are located downslope from the millsite, and were likely formed by dumping tailings from the mill. The two former settling ponds within the AA are the focus of this wetland delineation.
- Unvegetated to sparsely vegetated waste rock piles located upslope from the AA likely contribute to sedimentation and ongoing contaminant loading to the AA via overland erosion, leaching, infiltration, and subsurface transport.

- General topography trends downhill toward the northwest.
- The Site is administered by the Forest Service, with active claims at the Upper and Lower Monumental Mine adits (Appendix A; Figure 2).
- The landscape is dominated by mid to late-successional conifer forest with a subalpine fir/grand fir/ Engelmann spruce overstory.
- Runoff is directed to the northwest and locally toward the unnamed tributary, which bisects the AA.
- The settling ponds appear to be hydraulically connected. No outlet was observed from the lowest settling pond during field investigation activities.
- The unnamed tributary daylights downslope from the lowest waste rock pile and converges with Granite Creek, about 2.5 miles west of the Site.
- Color photographs of the AA are presented in Appendix C.

3.0 SITE ALTERATIONS

Gold mining activities began in the Granite Creek area in the 1860's (EA, 2003). The Monumental Mine was discovered and claimed in 1870. In 1875, a 20-stamp mill and chlorination plant were constructed and the mine and mill operated intermittently until about 1928.

Many of the remnants from mining operations remain at the Site, which include the following:

- The foundation and timbers of the former 20-stamp mill, floatation table, and chlorination flue (millsite upslope from the AA).
- Two adits and large waste rock piles. The upper adit and waste rock pile are located upslope from the AA and could contribute contaminant loading to the wetland.
- Contaminated tailings adjacent to the south and upslope from the upper settling pond. These tailings likely contribute to arsenic and other hazardous substances loading to the wetland.
- Two filled settling ponds in series, which are the focus of this delineation.
- The ponds are located to the northwest and downslope from the former millsite, adit, waste rock piles, and tailings piles.
- The former settling ponds were likely created to dump contaminated tailings from the mill. These depositional areas were also probably filled with depositional sediment since mining and milling operations ceased at the Site.
- The former settling ponds are primarily filled with tailings and depositional sediment and are vegetated with palustrine emergent wetland plants.

4.0 PRECIPITATION DATA AND ANALYSIS

The Site is located within the Blue Mountain physiographic province at an elevation of approximately 6,300 feet amsl.

- In the Blue Mountains, the fall, winter, and spring months are typically cold and wet, while summer months are warm and dry.
- At the Granite 4 west southwest (WSW) weather station, which operated from 1948 to 1967 about 8 miles southwest of the Site, approximately 84% of annual precipitation was recorded between the months of October and May, with snowfall the primary source of precipitation between November

and April (WRCC, 2010). Precipitation recorded at this weather station showed average annual precipitation was 26.37 inches per year.

The nearest continually operating weather station in the Blue Mountains is located at Meacham, Oregon, approximately 60 miles north of the Site at an elevation of 4,055 feet amsl.

- Precipitation totals average about 34.13 inches per year at the Meacham #2 (355394) station (NOAA, 2009).
- Table 1 (Appendix D) includes a summary of precipitation data for the 2008-2009 water year for the Meacham #2 weather station.
- In addition, the table below identifies precipitation during the three months preceding the delineation, as well as the water year beginning October 1, 2008.

Table A. Summary of Normal and Recorded Precipitation Between July 1, 2009 and September 31, 2009, Meacham, Oregon Station

Category	July 2009	August 2009	September 2009	Total Water Year to Date
Recorded Precipitation	0.39 in.	1.36 in.	Trace	34.13 in.
Precipitation Average	0.21 in.	0.77 in.	1.72 in.	27.21 in.
Percent of Normal	186%	176%	0%	125%

NOTE: Data obtained from the NOAA online weather data website: http://www.weather.gov/climate/. July 2009 data were obtained from the Weather Underground website: www.wunderground.com

As shown, precipitation trends varied in the months preceding the delineation.

- Precipitation totals in July and August 2009 were well above average.
- Very little precipitation fell in the month of September 2009, which is well below average.
- Collectively, precipitation for the three months preceding the delineation was about 65% of average.

Table B. Summary of Recorded Precipitation Between September 15-30, 2009 and October 1, 2009, Meacham, Oregon Station

Category	September 15-30 2009	October 1, 2009	Total Water Year to Date
Recorded Precipitation	Trace	0.05 in.	34.13 in.
Average*	~ 0.86 in.	--	27.21 in.
Percent of Normal	0%	--	125%

NOTE: Average was calculated from half the average monthly total of 1.72 inches.

As shown, about 0.05 inches of precipitation fell the day of the delineation, and a trace of precipitation was recorded for the two weeks preceding the investigation in September 2009.

- The monthly average for September is 1.72 inches of precipitation.
- As such, precipitation for the two weeks preceding the delineation was well below average.
- However, precipitation for the water year (October 1, 2008 – September 30, 2009) was about 125% of average.

5.0 WETLAND DELINEATION METHODS

On October 1, 2009, Ryan Tobias and Timothy Otis, P.E., of CES conducted a routine wetland delineation of the AA. The study area includes the upper settling pond, downslope along the riparian area of the unnamed tributary, to the second settling pond. The wetland delineation methodology for this investigation included the following:

- Previous investigations and public domain resources were reviewed prior to the field effort to determine, to the extent possible, existing conditions and potential wetland indicators on the subject property. These resources included:
    - Site Inspection Report (EA Engineering, Science, and Technology, 2003).
    - The Mt. Ireland, Oregon quadrangle National Wetland Inventory (NWI) map (Appendix A; Figure 3).
    - Forest Service Wallowa Whitman soils data (Appendix A; Figure 4).
    - Historic aerial photographs (Appendix A; Figures A1-A4).
- Nine data plot locations were identified, three within the wetland and six outside the wetland, to determine wetland/upland characteristics.
- Soil conditions at the Site were determined by advancing shallow hand auger borings at the established data plots to approximately 18 inches or refusal. A Munsell color chart was used to identify soil hue, value, and chroma at each data plot.
- Hydrologic conditions were documented at each data plot.
- Vegetation and estimated percent cover were documented within a 20-foot radius of each data plot.
- Wetland boundaries were delineated, flagged, and surveyed by Anderson Perry and Associates, Inc. in La Grande, Oregon
    - For each distinct wetland area, representative data plots were selected to characterize both wetland and upland habitats.
    - Nine data plots MMW-1 through MMW-9 (Figure 5) were established to collect vegetation, soils, and hydrology information. Each data plot was flagged and mapped with a handheld global positioning system (GPS) device.
- Wetland conditions were determined using the *2008 Corps Interim Regional Supplement to the Corps of Engineering Wetland Delineation Manual* (Corps, 2008).
- A routine wetland determination was used since wetlands within the subject property contained homogeneous vegetation, soil, and hydrologic regimes.
- Data regarding vegetation, soil, and hydrology were collected at each sample plot and recorded on routine wetland determination data forms, which are presented in Appendix B.
- The wetland boundaries were determined at the location in which upland conditions changed to wetland conditions. Wetland conditions were defined by the following three parameters:
    - Dominant plant species were considered hydrophytic by the U.S. Fish and Wildlife Service (USFWS) (Reed, 1988; Reed et, al, 1993).
    - Soil was considered hydric under federal definition.
    - Hydrologic conditions meeting the federal wetland definitions were present or inferred.
- Wetland functions and values were determined using the Oregon Wetland Assessment Protocol (ORWAP) (reference) method, as defined by DSL regulations and guidance (Oregon Administrative Rule [OAR] 141-090-005 to 0055; DSL, 2009) and were determined with consideration of the entire wetland system associated with onsite wetlands.

6.0 DESCRIPTION OF WETLAND AND NON-WETLAND WATERS

A 0.08-acre contiguous wetland was delineated within the AA during field activities at the Site. The boundaries and characteristics of the wetland system are described below:

- The delineated wetland is a Palustrine Emergent (PEM)/riverine wetland that extends from the upper settling pond, along the riparian corridor of the unnamed tributary, to the bottom of the second settling pond.
- Data plots MMW-2, MMW-5, and MMW-8 were located within the wetland area. Please refer to Appendix B for additional information regarding these sample plot characteristics.
- The wetland supports various hydric plant species, dominated by Pacific onion (*Allium validium* OBL); tall managrass (*Glyceria elata* FACW); spotted saxifrage (Saxifraga punctata FAC); cow parsnip (*Heracleum lanatum* FAC); and monkey flower (*Mimulus spp*.) (possibly musk flower).
- Upland plots included a variety of coniferous species such as subalpine fir (*Abies lasiocarpa* FACU), grand fir (*Abies grandis* NI), lodgepole pine (*Pinus contorta* FAC-), Engelmann spruce (*Picea* engelmannii FAC), and Western larch (*Larix occidentialis* FACU). Understory species in upland plots included Idaho fescue (*Fescue idahoensis* NI), one-sided wintergreen (*Pyrolla secunda* FACU), and Canada goldenrod (*Solidago canadensis* FACU).
- Wetland hydrology is provided by perennial flow from a spring that forms the headwaters of the unnamed tributary to Granite Creek. The spring is located approximately 150 feet upslope from the upper settling pond.
- Seeps also emanate adjacent to the unnamed tributary channel and appear to provide year-round flow to the wetland system.
- Saturated conditions and surface water flow were noted during the delineation throughout the wetland area.
- The frequency and duration of saturated conditions support hydric soil characteristics in the wetland.
- Hydric soil criteria were met in three of the nine data plots established at the Site.
  - Soils collected from data plots MMW-2, MMW-5, and MMW-8 exhibited characteristics commonly observed in hydric soils (e.g., saturation in the upper 12-inches, matrix color, and sediment deposits).
  - Gleyed soil conditions were noted within plot MMW-5 from 9 to 18 inches.
  - Apparent mine tailings were encountered in wetland plots MMW-2, and MMW-8 during the field investigation at depths ranging from 10 to 18 inches below ground surface.
  - Upland habitat (Data Plots MMW-1, MMW -3, MMW -4, MMW -6, MMW -7, and MMW -9) was dominated by dry shallow forest soils consisting of duff/litter, underlain by loamy silt and gravel.

7.0 DEVIATION FROM LOCAL WETLAND INVENTORY OR NATIONAL WETLAND INVENTORY

Prior to conducting field activities at the Site, the Mt. Ireland 7.5-minute Quadrangle NWI map was reviewed to identify the possible presence of wetlands (Appendix A; Figure 3). There is no known local wetland inventory (LWI) map for the Site or surrounding areas.

- A review of the NWI map of the Site identified the unnamed tributary channel as riverine, upper perennial, unconsolidated bottom, permanently flooded (R3UBH) (USFWS, 1994).

- The NWI map did not show the presence of wetlands at the site.
- The onsite delineation identified a wetland system within this channel, however; the primary feature of the wetland system is the two settling ponds, which support PEM/riverine vegetation.

8.0 MAPPING METHOD

Wetland boundaries were marked with numbered flags during delineation activities at the Site using ribbon flagging and/or colored pin flags.

- The wetland boundaries were surveyed by a Professional Land Surveyor from Anderson Perry Associates, Inc.
- Flags were surveyed to an accuracy of one foot and the survey was extended approximately 100-feet beyond the wetland boundary.

A map of the delineated wetland is included in Appendix A (Figure 5).

9.0 ADDITIONAL INFORMATION

A review of public domain documents provided soil, wetland, rare, threatened or endangered species presence information, and historical background information for the Site. This information is presented in the following sections.

9.1 Soils

Preliminary soils data for the Site were provided by the Wallowa-Whitman National Forest, Baker Ranger District (USFS, 2010). A copy of the soil survey map for the Site is presented in Appendix A (Figure 4).

- The AA is mapped within soil type 0991CS. This soil is characterized by the Elkhorn, Prouty, and Hoffer components on 30 to 60 percent slopes.
    - Elevations range from 6,273 to 7,037 feet amsl.
    - Soils are typically well-drained.
    - The typical profile includes ashy sandy and silty loam, underlain by sandy to cobbly loam, with bedrock encountered at approximately 15 inches to 57 inches below ground surface.

9.2 Aerial Photograph Review

Aerial photographs can sometimes help identify historic areas of inundation and/or wetland features at a property. Evaluation of aerials is controlled by the photograph scale and quality. CES reviewed reasonably available aerial photographs depicting the Site and surrounding vicinity at periodic intervals (UO, 2009).

A total of 4 aerial photographs were available for review for the years 1956, 1971, 1994, and 2005. CES has summarized information from the review in Table C and provided copies of the aerial photographs in Appendix A (Figures A1-A4).

Table C. Aerial Photograph Review of the Site and Surrounding Areas

Date	Description
1956	The Site appears to be primarily forested, although a slight change in vegetation type is apparent at the assessment area. Waste rock piles are visible to the east and west. A cleared area adjacent to the south of the Site appears to have one structure. Remaining areas surrounding the Site are primarily forested.
1971	The Site and surrounding areas are relatively unchanged from the 1956 photograph.
1994	The Site appears to be primarily forested, with a very slight change in vegetation type depicted at the assessment area. A road is visible adjacent to the east of the Site, beyond which, is an apparent waste rock pile. Additional roadways and clearcuts are depicted to the north and west of the Site. The remaining areas are primarily forested.
2005	The Site and surrounding areas are relatively unchanged from the 1994 photograph.

As shown, a slight difference in vegetation type was visible at the AA in the available historic aerial photographs. The AA appears to have a more open canopy than the surrounding forested areas. Wetlands at the Site could not be deciphered on the aerial photographs.

9.3 Historic Photograph – Monumental Mine

CES has included a historic photograph of the Monumental Mine for reference purposes (Figure 6). The photograph depicts the 20-stamp mill, chlorination plant and exhaust, and approximate location of the upper settling pond in the AA (Baker County, 2009). Widespread Site alterations are visible in the photograph, including logging around the upper settling pond and headwaters of the unnamed tributary.

9.4 Rare, Threatened, and Endangered Species

A review of the possible presence of Rare, Threatened, and Endangered species was conducted as part of the SI (EA, 2003). The report identified the potential presence of the following species:

- Mid-Columbia River steelhead (federal threatened)
- Bull trout (federal threatened)
- Inland redband trout (species of concern)
- Westslope cutthroat trout (species of concern)
- Olive sided flycatcher (species of concern)
- Columbia spotted frog (state sensitive)

The presence of these species was not field verified during wetlands delineation activities. However, fish have been documented in the unnamed tributary to Granite Creek, which originates at the Site wetland.

10.0 WETLAND FUNCTIONAL ASSESSMENT

The purpose of the wetland functional assessment is to document wetlands and values anticipated to be lost as a result of the project and to assess mitigation success in terms of lost function and value replacement.

- The Oregon Rapid Wetland Assessment Protocol (ORWAP; Adamus et al., 2009) was used to evaluate the functions and values of the Site wetland. Using the ORWAP provides a rating score between 0 (low) and 10 (high) for selected wetland functions and values. The highest ratings identify the principle functions and values for a given wetland that should be protected or replaced (mitigated for), and lower ratings identify functions and values that may be improved during mitigation actions.

- The tables of ORWAP output scores calculated for the Site wetland are provided in Appendix D.
- Functions are the physical, chemical, and biological processes that characterize wetland ecosystems.
- ORWAP function scores rate the relative effectiveness of the wetland in performing each function.
- Values are the importance (worth) of wetland functions that include public attitude and the opportunity for a wetland to provide a specific function based on location.

Function and value scores are described in the Table D.

Table D. Oregon Rapid Wetland Assessment Protocol Function Scores for the Forest Service – Monumental Wetland

Function	Relative Effectiveness of the Function	Relative Value of the Function
Water Storage and Delay (WS)	0.00	2.92
Sediment Retention and Stabilization (SR)	7.17	2.94
Phosphorus Retention (PR)	9.08	4.18
Nitrate Removal and Retention (NR)	5.33	4.35
Thermoregulation (T)	0.00	0.00
Carbon Sequestration (CS)	4.19	
Organic Matter Export (OE)	0.00	
Aquatic Invertebrate Habitat (INV)	3.50	5.28
Anadromous Fish Habitat (FA)	0.00	0.33
Non-Anadromous Fish Habitat (FR)	1.50	10.00
Amphibian and Reptile Habitat (AM)	4.80	6.67
Waterbird Feeding Habitat (WBF)	0.33	4.50
Waterbird Nesting Habitat (WNH)	0.00	3.00
Songbird, Raptor, & Mammal Habitat (SBM)	5.28	3.33
Pollinator Habitat (PH)	4.95	5.00
Native Plant Diversity (PD)	3.33	5.14

As shown, function and value scores varied greatly for the Site wetland. Based on this:

- Potential enhancement opportunities are available for a number of components that scored low in the ORWAP assessment.
- Some functional components such as anadromous fish habitat cannot be enhanced since these species do not inhabit the uppermost headwaters of Granite Creek and tributaries.

Grouped services are considered a “roll-up” of individual functions and their associated values. A summary of grouped service function scores is provided in Table E.

Table E. Oregon Rapid Wetland Assessment Protocol Group Service Function and Value Scores for the Forest Service – Monumental Wetland

Grouped Service Function	Group Function Scores	Group Value Scores
Hydrologic Function (WS)	0.00	2.92
Water Quality Support Group	9.08	4.35
Carbon Sequestration Function	4.19	
Fish Support Group (FISH)	1.50	10.00
Aquatic Support Group (AQ)	4.80	6.67
Terrestrial Support Group (TERR)	5.28	5.14
Public Use & Recognition (PU)		0.83
Provisioning Services		0.00
Other Attributables		
Wetland Ecological Condition [1]		5.73
Wetland Stressors [2]		6.44
Wetland Sensitivity [3]		5.07

NOTES:
1 Condition is the integrity or health of a wetland based primarily on the vegetation component.
2 Stressors include the degree to which the wetland has been recently altered by, or exposed to risk, from human alterations.
3 Sensitivity is the resistance and resilience of a wetland to human and natural stressors.

11.0 RESULTS AND CONCLUSIONS

CES has completed a wetland delineation of the former settling ponds and riparian channel at the Forest Service Monumental Mine in Grant County, Oregon. Results of this delineation identified the following:

- Based on soil, vegetation, and hydrological conditions exhibited during the field investigation, one 0.08-acre PEM/riverine wetland was delineated at the Site.
- An assessment of functions and values was completed using ORWAP. The assessment identified a wide variety of component values.
- The highest function scores were for phosphorus retention and sediment retention and stabilization. Function scores of 0 were exhibited for water storage and delay, thermoregulation, organic matter export, anadromous fish habitat, and waterbird nesting habitat. Other low function scores were identified for non-anadromous fish habitat, waterbird feeding habitat, and native plant diversity.
- The ecological condition of the wetland, based solely on the vegetative component, scored 5.73. The stressor score, which measures alterations and risk to the wetland, measured 6.44. The wetland sensitivity score was 5.07.
- The ponds will likely need to be remediated as part of the CERCLA non-time critical RA at the Site.
- The wetland is considered to have a high potential for enhancement.
- Remediation of hazardous substances within the settling ponds will result in unavoidable impacts to the wetland. The RA must therefore include measures to avoid and minimize wetland impacts, and impacts to the unnamed tributary channel between the settling ponds should be avoided.

12.0 PROPOSED WETLAND IMPACTS AND MITIGATION OPTIONS

Remedial alternatives for the Monumental Mine are described in the EE/CA document. Proposed remedial actions at the Site may include removal of tailings from the settling ponds and restoration of the wetland system. The contaminated tailings are proposed to be disposed in an onsite repository.

- Compensatory mitigation is required for fill or excavation activities within a wetland.
- The proposed remedial action would excavate tailings from approximately 0.04 acres of wetland.
- To meet the 1:1 restoration mitigation ratio requirements approximately 0.04 to 0.06 acres of the excavated area will be restored to equivalent or enhanced pre-remediation functions and values.
- The actual acreage of excavated wetlands and subsequent final determination of restoration acreage can be verified following development of the final remedial design.

12.1 Mitigation Assumptions and Alternatives

12.1.1 Assumptions

The following assumptions have been developed with respect to wetland remedial activities:

- The Site waste rock and tailings piles will be excavated and disposed in an onsite repository. As such, sources of arsenic contamination, including the contaminated tailings within the AA, will be removed from the wetland and upslope sources.
- Since the source of arsenic contamination will be removed during the RA, the newly restored wetland system will not need to be engineered to treat contaminated water originating from the mine.

12.1.2 Goals

The primary objective of wetland restoration is promotion of native wetland characteristics with functions and values higher than pre-remediation conditions. To meet this objective, the following mitigation alternatives have been developed for the Site:

Mitigation options should include preservation of the current riparian areal extent, connecting the upper and middle settling ponds, and restoration of about 0.04 acres of wetland impacted from RA activities at the Site.

- Details of the wetland restoration, if completed, will be provided at a later date. Restoration may include replacement of contaminated tailings with clean organic fill and contouring to promote water retention within these areas.
- Target wetland types should resemble the current filled settling ponds and could include replanting of dominant species.
- As discussed in Section 9.4, the fish have been documented in the unnamed tributary to Granite Creek, which originates at the Site wetland. Moreover, federally threatened summer steelhead have been documented at the confluence of the unnamed tributary and Granite Creek. Therefore, water quality at the Site and downstream from the Site; fish and wildlife habitat; and human health/ecological considerations should be the key functions and values targeted for wetland restoration planning.
- The restoration will include post-construction monitoring and ORWAP assessment to verify enhanced wetland functions and values.

13.0 DISCLAIMER

This report documents the investigation, best professional judgment, and conclusions of the investigator. It is correct and complete to the best of CES' knowledge. It should be considered a Preliminary Jurisdictional Determination of wetlands and other waters of the state and used for CERCLA response actions conducted entirely on-site, where such action is selected and carried out in compliance with CERCLA Section 121(e)(1).

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15. United States Geological Survey (USGS), 1982. 7.5 Minute Series Topographic Map Mt. Ireland, Oregon. U.S. Geological Survey, Washington, D.C.

16. Western Regional Climate Center (WRCC), 2010. "Period of Record Monthly Climate Summary, Granite 4 WSW, Oregon (353430)." wrcc@dri.edu. Western Regional Climate Center website. Accessed January 4, 2010.

APPENDICES

Appendix A.

Maps

Aerial Photographs

Appendix B.

Field Data Forms

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: USFS – Monumental Mine City/County: 8 Miles NE of Granite, Oregon Sampling Date: 10/1/2009

Applicant/Owner: U.S. Forest Service, Wallowa-Whitman National Forest State: Oregon Sampling Point: MMW-1

Investigator(s): Tobias/Otis Section, Township, Range: Section 18, Township 8 South, Range 36 East

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Concave Slope (%): 30

Subregion (LRR): E Lat: N 44° 51.627' Long: W 118° 21.217' Datum: NAD 1983

Soil Map Unit Name: Elkhorn, Prouty, Hoffer (0991CS) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation X, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes ____ No X

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____ No X	**Is the Sampled Area within a Wetland?** **Yes ____ No X**
Hydric Soil Present?	Yes ____ No X	
Wetland Hydrology Present?	Yes ____ No X	

Remarks:

Site conditions were altered significantly due to mining practices that began in 1870. The area delineated includes two settling ponds from the mine with tailings material containing high concentrations of arsenic.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 20-foot radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. Abies lasiocarpa	30	Yes	FACU
2. Pinus contorta	10	No	FAC-
3.			
4.			
	40 = Total Cover		
Sapling/Shrub Stratum (Plot size: 20-foot radius)			
1. Chimpaphilia umbellata	10	No	--
2. Vaccinium spp	5	No	--
3.			
4.			
5.			
	15 = Total Cover		
Herb Stratum (Plot size: 20-foot radius)			
1. Fragaria virginiana	5	No	UPL
2. Fescue idahoensis	15	No	NI
3. Solidago canadensis	5	No	FACU
4. Mertensia paniculata	<1	No	FACW
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	25 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ = Total Cover		

% Bare Ground in Herb Stratum 75

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species ____	x 1 = ____
FACW species ____	x 2 = ____
FAC species ____	x 3 = ____
FACU species ____	x 4 = ____
UPL species ____	x 5 = ____
Column Totals: ____ (A)	____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes ____ No X**

Remarks:

SOIL

Sampling Point: MMW-1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-4"							Duff/Litter	
4-15"	10YR 2/2	100					Loamy silt	Dark brown
15-18"	2.5YR 3/2	100						

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

__ Histosol (A1)
__ Histic Epipedon (A2)
__ Black Histic (A3)
__ Hydrogen Sulfide (A4)
__ Depleted Below Dark Surface (A11)
__ Thick Dark Surface (A12)
__ Sandy Mucky Mineral (S1)
__ Sandy Gleyed Matrix (S4)
__ Sandy Redox (S5)
__ Stripped Matrix (S6)
__ Loamy Mucky Mineral (F1) (**except MLRA 1**)
__ Loamy Gleyed Matrix (F2)
__ Depleted Matrix (F3)
__ Redox Dark Surface (F6)
__ Depleted Dark Surface (F7)
__ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

__ 2 cm Muck (A10)
__ Red Parent Material (TF2)
__ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ________

Depth (inches): ________

Hydric Soil Present? Yes ____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

__ Surface Water (A1)
__ High Water Table (A2)
__ Saturation (A3)
__ Water Marks (B1)
__ Sediment Deposits (B2)
__ Drift Deposits (B3)
__ Algal Mat or Crust (B4)
__ Iron Deposits (B5)
__ Surface Soil Cracks (B6)
__ Inundation Visible on Aerial Imagery (B7)
__ Sparsely Vegetated Concave Surface (B8)
__ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
__ Salt Crust (B11)
__ Aquatic Invertebrates (B13)
__ Hydrogen Sulfide Odor (C1)
__ Oxidized Rhizospheres along Living Roots (C3)
__ Presence of Reduced Iron (C4)
__ Recent Iron Reduction in Tilled Soils (C6)
__ Stunted or Stressed Plants (D1) (**LRR A**)
__ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

__ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
__ Drainage Patterns (B10)
__ Dry-Season Water Table (C2)
__ Saturation Visible on Aerial Imagery (C9)
__ Geomorphic Position (D2)
__ Shallow Aquitard (D3)
__ FAC-Neutral Test (D5)
__ Raised Ant Mounds (D6) (**LRR A**)
__ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available: Aerial Photos reviewed from 1956, 1971, 1994 and 2005.

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: USFS – Monumental Mine City/County: 8 Miles NE of Granite, Oregon Sampling Date: 10/1/2009

Applicant/Owner: U.S. Forest Service, Wallowa-Whitman National Forest State: Oregon Sampling Point: MMW-2

Investigator(s): Tobias/Otis Section, Township, Range: Section 18, Township 8 South, Range 36 East

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Concave Slope (%): 0

Subregion (LRR): E Lat: N 44° 51.618' Long: W 118° 21.225' Datum: NAD 1983

Soil Map Unit Name: Elkhorn, Prouty, Hoffer (0991CS) NWI classification: PEMB

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation X, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes ___ No X

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ___	**Is the Sampled Area within a Wetland?** Yes X No ___
Hydric Soil Present?	Yes X No ___	
Wetland Hydrology Present?	Yes X No ___	

Remarks:

Site conditions were altered significantly due to mining practices that began in 1870. The area delineated includes two settling ponds from the mine with tailings material containing high concentrations of arsenic.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ___)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	___ = Total Cover		
Sapling/Shrub Stratum (Plot size: 20-foot radius)			
1. Alnus tenuifolia	5	No	FACW
2. Ribes lacustre	5	No	FAC+
3. Ribes spp	5	No	--
4.			
5.			
	15 = Total Cover		
Herb Stratum (Plot size: 20-foot radius)			
1. Allium validium	30	Yes	OBL
2. Glyceria elata	35	Yes	FACW
3. Senecio triangularis	5	No	FACW+
4. Solidago canadensis	<1	No	FACU
5. Saxifraga punctata	20	Yes	FAC
6. Liverwort spp			
7. Moss spp			
8.			
9.			
10.			
11.			
	90 = Total Cover		
Woody Vine Stratum (Plot size: ___)			
1.			
2.			
	___ = Total Cover		

% Bare Ground in Herb Stratum 10

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 67 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species ___	x 1 = ___
FACW species ___	x 2 = ___
FAC species ___	x 3 = ___
FACU species ___	x 4 = ___
UPL species ___	x 5 = ___
Column Totals: ___ (A)	___ (B)

Prevalence Index = B/A = ___

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Wetland Non-Vascular Plants[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ___

Remarks:

SOIL

Sampling Point: MMW-2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-5”	7.5YR 3/1	100					Clayey silt	Dark brown
5-10”	7.5YR 4/4	100					Coarse sand	Brown/orange
10-18”	5YR 5/2	100					Tailings	Pink/brown/gray

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- __ Histosol (A1)
- __ Histic Epipedon (A2)
- __ Black Histic (A3)
- __ Hydrogen Sulfide (A4)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- X Sandy Mucky Mineral (S1)
- __ Sandy Gleyed Matrix (S4)
- __ Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- __ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- __ Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- __ 2 cm Muck (A10)
- __ Red Parent Material (TF2)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes X No ______

Remarks: Contaminated mine tailings encountered from 10-18”.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- __ Water Marks (B1)
- X Sediment Deposits (B2)
- __ Drift Deposits (B3)
- __ Algal Mat or Crust (B4)
- __ Iron Deposits (B5)
- __ Surface Soil Cracks (B6)
- __ Inundation Visible on Aerial Imagery (B7)
- __ Sparsely Vegetated Concave Surface (B8)
- __ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B)**
- __ Salt Crust (B11)
- __ Aquatic Invertebrates (B13)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres along Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Tilled Soils (C6)
- __ Stunted or Stressed Plants (D1) (**LRR A**)
- __ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- __ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B)**
- __ Drainage Patterns (B10)
- __ Dry-Season Water Table (C2)
- __ Saturation Visible on Aerial Imagery (C9)
- __ Geomorphic Position (D2)
- __ Shallow Aquitard (D3)
- __ FAC-Neutral Test (D5)
- __ Raised Ant Mounds (D6) (**LRR A**)
- __ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present?	Yes X	No ______	Depth (inches): At surface
Water Table Present?	Yes X	No ______	Depth (inches): 10”
Saturation Present? (includes capillary fringe)	Yes X	No ______	Depth (inches): At surface

Wetland Hydrology Present? Yes X No ______

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available: Aerial Photos reviewed from 1956, 1971, 1994 and 2005.

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: USFS – Monumental Mine City/County: 8 Miles NE of Granite, Oregon Sampling Date: 10/1/2009

Applicant/Owner: U.S. Forest Service, Wallowa-Whitman National Forest State: Oregon Sampling Point: MMW-3

Investigator(s): Tobias/Otis Section, Township, Range: Section 18, Township 8 South, Range 36 East

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Concave Slope (%): 10-20

Subregion (LRR): E Lat: N 44° 51.621' Long: W 118° 21.240' Datum: NAD 1983

Soil Map Unit Name: Elkhorn, Prouty, Hoffer (0991CS) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation X , Soil X , or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes ____ No X

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		X
Hydric Soil Present?		X
Wetland Hydrology Present?		X

Is the Sampled Area within a Wetland? Yes ____ No X

Remarks:

Site conditions were altered significantly due to mining practices that began in 1870. The area delineated includes two settling ponds from the mine with tailings material containing high concentrations of arsenic.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 20-foot radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. Abies lasiocarpa	40	Yes	FACU
2. Larix occidentalis	20	Yes	FACU+
3. Pinus contorta	5	No	FAC-
4. Abies grandis	5	No	--
	70 = Total Cover		
Sapling/Shrub Stratum (Plot size: 20-foot radius)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: 20-foot radius)			
1. Pyrolla secunda	20	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	20 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ = Total Cover		

% Bare Ground in Herb Stratum 80

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Wetland Non-Vascular Plants[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks:

SOIL

Sampling Point: MMW-3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-5"							Duff/Litter	
5-8"	5YR 5/2	100					Tailings	Pink/brown
8-13"	10YR 2/2	100					Loamy silt	Dark brown
13-18"	2.5YR	100					Loamy silt	Brown

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ______ No X

Remarks: Contaminated tailings from 5-8"

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ______ No X Depth (inches): ______

Water Table Present? Yes ______ No X Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ______ No X Depth (inches): ______

Wetland Hydrology Present? Yes ______ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available: Aerial Photos reviewed from 1956, 1971, 1994 and 2005.

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: USFS – Monumental Mine City/County: 8 Miles NE of Granite, Oregon Sampling Date: 10/1/2009

Applicant/Owner: U.S. Forest Service, Wallowa-Whitman National Forest State: Oregon Sampling Point: MMW-4

Investigator(s): Tobias/Otis Section, Township, Range: Section 18, Township 8 South, Range 36 East

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Concave Slope (%): 20

Subregion (LRR): E Lat: N 44° 51.630' Long: W 118° 21.244' Datum: NAD 1983

Soil Map Unit Name: Elkhorn, Prouty, Hoffer (0991CS) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation X , Soil X , or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes ____ No X

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	**Is the Sampled Area within a Wetland?** **Yes** ____ **No** X
Hydric Soil Present?	Yes ____	No X	
Wetland Hydrology Present?	Yes ____	No X	

Remarks:

Site conditions were altered significantly due to mining practices that began in 1870. The area delineated includes two settling ponds from the mine with tailings material containing high concentrations of arsenic.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 20-foot radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. Abies lasiocarpa	20	Yes	FACU
2. Picea engelmannii	30	Yes	FAC
3.			
4.			
	50 = Total Cover		
Sapling/Shrub Stratum (Plot size: 20-foot radius)			
1. Chimpaphilia umbellata	5	No	--
2.			
3.			
4.			
5.			
	15 = Total Cover		
Herb Stratum (Plot size: 20-foot radius)			
1. Pyrola secunda	5	No	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	5 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ = Total Cover		

% Bare Ground in Herb Stratum 95

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species ____	x 1 = ____
FACW species ____	x 2 = ____
FAC species ____	x 3 = ____
FACU species ____	x 4 = ____
UPL species ____	x 5 = ____
Column Totals: ____ (A)	____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Wetland Non-Vascular Plants[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ____ **No** X

Remarks:

SOIL

Sampling Point: MMW-4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-3"							Duff/Litter	
3-5"	5YR 5/2	100					Tailings	Pink/brown
5-14"	10YR 2/2	100					Loamy silt	Dark brown
14-18	2.5YR 3/2	100					Loamy silt	Brown

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
___ Loamy Gleyed Matrix (F2)
_X_ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10)
___ Red Parent Material (TF2)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ______________

Depth (inches): ______________

Hydric Soil Present? **Yes** ______ **No** _X_

Remarks: Contaminated tailings present at 3-5"

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B)**
___ Salt Crust (B11)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Stunted or Stressed Plants (D1) (**LRR A**)
___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B)**
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Saturation Visible on Aerial Imagery (C9)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)
___ Raised Ant Mounds (D6) (**LRR A**)
___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ______ No _X_ Depth (inches): ____________
Water Table Present? Yes ______ No _X_ Depth (inches): ____________
Saturation Present? (includes capillary fringe) Yes ______ No _X_ Depth (inches): ____________

Wetland Hydrology Present? **Yes** ______ **No** _X_

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available: Aerial Photos reviewed from 1956, 1971, 1994 and 2005.

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: USFS – Monumental Mine City/County: 8 Miles NE of Granite, Oregon Sampling Date: 10/1/2009

Applicant/Owner: U.S. Forest Service, Wallowa-Whitman National Forest State: Oregon Sampling Point: MMW-5

Investigator(s): Tobias/Otis Section, Township, Range: Section 18, Township 8 South, Range 36 East

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Concave Slope (%): 10

Subregion (LRR): E Lat: N 44° 51.629' Long: W 118° 21.234' Datum: NAD 1983

Soil Map Unit Name: Elkhorn, Prouty, Hoffer (0991CS) NWI classification: PEMB

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation X, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes ___ No X

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No
Hydric Soil Present?	Yes X	No
Wetland Hydrology Present?	Yes X	No

Is the Sampled Area within a Wetland? **Yes X No**

Remarks:

Site conditions were altered significantly due to mining practices that began in 1870. The area delineated includes two settling ponds from the mine with tailings material containing high concentrations of arsenic.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: 20-foot radius)			
1. Alnus tenuifolia	5	No	FACW
2.			
3.			
4.			
5.			
= Total Cover	5		
Herb Stratum (Plot size: 20-foot radius)			
1. Alium validium	30	Yes	OBL
2. Glyceria elata	30	Yes	FACW
3. Heracleum lanatum	<1	No	FAC
4. Solidago canadensis	5	No	FACU
5. Saxifraga punctata	10	Yes	FAC
6. grass spp	<1	No	--
7. Moss spp	--	--	--
8. Viola spp	5	No	--
9. Mimulus spp (moschatus)?	5	No	FACW+
10. Mertensia paniculata	2	No	FACW
11. Sandwort spp	2	No	--
= Total Cover	89		
Woody Vine Stratum (Plot size:)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum 11

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

__ Prevalence Index is ≤3.0[1]

__ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

__ Wetland Non-Vascular Plants[1]

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes X No**

Remarks:

SOIL

Sampling Point: MMW-5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-8”	2.5YR 2.5/1	100					Clayey silt	Black
8-9”	7.5YR 3/2	100					Clayey sand	Brown
9-18”	Gley 3/5G	100					Clay	Gleyed

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
_X_ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
___ Loamy Gleyed Matrix (F2)
_X_ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10)
___ Red Parent Material (TF2)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ________

Depth (inches): ________

Hydric Soil Present? **Yes** _X_ **No** ___

Remarks: Possible iron/reducing conditions from 9-18”.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

_X_ Surface Water (A1)
_X_ High Water Table (A2)
_X_ Saturation (A3)
___ Water Marks (B1)
_X_ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
_X_ Iron Deposits (B5)
___ Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B)**
___ Salt Crust (B11)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Stunted or Stressed Plants (D1) (**LRR A**)
___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B)**
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Saturation Visible on Aerial Imagery (C9)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)
___ Raised Ant Mounds (D6) (**LRR A**)
___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes _X_ No ___ Depth (inches): At surface
Water Table Present? Yes ___ No _X_ Depth (inches): --
Saturation Present? (includes capillary fringe) Yes _X_ No ___ Depth (inches): At surface

Wetland Hydrology Present? **Yes** _X_ **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available: Aerial Photos reviewed from 1956, 1971, 1994 and 2005.

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: USFS – Monumental Mine City/County: 8 Miles NE of Granite, Oregon Sampling Date: 10/1/2009

Applicant/Owner: U.S. Forest Service, Wallowa-Whitman National Forest State: Oregon Sampling Point: MMW-6

Investigator(s): Tobias/Otis Section, Township, Range: Section 18, Township 8 South, Range 36 East

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Concave Slope (%): 25

Subregion (LRR): E Lat: N 44° 51.621' Long: W 118° 21.240' Datum: NAD 1983

Soil Map Unit Name: Elkhorn, Prouty, Hoffer (0991CS) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation X , Soil X , or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes ___ No X

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		X
Hydric Soil Present?		X
Wetland Hydrology Present?		X

Is the Sampled Area within a Wetland? **Yes** ___ **No** X

Remarks:

Site conditions were altered significantly due to mining practices that began in 1870. The area delineated includes two settling ponds from the mine with tailings material containing high concentrations of arsenic.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 20-foot radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. Abies grandis	20	Yes	--
2. Pinus contorta	25	Yes	FACU-
3.			
4.			
	45 = Total Cover		
Sapling/Shrub Stratum (Plot size: 20-foot radius)			
1. Chimpaphila umbellata	5	No	--
2.			
3.			
4.			
5.			
	5 = Total Cover		
Herb Stratum (Plot size: 20-foot radius)			
1. Pyrolla secunda	5	No	FACU
2. Solidago canadensis	10	Yes	FACU
3. Fragaria virginiana	5	No	UPL
4. Fescue idahoensis	10	Yes	NI
5. Eroginum spp	2	No	--
6. Penstemon spp	2	No	--
7.			
8.			
9.			
10.			
11.			
	34 = Total Cover		
Woody Vine Stratum (Plot size: ___)			
1.			
2.			
	___ = Total Cover		

% Bare Ground in Herb Stratum 66

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species ___	x 1 = ___
FACW species ___	x 2 = ___
FAC species ___	x 3 = ___
FACU species ___	x 4 = ___
UPL species ___	x 5 = ___
Column Totals: ___ (A)	___ (B)

Prevalence Index = B/A = ___

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks:

SOIL

Sampling Point: MMW-6

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-4"							Duff/Litter	
4-8"	10YR 2/2	100					Loamy silt	Dark brown
8-18"	2,5YR 3/2	100					Loamy silt	Brown
18"		100					Gravel	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- _X_ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: Gravel

Depth (inches): 18"

Hydric Soil Present? Yes ______ No _X_

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ______ No _X_ Depth (inches): ______

Water Table Present? Yes ______ No _X_ Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ______ No _X_ Depth (inches): ______

Wetland Hydrology Present? Yes ______ No _X_

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available: Aerial Photos reviewed from 1956, 1971, 1994 and 2005.

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: USFS – Monumental Mine City/County: 8 Miles NE of Granite, Oregon Sampling Date: 10/1/2009

Applicant/Owner: U.S. Forest Service, Wallowa-Whitman National Forest State: Oregon Sampling Point: MMW-7

Investigator(s): Tobias/Otis Section, Township, Range: Section 18, Township 8 South, Range 36 East

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Concave Slope (%): 25

Subregion (LRR): E Lat: N 44° 51.638' Long: W 118° 21.262' Datum: NAD 1983

Soil Map Unit Name: Elkhorn, Prouty, Hoffer (0991CS) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation X, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes ____ No X

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____ No X	Is the Sampled Area within a Wetland? Yes ____ No X
Hydric Soil Present?	Yes ____ No X	
Wetland Hydrology Present?	Yes ____ No X	

Remarks:

Site conditions were altered significantly due to mining practices that began in 1870. The area delineated includes two settling ponds from the mine with tailings material containing high concentrations of arsenic.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 20-foot radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. Abies lasiocarpa	20	Yes	FACU
2. Picea engelmannii	30	Yes	FAC
3. Larix occidentalis	5	No	FACU
4. Pinus contorta	5	No	FAC-
	60 = Total Cover		
Sapling/Shrub Stratum (Plot size: 20-foot radius)			
1. Vaccinium spp	<1	No	--
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: 20-foot radius)			
1. Pyrola secunda	2	No	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	2 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ = Total Cover		

% Bare Ground in Herb Stratum 98

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	____	x 1 = ____
FACW species	____	x 2 = ____
FAC species	____	x 3 = ____
FACU species	____	x 4 = ____
UPL species	____	x 5 = ____
Column Totals:	____ (A)	____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks:

SOIL

Sampling Point: MMW-7

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-2”							Duff/Litter	
2-9 ”	2.5YR 3/2	100					Loamy silt	Brown
9”	Refusal							

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10)
___ Red Parent Material (TF2)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: Bedrock?

Depth (inches): 9”

Hydric Soil Present? Yes ______ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B)**
___ Salt Crust (B11)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Stunted or Stressed Plants (D1) (**LRR A**)
___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B)**
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Saturation Visible on Aerial Imagery (C9)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)
___ Raised Ant Mounds (D6) (**LRR A**)
___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ______ No X Depth (inches): ______
Water Table Present? Yes ______ No X Depth (inches): ______
Saturation Present? (includes capillary fringe) Yes ______ No X Depth (inches): ______

Wetland Hydrology Present? Yes ______ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available: Aerial Photos reviewed from 1956, 1971, 1994 and 2005.

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: USFS – Monumental Mine City/County: 8 Miles NE of Granite, Oregon Sampling Date: 10/1/2009

Applicant/Owner: U.S. Forest Service, Wallowa-Whitman National Forest State: Oregon Sampling Point: MMW-8

Investigator(s): Tobias/Otis Section, Township, Range: Section 18, Township 8 South, Range 36 East

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Concave Slope (%): 0

Subregion (LRR): E Lat: N 44^o 51.643' Long: W 118^o 21.251' Datum: NAD 1983

Soil Map Unit Name: Elkhorn, Prouty, Hoffer (0991CS) NWI classification: PEMB

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation X , Soil X , or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes ____ No X

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ____	**Is the Sampled Area within a Wetland?**	**Yes X No ____**
Hydric Soil Present?	Yes X No ____		
Wetland Hydrology Present?	Yes X No ____		

Remarks:

Site conditions were altered significantly due to mining practices that began in 1870. The area delineated includes two settling ponds from the mine with tailings material containing high concentrations of arsenic.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: 20-foot radius)			
1. Saxifraga punctata	5	No	FACW
2. Solidago cana	5	No	FACU
3. Claytonia sibirica	5	No	FAC
4. Abies grandis	5	No	--
5.			
= Total Cover	20		
Herb Stratum (Plot size: 20-foot radius)			
1. Moss spp	--	--	--
2. Glyceria elata	40	Yes	FACW
3. Heracleum lanatum	15	Yes	FAC
4. Mimulus spp (moschatus)?	10	Yes	FACW+
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	65		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
= Total Cover			
% Bare Ground in Herb Stratum 35			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species ____	x 1 = ____
FACW species ____	x 2 = ____
FAC species ____	x 3 = ____
FACU species ____	x 4 = ____
UPL species ____	x 5 = ____
Column Totals: ____ (A)	____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

__ Prevalence Index is ≤3.0[1]

__ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

__ Wetland Non-Vascular Plants[1]

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks:

SOIL

Sampling Point: MMW-8

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-2"	2.5YR 3/1	100					Peat	Organic/Black
2-6"	10YR 5/4	100					Coarse sand	Light brown
6-12"	2.5YR 2.5/1	100					Clayey silt	Black
12-18"	5YR 5/2	100					Tailings	Pink/brown/gray

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- X Histosol (A1)
- X Histic Epipedon (A2)
- __ Black Histic (A3)
- __ Hydrogen Sulfide (A4)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- X Sandy Mucky Mineral (S1)
- __ Sandy Gleyed Matrix (S4)
- __ Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- __ Loamy Gleyed Matrix (F2)
- __ Depleted Matrix (F3)
- __ Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- __ 2 cm Muck (A10)
- __ Red Parent Material (TF2)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ________

Depth (inches): ________

Hydric Soil Present? Yes X No ____

Remarks: Contaminated tailings present at 12-18"

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- __ Water Marks (B1)
- X Sediment Deposits (B2)
- __ Drift Deposits (B3)
- __ Algal Mat or Crust (B4)
- __ Iron Deposits (B5)
- __ Surface Soil Cracks (B6)
- __ Inundation Visible on Aerial Imagery (B7)
- __ Sparsely Vegetated Concave Surface (B8)
- __ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B)**
- __ Salt Crust (B11)
- __ Aquatic Invertebrates (B13)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres along Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Tilled Soils (C6)
- __ Stunted or Stressed Plants (D1) (**LRR A**)
- __ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- __ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B)**
- __ Drainage Patterns (B10)
- __ Dry-Season Water Table (C2)
- __ Saturation Visible on Aerial Imagery (C9)
- __ Geomorphic Position (D2)
- __ Shallow Aquitard (D3)
- __ FAC-Neutral Test (D5)
- __ Raised Ant Mounds (D6) (**LRR A**)
- __ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes X No ____ Depth (inches): At surface

Water Table Present? Yes X No ____ Depth (inches): 6"

Saturation Present? (includes capillary fringe) Yes X No ____ Depth (inches): At surface

Wetland Hydrology Present? Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available: Aerial Photos reviewed from 1956, 1971, 1994 and 2005.

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: USFS – Monumental Mine City/County: 8 Miles NE of Granite, Oregon Sampling Date: 10/1/2009

Applicant/Owner: U.S. Forest Service, Wallowa-Whitman National Forest State: Oregon Sampling Point: MMW-9

Investigator(s): Tobias/Otis Section, Township, Range: Section 18, Township 8 South, Range 36 East

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Concave Slope (%): 20

Subregion (LRR): E Lat: N 44° 51.634' Long: W 118° 21.262' Datum: NAD 1983

Soil Map Unit Name: Elkhorn, Prouty, Hoffer (0991CS) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation X, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes ___ No X

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		X
Hydric Soil Present?		X
Wetland Hydrology Present?		X

Is the Sampled Area within a Wetland? **Yes** ___ **No** X

Remarks:

Site conditions were altered significantly due to mining practices that began in 1870. The area delineated includes two settling ponds from the mine with tailings material containing high concentrations of arsenic.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 20-foot radius)			
1. Abies grandis	<1	No	--
2. Picea engelmannii	50	Yes	FAC
3.			
4.			
= Total Cover	50		
Sapling/Shrub Stratum (Plot size: 20-foot radius)			
1. Chimpaphila umbellata	5	No	--
2.			
3.			
4.			
5.			
= Total Cover	5		
Herb Stratum (Plot size: 20-foot radius)			
1. Pyrola secunda	<1	No	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	0		
Woody Vine Stratum (Plot size: ___)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum 100

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	0	x 2 = 0
FAC species	1	x 3 = 3
FACU species	1	x 4 = 4
UPL species	0	x 5 = 0
Column Totals:	2 (A)	7 (B)

Prevalence Index = B/A = 3.5

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Wetland Non-Vascular Plants[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks:

SOIL

Sampling Point: MMW-9

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-2"							Duff/Litter	
2-18 "	2.5YR 3/2	100					Loamy silt	Brown

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10)
___ Red Parent Material (TF2)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? Yes ______ No __X__

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B)**
___ Salt Crust (B11)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Stunted or Stressed Plants (D1) (**LRR A**)
___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B)**
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Saturation Visible on Aerial Imagery (C9)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)
___ Raised Ant Mounds (D6) (**LRR A**)
___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ______ No __X__ Depth (inches): ____________
Water Table Present? Yes ______ No __X__ Depth (inches): ____________
Saturation Present? (includes capillary fringe) Yes ______ No __X__ Depth (inches): ____________

Wetland Hydrology Present? Yes ______ No __X__

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available: Aerial Photos reviewed from 1956, 1971, 1994 and 2005.

Remarks:

Appendix C.

Ground Level Color Photographs

Photograph 1.

Wetland vegetation in the upper settling pond.

Photograph 2.

Sample Plot MMW-2.

Photograph 3.

Upland Plot MMW-3.

Photograph 4.

Plot MMW-5 within the channel of the unnamed tributary.

Photograph 5.

Perennial spring at headwaters of the unnamed tributary .

Appendix D.

Additional Tables of Information

Table 1. Summary of Precipitation for 2008-2009 Water Year
Forest Service Monumental Mine - DGA Wetland Delineation
Wallowa-Whitman National Forest, Grant County, Oregon

Month	**Recorded Precipitation[1]**	**Normal**	**Departure from Normal**	**Percent of Normal**
	inches			
October 2008	1.59	2.34	-0.75	68%
November 2008	4.21	3.15	1.06	134%
December 2008	6.58	3.81	2.77	173%
January 2009	5.84	3.76	2.08	155%
February 2009	2.05	3.19	-1.14	64%
March 2009	6.91	2.55	4.36	271%
April 2009	3.59	1.25	2.34	287%
May 2009	3.19	2.79	0.4	114%
June 2009	1.79	2.16	-0.37	83%
July 2009[2]	0.39	0.21	0.18	186%
August 2009	1.36	0.77	0.59	177%
September 2009	Trace	1.72	1.72	0%
Total Precipitation	**34.13**	**27.21**	**6.92**	**125%**
Field Investigation and Preceding Dates[2]				
October 1, 2009	0.05	--	--	--
September 15-30, 2009	Trace	--	--	--

NOTES:
[1] From the Meacham #2 (355394) weather station located approximately 60 miles north of the Monumental Mine at an elevation of 4,055 feet msl. Data obtained from the National Oceanic and Atmospheric Administration (NOAA) website: www.weather.gov/climate
[2] Data obtained from the Weather Underground website: www.wunderground.com
[2] OAR 141-090-0035 requires precipitation data for the day of the investigation and preceding 1-2 weeks.
-- = Not Measured

NOWData - NOAA Online Weather Data

MEACHAM #2 (355394)
Monthly Totals/Averages
Precipitation (inches)
Year: 2009

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2009	5.84	2.05	6.91	3.59	3.19	1.79	-	1.36	0.00	3.04	2.60	3.76	34.13

Official data and data for additional locations and years are available from the Regional Climate Centers and the National Climatic Data Center.

Climate Data Requested

Back to the clickable map
Back to the data request form

Display Normals
Display Records

<-- Prev Month   Next Month -->
<-- Prev Year   Next Year -->

Observed Data for Meacham No 2 September 2008

Day	Max	Min	Precip	Snow	Depth
1	M	M	0.00	0.0	0
2	M	M	0.00	0.0	0
3	M	M	0.00	0.0	0
4	M	M	0.00	0.0	0
5	M	M	0.00	0.0	0
6	M	M	0.00	0.0	0
7	M	M	0.00	0.0	0
8	M	M	0.00	0.0	0
9	M	M	0.00	0.0	0
10	M	M	0.00	0.0	0
11	M	M	0.00	0.0	0
12	M	M	0.00	0.0	0
13	M	M	0.00	0.0	0
14	M	M	0.00	0.0	0
15	M	M	0.00	0.0	0
16	M	M	0.00	0.0	0
17	M	M	0.00	0.0	0
18	M	M	0.00	0.0	0
19	M	M	0.00	0.0	0
20	M	M	M	0.0	0
21	M	M	M	0.0	0
22	M	M	0.00	0.0	0
23	M	M	0.00	0.0	0
24	M	M	0.00	0.0	0
25	M	M	0.00	0.0	0
26	M	M	0.00	0.0	0
27	M	M	0.00	0.0	0
28	M	M	0.00	0.0	0
29	M	M	0.00	0.0	0
30	M	M	0.00	0.0	0
Avg	M	M	0.00	0.0	
Dep	M	M	M	M	*(Departure from climatological normals)

Climate Data Requested

Back to the clickable map
Back to the data request form

Display Normals
Display Records

<-- Prev Month   Next Month -->
<-- Prev Year   Next Year -->

Observed Data for Meacham No 2 October 2008

Day	Max	Min	Precip	Snow	Depth
1	M	M	0.00	0.0	0
2	M	M	0.00	0.0	0
3	M	M	0.62	0.0	0
4	M	M	0.23	0.0	0
5	M	M	0.13	0.0	0
6	M	M	0.03	0.0	0
7	M	M	0.02	0.0	0
8	M	M	M	0.0	0
9	M	M	0.13	0.0	0
10	M	M	0.21	2.7	2
11	M	M	0.00	0.0	M
12	M	M	0.00	0.0	M
13	M	M	0.00	0.0	0
14	M	M	0.00	0.0	0
15	M	M	0.00	0.0	0
16	M	M	T	0.0	0
17	M	M	0.00	0.0	0
18	M	M	0.03	0.0	0
19	M	M	0.00	0.0	0
20	M	M	0.00	0.0	0
21	M	M	0.19	0.0	0
22	M	M	0.00	0.0	0
23	M	M	0.00	0.0	0
24	M	M	0.00	0.0	0
25	M	M	0.00	0.0	0
26	M	M	0.00	0.0	0
27	M	M	0.00	0.0	0
28	M	M	0.00	0.0	0
29	M	M	0.00	0.0	0
30	M	M	0.00	0.0	0
31	M	M	0.00	0.0	0
Avg	M	M	1.59	2.7	
Dep	M	M	M	M	*(Departure from climatological normals)

Climate Data Requested

Back to the clickable map
Back to the data request form

Display Normals
Display Records

<-- Prev Month   Next Month -->
<-- Prev Year   Next Year -->

Observed Data for Meacham No 2 November 2008

Day	Max	Min	Precip	Snow	Depth
1	M	M	0.08	0.0	0
2	M	M	0.02	0.0	0
3	M	M	0.10	0.0	0
4	M	M	0.05	0.0	0
5	M	M	0.88	3.9	3
6	M	M	0.02	0.0	2
7	M	M	0.07	0.0	1
8	M	M	0.01	0.0	0
9	M	M	0.17	0.0	0
10	M	M	0.25	0.0	0
11	M	M	0.04	0.0	0
12	M	M	1.28	0.0	0
13	M	M	1.02	0.0	0
14	M	M	0.00	0.0	0
15	M	M	0.00	0.0	0
16	M	M	0.00	0.0	0
17	M	M	0.00	0.0	0
18	M	M	0.00	0.0	0
19	M	M	0.00	0.0	0
20	M	M	0.00	0.0	0
21	M	M	0.13	0.7	0
22	M	M	0.00	0.0	0
23	M	M	0.01	T	0
24	M	M	0.00	0.0	0
25	M	M	0.00	0.0	0
26	M	M	0.00	0.0	0
27	M	M	0.00	0.0	0
28	M	M	0.02	0.0	0
29	M	M	0.06	0.0	0
30	M	M	0.00	0.0	0
Avg	M	M	4.21	4.6	
Dep	M	M	M	M	*(Departure from climatological normals)

Climate Data Requested

Back to the clickable map
Back to the data request form

Display Normals
Display Records

<-- Prev Month Next Month -->
<-- Prev Year Next Year -->

Observed Data for Meacham No 2 December 2008

Day	Max	Min	Precip	Snow	Depth
1	M	M	0.00	0.0	0
2	M	M	0.36	0.0	0
3	M	M	0.04	0.0	0
4	M	M	0.00	0.0	0
5	M	M	0.00	0.0	0
6	M	M	0.00	0.0	0
7	M	M	0.00	0.0	0
8	M	M	1.48	4.2	4
9	M	M	0.02	0.0	4
10	M	M	0.00	0.0	3
11	M	M	0.00	0.0	2
12	M	M	0.00	0.0	2
13	M	M	0.41	3.4	5
14	M	M	0.86	15.3	18
15	M	M	0.07	1.2	17
16	M	M	0.01	0.4	17
17	M	M	0.00	0.0	15
18	M	M	0.04	0.6	13
19	M	M	0.51	8.4	23
20	M	M	0.15	2.3	20
21	M	M	0.17	2.8	21
22	M	M	0.36	5.5	23
23	M	M	T	0.2	21
24	M	M	T	0.5	20
25	M	M	0.24	3.6	22
26	M	M	0.02	0.4	20
27	M	M	0.96	8.2	28
28	M	M	0.22	2.7	24
29	M	M	0.46	0.3	20
30	M	M	0.18	1.1	19
31	M	M	0.02	0.2	18
Avg	M	M	6.58	61.3	
Dep	M	M	M	M	`(Departure from climatological normals)

NOWData - NOAA Online Weather Data

MEACHAM #2 (355394)
Daily Almanac
Date: Oct 1, 2009

Daily Values	Observed	Normal	Record/Year	Prev Year
Max Temperature	-	-	- in 0	-
Min Temperature	-	-	- in 0	-
Avg Temperature	-	-	- in 0	-
Precipitation	0.05	-	2.00 in 2000	0.00
New Snowfall	0.0	-	0.0 in 2009+	0.0
Snow Depth	0	-	0 in 2009+	0
HDD (base 65)	-	-	- in 0	-
CDD (base 65)	-	-	- in 0	-

Month-To-Date	Observed	Normal	Record/Year	Prev Year
Avg Max Temperature	-	-	- in 0	-
Avg Min Temperature	-	-	- in 0	-
Avg Temperature	-	-	- in 0	-
Total Precipitation	0.05	-	2.00 in 2000	0.00
Total Snowfall	0.0	-	0.0 in 2009	0.0
Avg Snow Depth	0	-	0 in 2009	0
Total HDD	-	-	- in 0	-
Total CDD	-	-	- in 0	-

+ indicates record also occurred in previous years (last occurrence listed).

Official data and data for additional locations and years are available from the Regional Climate Centers **and the** National Climatic Data Center.

GRANITE 4 WSW, OREGON (353430)

Period of Record Monthly Climate Summary

Period of Record : 7/ 2/1948 to 10/16/1967

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	30.3	36.4	40.1	49.0	58.0	66.2	77.5	76.2	68.9	55.8	40.0	32.2	52.6
Average Min. Temperature (F)	11.3	15.1	17.0	25.3	31.4	36.6	39.3	38.4	33.8	28.8	21.5	15.6	26.2
Average Total Precipitation (in.)	3.66	2.93	2.73	1.87	2.33	1.76	0.60	0.71	1.08	1.93	2.93	3.84	26.37
Average Total SnowFall (in.)	40.6	31.5	29.7	10.5	3.9	0.6	0.0	0.0	0.7	3.7	17.5	35.4	174.1
Average Snow Depth (in.)	28	35	35	16	1	0	0	0	0	0	3	14	11

Percent of possible observations for period of record.
Max. Temp.: 99.3% Min. Temp.: 99.2% Precipitation: 99.4% Snowfall: 99.1% Snow Depth: 98.6%
Check Station Metadata or Metadata graphics for more detail about data completeness.

Western Regional Climate Center, wrcc@dri.edu

CoverPg: Basic Description of Assessment

Site Name:	USFS - Monumental Mine
Investigator Name:	Tobias
Date of Field Assessment:	10/1/2009
County:	Grant
Nearest Town:	Granite
Latitude (decimal degrees):	44.8606
Longitude (decimal degrees):	-118.354
TRS, quarter/quarter section and tax lot(s)	T 8S, R 36E, Sec 18
Approximate size of the Assessment Area (AA, in acres)	0.1
AA as percent of entire wetland (approx.)	
If delineated, DSL file number (WD #) if known	
Soil Map Units within the AA (list these in approx. rank order by area, from WSS web site or published county survey; see manual)	0991CS
Soil Map Units surrounding and contiguous to the AA (list all present in approx. rank order by area; see manual)	9413BO
	0988BS
	0990BS
	0993CN
Cowardin Systems & Classes (indicate all present, based on field visit and/or aerial imagery): Systems: Palustrine =P, Riverine =R, Lacustrine =L, Estuarine =E Classes: Emergent =EM, Scrub-Shrub =SS, Forested =FO, Aquatic Bed (incl. SAV) =AB, Open Water =OW, Unconsolidated Bottom =UB, Unconsolidated Shore =US	
	P
	EM
HGM Class (Scores worksheet will suggest a class; see manual section 2.4.2)	Slope
If tidal, the tidal phase during most of visit:	
What percent (approx.) of the **wetland** were you able to visit?	100
What percent (approx.) of the **AA** were you able to visit?	100
Have you attended an ORWAP training session? If so, indicate approximate month & year.	
How many wetlands have you assessed previously using ORWAP (approx.)?	
Comments about the site or this ORWAP assessment (attach extra page if desired):	

ORWAP SCORES SHEET. Version 2.0.

Site Name:	USFS - Monumental Mine		
Investigator Name:	Tobias		
Date of Field Assessment:			10/1/2009
Latitude (decimal degrees):	44.86060	Longitude (decimal degrees):	-118.35400

Note: It is normal for some cells below to have non-zero values even when no data have been entered. This does not imply hidden weighting of those functions or values.

Please cite this method as: **Adamus, P., J. Morlan, and K. Verble. 2009. Oregon Rapid Wetland Assessment Protocol (ORWAP): calculator spreadsheet, databases, and data forms. Oregon Dept. of State Lands, Salem, OR.**

SPECIFIC FUNCTIONS:	Relative Effectiveness of the Function	Relative Values of the Function	(click on cells in this column to see definitions of the wetland functions)
Water Storage & Delay (WS)	0.00	2.92	
Sediment Retention & Stabilization (SR)	7.17	2.94	
Phosphorus Retention (PR)	9.08	4.18	
Nitrate Removal & Retention (NR)	5.33	4.35	
Thermoregulation (T)	0.00	0.00	
Carbon Sequestration (CS)	4.19		
Organic Matter Export (OE)	0.00		
Aquatic Invertebrate Habitat (INV)	3.50	5.28	
Anadromous Fish Habitat (FA)	0.00	0.33	
Non-anadromous Fish Habitat (FR)	1.50	10.00	
Amphibian & Reptile Habitat (AM)	4.80	6.67	
Waterbird Feeding Habitat (WBF)	0.33	4.50	
Waterbird Nesting Habitat (WBN)	0.00	3.00	
Songbird, Raptor, & Mammal Habitat (SBM)	5.28	3.33	
Pollinator Habitat (POL)	4.95	5.00	
Native Plant Diversity (PD)	3.33	5.14	

GROUPED SERVICES:	Group Scores (functions)	Group Scores (values)	
Hydrologic Function (WS)	0.00	2.92	(identical to Water Storage and Delay function and value scores)
Water Quality Support Group (WQ)	9.08	4.35	(maximum of scores for SR, PR, NR, and T)
Carbon Sequestration Function (CS)	4.19		(identical to Carbon Sequestration score above)
Fish Support Group (FISH)	1.50	10.00	(maximum of scores for FA and FR)
Aquatic Support Group (AQ)	4.80	6.67	(maximum of scores for OE, AM, INV, WBF, and WBN)
Terrestrial Support Group (TERR)	5.28	5.14	(maximum of scores for PD, POL, and SBM)
Public Use & Recognition (PU)		0.83	
Provisioning Services (PS)		0.00	

OTHER ATTRIBUTES:			
Wetland Ecological Condition		5.73	(click on this cell to see this attribute defined)
Wetland Stressors		6.44	(click on this cell to see this attribute defined)
Wetland Sensitivity		5.07	(click on this cell to see this attribute defined)

HGM Class - Relative Probabilities	
Estuarine	0.00
Riverine	0.00
Slope	3.15
Flat	0.00
Depressional	0.00
Lacustrine	0.00

Appendix B

Supplemental Site Investigation Report

DRAFT

Supplemental Site Investigation Report

Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

Prepared for

United States Department of Agriculture Forest Service
1220 SW 3rd Avenue
Portland, Oregon 97204

Prepared by

Terraphase Engineering Inc.
610 SW Broadway, Suite 405
Portland, Oregon 97205

February 3, 2025

Project Number O031.005.002

This is a draft document and the information contained herein is subject to change. It should not be relied upon; consult the final document.

File: rpt-SSI-UpperGraniteCrkWatershed-O031-005-FDFCR

terraphase engineering

Contents

Tables

Figures

Appendices

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Acronyms and Abbreviations

CES	Cascade Environmental Sciences
EE/CA	Engineering Evaluation/Cost Analysis
IVBA	in-vitro bioavailability
mg/kg	milligrams per kilogram
ODEQ	Oregon Department of Environmental Quality
ppm	parts per million
RBA	relative bioavailability adjustment
RBC	Risk-Base Concentration
PRG	preliminary remediation goal
QA	quality assurance
QC	quality control
SAP	*Sampling and Analysis Plan*
Site	Upper Granite Creek Watershed Mines
Terraphase	Terraphase Engineering Inc.
UCL	upper confidence level
USEPA	Unite State Environmental Protection Agency
USDA	United States Department of Agriculture
WRP	waste rock piles
XRF	x-ray fluorescence

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1 Introduction

Terraphase has prepared this *Supplemental Site Investigation Report* for the United States Department of Agriculture (USDA) Forest Service to describe sampling and analysis activities conducted at the Upper Granite Creek Watershed Mines (the "Site"; Figure 1) to support preparation of an updated Engineering Evaluation/Cost Analysis (EE/CA) for the Site, to which this document is an appendix.

The Site is comprised of the following nine mines (Figure 2):

1. Monumental Mine
2. Cap Martin Mine
3. Tillicum Mine
4. Sheridan Mine
5. Golden Fraction Mine
6. Central Mine
7. Granite Creek #5 Mine
8. Granite Creek #6 Mine
9. Granite Creek #7 Mine

All field work was performed in accordance with the *Sampling and Analysis Plan* (SAP) approved by the USDA Forest Service on September 23, 2024 (Terraphase 2024a). Additional background information, including detailed descriptions of each mine and the results of previous environmental investigations, can be found in the SAP and the updated EE/CA.

2 Investigation Activities

This section describes site investigation activities performed by Terraphase between October 1 and 5, 2024. Field notes for the site investigation are included in Appendix A.

2.1 Pre-Field Activities

Prior to conducting the site investigation, Terraphase prepared a site-specific *Health and Safety Plan* (2024b), which identifies potential hazards at the Site and identifies controls (i.e., personal protective equipment) and procedures to be used when conducting sampling work to minimize those hazards.

2.2 Mapping of Site Features

Terraphase documented observable features at each mine using an EOS Arrow 100 handheld GPS device. Points were recorded with a minimum accuracy of 30 inches. For waste rock piles (WRPs), tailing piles, placer deposits, and other areal features, Terraphase collected points around the perimeter of each feature. For trenches, former roadways, tributaries, and other linear features, Terraphase collected survey points along the visible extent of each feature. A total of 245 points, 73 areal features, and 48 linear features were recorded. When applicable, the shape and extent of features were corrected using light detection and ranging (LIDAR) data obtained from the United States Geological Survey.[1] Terraphase named the adits, shafts, WRPs, and tailings piles using a consistent format. All mapped features and sampling points are shown on Figures 2 through 15. Photographs of Site features are included in the field notes (Appendix A).

The cut-fill spatial analyst tool in ArcGIS Pro was used to calculate the volumes of each waste rock and tailings pile. This process involves creating a base surface within the extent of each pile polygon. The base surface has variable elevation, determined by interpolating the unique Z-value (elevation) assigned to each point along the perimeter of the waste rock or tailings pile polygon. The original surface elevations within the extent of each polygon were then compared to the corresponding base surface to calculate the pile's volume. Where the original surface elevations are higher than the base surface elevations, the difference is considered a "cut." Conversely, where the original surface elevations are lower than the base surface elevations, the difference is considered a "fill." These differences were summed within each waste rock or tailings pile polygon to calculate a total volume for each pile. Calculated and previously estimated waste rock and tailings piles volumes are included in Table 1.

2.3 X-Ray Fluorescence Waste Rock and Tailings Screening

Terraphase used a handheld Vanta C Series x-ray fluorescence (XRF) device to measure arsenic concentrations in waste rock and tailings piles, and in soil surrounding select piles, in accordance with the procedures outlined in the SAP. Measurements were made of select locations downslope of WRPs (samples designated with "-DS" suffix) to assess the potential for surficial erosion of the piles. All XRF measurements were taken of soil samples collected below rooting depth (i.e., from approximately 0.5 to 1 foot below ground surface) using clean plastic trowels. The samples were placed in bags prior to measurement. XRF measurements were recorded by taking readings from both sides of each bagged sample until the standard deviation of the samples was less than 30 or until 10 measurements were recorded, consistent with EPA guidance (EPA 2022a). A minimum of four readings were recorded for each sample. Overall, a total of 897 XRF measurements were recorded at 124 sample locations, with arsenic concentrations ranging from 5 to 18,300 milligrams per kilogram (mg/kg) or parts per million (ppm). XRF sample locations are shown on Figures 3 through 14.

2.4 Soil, Waste Rock, and Tailings Sampling

Samples of soil, waste rock, and tailings (when applicable) were collected from each mine for laboratory analysis. At each mine, samples were generally collected from locations with the highest XRF measurements. Again, all samples were collected from below the rooting depth (from approximately 0.5 to 1 foot below ground surface) using clean plastic trowels. Samples were also collected in the soil downslope of WRPs with high XRF measurements to assess the risk of surface erosion from the WRPs.

These samples were submitted to ALS Environmental in Kelso, Washington, following strict chain-of-custody procedures for analysis of arsenic using United States Environmental Protection Agency (USEPA) Method 6020B. Select samples were also analyzed for arsenic and lead in-vitro bioavailability (IVBA)

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[1] https://apps.nationalmap.gov/downloader/

using USEPA Method 1340. Forty-two samples were submitted for arsenic analysis; 13 samples were submitted for IVBA analysis. Sample locations are shown on Figures 3 through 14.

2.5 Surface Water and Stream Sediment Sampling

Eight co-located surface water and sediment samples were collected at regular intervals within Granite Creek between Forest Service Road 73 and its headwaters near Monumental Mine. These surface water and sediment samples were collected to support overall characterization of metals in these environmental media to help initially evaluate potential ecological risk (Figure 15).

Samples were submitted to ALS Environmental following strict chain-of-custody procedures. The samples were analyzed for antimony, arsenic, cadmium, chromium, lead, silver, and zinc using USEPA Method 6020B and for mercury using USEPA Method 7470A (surface water) or 7471B (sediment). Surface water samples were also analyzed for hardness using USEPA Method SM 2340B.

2.6 Decontamination and Quality Assurance/Quality Control Sampling

The plastic trowels used to collect soil samples were decontaminated in between each sample collection to prevent cross-contamination. This was done by first cleaning each trowel with tap water, then scrubbing it with non-phosphate containing detergent (Alconox), and finally rinsing it with laboratory-supplied deionized water. Three equipment blanks were collected by pouring laboratory-supplied deionized water over the clean trowel and allowing it to fill the appropriate sample bottle. Equipment blanks were collected to assess the potential for cross-contamination. Duplicate samples were also collected at a rate of at 1 per 20 samples per media to evaluate sample variability.

2.7 Deviations from the SAP

The following summarizes completed tasks that varied from the SAP:

- Before visiting the Site, the extent to which WRPs could be identified as distinct from their surroundings was unknown and the SAP specified a procedure using the XRF to identify the extent of each pile over which soil concentrations were greater than preliminary remediation goals (PRGs). Upon visiting the Site, the WRPs were distinct. Terraphase verified using XRF that the visual edges of several piles represented different material than the surrounding material, but this was not done for every pile as stated in the SAP.
- The SAP proposed the collection of 10 co-located surface water and sediment samples to ensure the availability of a background sample (i.e., upstream of Monumental Mine, the first of the nine Site mines). However, after visiting Monumental Mine, it was apparent that the ground surface sloped away from Granite Creek and surface water/groundwater would be expected to flow to Cap Martin Creek instead, which enters Granite Creek between the Sheridan and Cap Martin Mines. Therefore, sample CS-1 was moved to the proposed location of sample CS-3 and all other sample names were adjusted accordingly. This change was approved by USDA Forest Service On-scene Coordinator Mario Isaias-Vera in the field.

- The SAP did not propose collecting samples for XRF measurement from the location of the WRPs along Granite Creek, identified in the previous EE/CA as Granite Creek Station 03. XRF arsenic concentrations were measured at the previously identified WRP (GC03-WRA) as well as one WRP observed upstream (GC03-WRB; Figure 6).
- The presence of shafts and WRPs uphill of Upper Monumental Mine Adit #2 were not recorded in previous investigations. Terraphase mapped and sampled this area (designated Upper-Upper Monumental Mine) and identified 9 shafts, 1 potential shaft, 10 WRPs, and 3 trenches. Arsenic concentrations determined via XRF measurements were taken at six WRPs and five samples were submitted for arsenic via laboratory analysis.

3 Results

This section summarizes the results of the site investigation. All soil sample locations are depicted on the relevant mine site map (Figures 3 through 14). Creek surface water and sediment sampling locations are depicted on Figure 15.

3.1 XRF Results

Table 2 lists XRF measurement by mine and WRP. Individual measurements are listed as X01 through X10 after the associated sample name. For example, the first XRF arsenic measurement from sample UMM-WRA-0.5-1 is listed as UMM-WRA-0.5-1-X01. The table includes calculated 95 upper confidence levels (UCLs) of the mean (UCLMs) for the readings taken from each sample (indicated by XUCL). For example, the UCLM from the 10 XRF readings made of sample LMM-WRA-0.5-3 is listed as LMM-WRA-0.5-3-XUCL. All UCLMs were calculated using ProUCL, Version 5.2.0 (USEPA 2022a). The output files from ProUCL, which include information regarding sample distribution and standard deviation, are included as Appendix B.

XRF measurements varied by mine and feature within the mine. Samples collected downslope and adjacent to WRPs generally had much lower concentrations than the WRPs, suggesting that erosion of the piles has not had a notable effect on surrounding soil. Exceptions to this are XRF measurements taken at locations between WRP A at Tillicum Mine and Granite Creek, which had similar concentrations to the WRP, and downslope of Golden Fraction Mine WRP D, which had generally low concentrations in both the WRP and the downslope sample. The following summarizes XRF arsenic measurements per mine and feature, as well as the associated downslope sample, where applicable:

- Monumental Mine (Upper Upper):
  - WRP A: 911–3,092 ppm; UCL downslope sample: 19–35 ppm
  - WRP B: 96–202 ppm
  - WRP C: 16–20 ppm
  - WRP D: 269–334 ppm
  - WRP E: 24–26 ppm

  - WRP F: 290–786 ppm
- Monumental Mine (Upper):
  - Flotation Table: 18,300 ppm (one measurement)
  - Tailings pile A: 316–3,402 ppm
  - Tailings pile B: 221–3,822 ppm
  - Tailings pile C: 410–3,389 ppm
  - WRP A: 128–1,876 ppm; downslope samples: 30–68 ppm
  - WRP B: 453–16,020 ppm; downslope sample: 65–78 ppm
- Monumental Mine (Lower):
  - Tailings pile A: 461–17,380 ppm
  - WRP A: 38–2,991 ppm; downslope sample: 16–50 ppm
  - WRP B: 97–978 ppm; downslope sample: 14–19 ppm
- Granite Creek Aquatic Station 03:
  - WRA: 30–45 ppm
  - WRB: 75–485 ppm
- Cap Martin Mine:
  - Placer Spoils: 25–36 ppm
  - WRP A: 5–13 ppm
  - WRP B: 5–14 ppm
  - WRP C: 36–375 ppm
- Sheridan Mine:
  - WRP A: 9–21 ppm
  - WRP B: 19–66 ppm
  - WRP C: 12–21 ppm
- Granite Creek #6 Mine:
  - WRP A: 134–422 ppm
  - Wet Trench Pile: 5–16 ppm
- Granite Creek #7 Mine:
  - WRP A: 10–31 ppm
  - WRP B: 10–12 ppm

- Tillicum Mine:
  - WRP A: 131–438 ppm; downslope samples: 150–185 ppm
  - WRP B: 67–184 ppm
  - WRP C: 99–205 ppm
- Granite Creek #5 Mine:
  - WRP A: 54–446 ppm; downslope sample: 56–76 ppm
  - WRP B: 52–162 ppm
- Golden Fraction Mine:
  - WRP A: 188–491 ppm
  - WRP B: 62–117 ppm
  - WRP C: 50–102 ppm
  - WRP D: 30–80 ppm, downslope sample: 31-62 ppm
  - Drain: 39–83 ppm
- Central Mine:
  - WRP A: 37–264 ppm; downslope sample: 30–38 ppm
  - WRP B: 125–242 ppm
  - WRP C: 52–170 ppm
  - WRP D: 56–87 ppm

3.2 Soil and Waste Rock Laboratory Analytical Results

Table 3 presents laboratory analytical results for arsenic in soil and waste rock for each mine site and mine feature, including those from previous investigations. Soil analytical results were screened against:

- Oregon Department of Environmental Quality (ODEQ) ecological Risk-Based Concentrations (RBCs);[2]
- ODEQ human health RBCs for soil direct contact[3] exposure of an excavation worker;
- ODEQ clean fill screening levels (Blue Mountains Province), which represent regional background concentrations;[4]
- PRGs developed for the SAP; and
- Refined PRGs developed with consideration for the IVBA results.

[2] https://www.oregon.gov/deq/Hazards-and-Cleanup/env-cleanup/Pages/ERA.aspx

[3] Considers incidental ingestion of soil, dermal contact with soil, and inhalation of soil-derived particulates and vapors.

[4] https://www.oregon.gov/deq/filtered%20library/imdcleanfill.pdf

Arsenic results are consistent with XRF measurements and generally show exceedances of ecological RBCs and PRGs. IVBA results and updated PRG calculations are discussed in Section 4.

3.3 Comparison of XRF to Laboratory Analytical Results

Arsenic concentrations measured via XRF, and those analyzed via USEPA Method 6020B, showed a strong correlation (R value of 0.98). Figure 16 is a plot of arsenic laboratory results versus arsenic XRF measurements. Figure 17 is a plot of each sample location on the x-axis with the laboratory result, the estimated arsenic concentration determined via XRF (based on UCLM), and the range of XRF measurements plotted on the y-axis. Most of the laboratory analytical results were within the range of concentrations measured via XRF. Figure 17 also shows total arsenic concentrations measured prior to IVBA extraction. These values are always greater than the associated non-IVBA total arsenic concentrations, which is likely because the IVBA total arsenic concentrations were measured after sieving the soil to a sample of material with a grain size less than 150 micrometers.

Combined XRF and laboratory analytical results, including laboratory analytical results of previous investigations, were used to calculate UCLMs for each waste rock and tailings pile. Table 4 lists the calculated UCLMs, as well as the sample distribution, maximum detected arsenic concentration, number of samples used to calculate UCLMs, and the number of sample locations on the features used for the samples. When six or more samples were available for a feature, the XRF UCLMs and analytical laboratory sample results were both used in the UCLM calculation. When less than six locations were associated with a recognized feature, individual XRF measurements were used in the UCLM calculation in lieu of XRF UCLs.

Terraphase reviewed the data distributions to infer if data were consistent within a Site feature. Data from 35 of the 40 features followed a normal distribution. When data did not follow a normal distribution, Terraphase evaluated the data and found that either the data represented two populations (WRPs SH-WRA, LMM-WRA, LMM-WRB, and UMM-WRB) and/or that an outlier skewed the distribution (WRP GF-WRC). For WRP GF-WRC, the outlier was from a previous consultant’s sample, which based on its concentration may not have been collected from this WRP. As a result, a revised UCLM was calculated for WRP GF-WRC with this outlier removed (Table 4).

3.4 Sediment Analytical Results

Table 5 presents sediment analytical results, including those from previous investigations. Sediment analytical results were screened against:

- ODEQ ecological RBCs for freshwater sediment;
- USEPA Region IV ecological screening values; [5]
- ODEQ clean fill screening levels (Blue Mountains Province);
- PRGs developed for the SAP; and

[5] https://www.epa.gov/sites/default/files/2018-03/documents/era_regional_supplemental_guidance_report-march-2018_update.pdf

- The PRG for tailings based on IVBA results (Section 4).

Concentrations of arsenic, cadmium, lead, silver, and zinc exceeded the ODEQ clean fill screening levels. Concentrations of arsenic, cadmium, mercury, and zinc exceeded the ecological RBC for freshwater sediment. Concentrations of arsenic, cadmium, mercury, silver, and zinc exceeded the ecological screening values. In general, samples CS-SD-7 and CS-SD-8, collected furthest downstream, had the highest metals concentrations, and samples CS-SD-1 and CS-SD-2, collected furthest upstream, had the lowest concentrations, showing the general contribution of the mines on sediment quality.

No concentrations exceeded the PRGs. The highest detected arsenic concentration of samples collected during this investigation was 35.2 mg/kg in sample CS-SD-8 collected downstream of all mines. These results are also relatively consistent with previously collected results presented in the prior EE/CA (Cascade Environmental Sciences [CES] 2011). Higher concentrations of arsenic and other metals were detected in sediment samples collected further downstream than the Site and likely reflect contribution from other non-site mines.

3.5 Surface Water Analytical Results

Table 6 presents surface water analytical results, including those from previous investigations. Surface water samples were screened against ODEQ ecological RBCs. There were no exceedances of ecological RBCs for samples collected during this investigation.

Figure 18 shows arsenic concentrations in surface water relative to the distance along Granite Creek. Concentrations increase with distance and provide an indication of the potential contribution from mine sites. The largest increase is between samples CS-SW-4 and CS-SW-5, likely associated with the contribution from Cap Martin Creek, a tributary that starts as a spring at Upper Monumental Mine and flows through settling ponds and tailings from Upper and Lower Monumental Mines.

The identification of concentrations below ecological RBCs suggests *de minimis* impact to aquatic receptors. This is consistent with previous sampling, which found that surface water sample metals concentrations were below ecological RBCs, except for lead at one sample location. Further downstream of the Site, there were two previous sampling locations with detected levels of mercury (2003 samples ST-SFW-53 and ST-SFW-54; Figure 15), but these are likely due to contribution of other non-site related mines.

Samples collected from adit seeps and surface water features at Cap Martin, Granite Creek #5, Golden Fraction, Lower Monumental, and Upper Monumental Mines had arsenic concentrations an order of magnitude higher than Granite Creek surface water samples. This suggests that the contribution of water from these features to Granite Creek is much less than other contributing springs and tributaries at and upstream of the Site.

3.6 Quality Assurance/Quality Control

Analyses were performed in accordance with the quality assurance (QA) and quality control (QC) procedures provided in the SAP.

Terraphase completed data validation after receiving the laboratory analytical reports. The data validation process included a review of chain-of-custody forms, holding times, laboratory analytical reports, method blanks, surrogate recoveries, matrix spike, matrix spike duplicates, and detection limits. The laboratory analytical reports are included as Appendix C, and the data validation reports are included as Appendix D. QA/QC information to note include the following:

- Data are considered usable and support the Work Plan objectives.
- All holding times were met, all sample preservation were appropriate, and all data were successfully verified against the electronic data deliverables and chain-of-custody form, with minor exceptions.
- Several laboratory flags related to laboratory QA/QC issues were reported. Flags were applied to sample results in cases where the estimated concentration was affected by the QA/QC issue.
- The relative percent difference for several laboratory duplicate samples were outside of the acceptable range. This is likely due to the heterogenous nature of the waste rock samples and not considered a significant issue.
- Arsenic was detected in all three equipment blanks collected during the investigation at concentrations of 0.64, 3.12, and 0.11 micrograms per liter. Arsenic concentrations detected in soil samples are more than five times these slight detections, and therefore, no data was qualified due to blank detections.
- All relative percent differences were considered acceptable (less than the 50 percent criteria established in the SAP) with the exception of the total IVBA lead analysis for sample UUMM-WRA-3-DUP.

4 Preliminary Remediation Goals

PRGs were developed for the SAP (Terraphase 2024a) to reflect updated risk assessment science and site-specific exposure assumptions consistent with current and reasonably anticipated use of the Site (Terraphase 2024a). This *Supplemental Site Investigation Report* includes an update to the PRG for arsenic to account for site- and material-specific relative bioavailability adjustment (RBA) factors as determined by sampling and analysis of soil, waste rock, and tailings. Consistent with the CES EE/CA (2011) and Terraphase SAP (2024a), the PRGs are based on the assumed potential exposure of a receptor assumed to be engaged in hunting, hiking, and/or camping activities (generally referred to herein as “a trespasser/recreator”). As described in the SAP, the PRGs conservatively reflect exposure of an adolescent trespasser/recreator who could encounter metals in soil/waste rock and tailings at the Site.

Standard default exposure factors, which USEPA (1991, 2011, 2014, 2017) recommends for use in estimating reasonable maximum exposure, were used where available and appropriate. Where standard default exposure factors are not available or appropriate, similarly conservative exposure factors based on site-specific considerations and professional judgement were used.[6] Toxicity values used were based on USEPA's (2003) hierarchy of sources. RBCs for carcinogens and noncarcinogens were calculated at a target incremental excess cancer risk of 1×10^{-6} and a target noncancer hazard quotient of 1 (OAR 340-122).[7] Finally, to account for background exposure, the proposed updated PRGs are representative of concentrations which are equal to the sum of the RBC and a background exposure concentration.[8]

To calculate a site-specific RBA, arsenic was analyzed for IVBA. This method determines the fraction of a contaminant in soil (e.g., arsenic) that is solubilized following extraction and subsequently available for absorption, or rather, is bioaccessible. The RBA is then determined using a simple regression model (i.e., an in vivo-in vitro correlation) which predicts the in vivo oral RBA for arsenic in soil based on the measured IVBA (Interstate Technology & Regulatory Council 2017).

For in vivo-in vitro correlation, arsenic RBA is expressed as a function of arsenic IVBA, which is expressed as the following fraction:

$$IVBA_{Arsenic} = \frac{\text{Bioaccessible Arsenic [mg/kg]}}{\text{Total Soil Arsenic Content [mg/kg]}}$$

The preferred model for predicting arsenic RBA from arsenic IVBA is:

$$RBA_{Arsenic} = (0.79 \cdot IVBA) + 0.03\ [R^2 = 0.87]$$

Where RBA and IVBA are expressed as fractions (Interstate Technology & Regulatory Council 2017; USEPA 2017).

The resulting IVBA and RBA calculations are summarized in Table 7. Calculated RBAs for soil and waste rock samples were similar and the datasets were combined. The RBAs for tailings were much higher than the soil and waste rock; therefore, a separate PRG was developed to assess exposure to tailings. A UCL was calculated using the RBA results from the combined soil and waste rock arsenic data (nine samples total), resulting in an RBA of 0.077 that was used to calculate a PRG of 190 mg/kg. From the two tailing samples, the maximum RBA of 0.36 was used to calculate a PRG of 110 mg/kg for arsenic in tailings.

These PRGs are higher than the previously calculated PRG of 82 mg/kg for arsenic provided in the SAP (Terraphase 2024a). The soil/waste rock PRG is higher than the 2006 risk assessment[9] PRG for arsenic of

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[6] Assumes that the trespasser/recreator could be present at the Site 2 days per month (24 days per year) over a 10-year period from the age of 6 until the age of 16.

[7] https://oregon.public.law/rules/oar_340-122-0040

[8] Background exposure concentrations for soil/waste rock and tailings were calculated using the available background sampling data. The exposure concentration is equal to the 90-percent UCLM.

[9] Terraphase assessed the previously performed calculations, including the exposure assumptions and toxicity values presented in the 2006 risk assessment, and was unable to replicate the PRG of 143 mg/kg. As presented in Appendix B10 of CES' (2011) *Human Health and Ecological Risk Assessment*, the reasonable maximum exposure concentration for arsenic of 1,800 mg/kg resulted in an excess cancer risk of 3×10^{-5}. By extension then, and using the same exposure assumptions and toxicity values for arsenic, a target excess cancer risk of 1×10^{-6} would result in an

143 mg/kg. Both previously calculated PRGs incorporated the use of the generic default RBA factor of 0.6 recommended by USEPA.[10] Consistent with the conclusions presented in the EE/CA (CES 2011) and SAP, a comparison of these updated PRGs to measured concentrations in waste rock/soil identified during prior and additional sampling of the Site demonstrates that arsenic in waste rock/soil represents the sole human health risk driver and primary chemical of concern for remedy decision-making.

While PRGs have not been calculated with consideration for ecological exposures, the outcome of this non-time-critical removal action, which is focused on eliminating potential unacceptable risks to human health, will also result in a reduction of potential risks to ecological receptors.

Figures 2 through 14 indicate the WRPs or tailings piles that have calculated UCLs above and below updated PRGs.

5 References

Cascade Environmental Sciences. 2011. *Non-Time-Critical Removal Action Engineering Evaluation/Cost Analysis, Upper Granite Creek, Grant County, Oregon, Wallowa-Whitman National Forest.* May.

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United States Environmental Protection Agency (USEPA). 2017. *Release of Standard Operating Procedure for an In Vitro Bioaccessibility Assay for Lead and Arsenic in Soil and Validation Assessment of the In Vitro Arsenic Bioaccessibility Assay for Predicting Relative Bioavailability of Arsenic in Soils and Soil-like Materials at Superfund Sites.* May 5.

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RBC for arsenic of approximately 60 mg/kg—generally consistent with the RBC of 67 mg/kg estimated by Terraphase in preparing the PRG for the SAP.

[10] This is USEPA's recommended default value in the absence of site-specific information (2012).

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Tables

Table 1
Waste Rock and Tailings Piles Volumes
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

Mine	Waste Rock Pile	Volume (cubic yards)	Previously Calculated Volume (cubic yards) (EA)	Previously Calculated Volume (cubic yards) (CES)
Upper-Upper Monumental	WRA	395	--	--
	WRB	5	--	--
	WRC	5	--	--
	WRD	10	--	--
	WRE	5	--	--
	WRF	10	--	--
	WRG	10	--	--
	WRH	25	--	--
	WRI	5	--	--
	WRJ	15	--	--
Upper Monumental	TLA	125**	--	400
	TLB	305	--	900
	TLC	10	--	100
	WRA	7,905	5,187	15,000*
	WRB	60	37	200
Lower Monumental	TLA	180	--	1,200
	WRA	5,560	6,874	18,500*
	WRB	170	--	100
Granite Creek Aq. Station 03	WRA	15	--	--
	WRB	80	--	--
Cap Martin	WRA	370	190	--
	WRB	10	--	--
	WRC	735	128	1,000
Sheridan	WRA	65	123	125
	WRB	30	--	--
	WRC	5	--	--
Granite Creek #6	WRA	45	--	30
	WTP	140	--	70
Granite Creek #7	WRA	195	--	200
	WRB	125	--	
Tillicum	WRA	205	267	400
	WRB	145	--	600
	WRC	210	51	300
Granite Creek #5	WRA	285	--	400
	WRB	10	--	20
Golden Fraction	WRA	295	--	2,000
	WRB	145	--	
	WRC	295	--	120
	WRD	1,105	--	380
Central	WRA	80	300	350
	WRB	25	17	40
	WRC	105	--	60
	WRD	25	--	200

Notes:
-- = not calculated
* = volume based on survey data
** = volume based on area multiplied by 4 feet (the maximum depth of tailings materials observed during the 2011 investigation performed by CES)
All Terraphase estimates have been rounded to the nearest 5 cubic yards, with 5 cubic yards being the minimum volume.

Table 2
Summary of XRF Measurements
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

AOI	Location	Field Sample ID	Material	Collection Depth (ft bgs)	Sample Date	Metals Arsenic
Tailings PRG						110
Waste Rock/Soil PRG						190
Cap Martin	CM-PS	CM-PS-0.5-XUCL	Waste Rock/Soil	0.5 - 1	10/3/2024	36
	CM-PS-1	CM-PS-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	38.61
	CM-PS-2	CM-PS-0.5-2-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	36
	CM-PS-3	CM-PS-0.5-3-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	33
	CM-PS-4	CM-PS-0.5-4-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	25
	CM-WRA-1	CM-WRA-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	5
		CM-WRA-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/3/2024	7
		CM-WRA-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/3/2024	9
		CM-WRA-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/3/2024	7
		CM-WRA-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/3/2024	8.92
	CM-WRA-2	CM-WRA-0.5-2-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	13
		CM-WRA-0.5-2-X02	Waste Rock/Soil	0.5 - 1	10/3/2024	12
		CM-WRA-0.5-2-X03	Waste Rock/Soil	0.5 - 1	10/3/2024	12
		CM-WRA-0.5-2-X04	Waste Rock/Soil	0.5 - 1	10/3/2024	11
		CM-WRA-0.5-2-XUCL	Waste Rock/Soil	0.5 - 1	10/3/2024	13
	CM-WRB-1	CM-WRB-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	11
		CM-WRB-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/3/2024	5
		CM-WRB-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/3/2024	10
		CM-WRB-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/3/2024	8
		CM-WRB-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/3/2024	11.61
	CM-WRB-2	CM-WRB-0.5-2-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	14
		CM-WRB-0.5-2-X02	Waste Rock/Soil	0.5 - 1	10/3/2024	11
		CM-WRB-0.5-2-X03	Waste Rock/Soil	0.5 - 1	10/3/2024	11
		CM-WRB-0.5-2-X04	Waste Rock/Soil	0.5 - 1	10/3/2024	13
		CM-WRB-0.5-2-XUCL	Waste Rock/Soil	0.5 - 1	10/3/2024	14
	CM-WRC-1	CM-WRC-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	60
		CM-WRC-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/3/2024	62
		CM-WRC-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/3/2024	81
		CM-WRC-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/3/2024	60
		CM-WRC-0.5-1-X05	Waste Rock/Soil	0.5 - 1	10/3/2024	77.76
	CM-WRC-2	CM-WRC-0.5-2-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	113
		CM-WRC-0.5-2-X02	Waste Rock/Soil	0.5 - 1	10/3/2024	62
		CM-WRC-0.5-2-X03	Waste Rock/Soil	0.5 - 1	10/3/2024	75
		CM-WRC-0.5-2-X04	Waste Rock/Soil	0.5 - 1	10/3/2024	84
		CM-WRC-0.5-2-X05	Waste Rock/Soil	0.5 - 1	10/3/2024	86
		CM-WRC-0.5-2-XUCL	Waste Rock/Soil	0.5 - 1	10/3/2024	101.9
	CM-WRC-3	CM-WRC-0.5-3-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	36
		CM-WRC-0.5-3-X02	Waste Rock/Soil	0.5 - 1	10/3/2024	63
		CM-WRC-0.5-3-X03	Waste Rock/Soil	0.5 - 1	10/3/2024	39
		CM-WRC-0.5-3-X04	Waste Rock/Soil	0.5 - 1	10/3/2024	55
		CM-WRC-0.5-3-XUCL	Waste Rock/Soil	0.5 - 1	10/3/2024	63.42
	CM-WRC-4	CM-WRC-0.5-4-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	309
		CM-WRC-0.5-4-X02	Waste Rock/Soil	0.5 - 1	10/3/2024	375
		CM-WRC-0.5-4-X03	Waste Rock/Soil	0.5 - 1	10/3/2024	322
		CM-WRC-0.5-4-X04	Waste Rock/Soil	0.5 - 1	10/3/2024	312
		CM-WRC-0.5-4-XUCL	Waste Rock/Soil	0.5 - 1	10/3/2024	365.8
	CM-WRC-5	CM-WRC-0.5-5-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	106
		CM-WRC-0.5-5-X02	Waste Rock/Soil	0.5 - 1	10/3/2024	83
		CM-WRC-0.5-5-X03	Waste Rock/Soil	0.5 - 1	10/3/2024	105
		CM-WRC-0.5-5-X04	Waste Rock/Soil	0.5 - 1	10/3/2024	77
		CM-WRC-0.5-5-XUCL	Waste Rock/Soil	0.5 - 1	10/3/2024	110.3
Central	CEM-WRA-1	CEM-WRA-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/5/2024	58
		CEM-WRA-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/5/2024	51
		CEM-WRA-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/5/2024	64
		CEM-WRA-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/5/2024	52
		CEM-WRA-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/5/2024	63.33
	CEM-WRA-2	CEM-WRA-0.5-2-X01	Waste Rock/Soil	0.5 - 1	10/5/2024	153
		CEM-WRA-0.5-2-X02	Waste Rock/Soil	0.5 - 1	10/5/2024	211
		CEM-WRA-0.5-2-X03	Waste Rock/Soil	0.5 - 1	10/5/2024	138
		CEM-WRA-0.5-2-X04	Waste Rock/Soil	0.5 - 1	10/5/2024	214
		CEM-WRA-0.5-2-X05	Waste Rock/Soil	0.5 - 1	10/5/2024	145
		CEM-WRA-0.5-2-X06	Waste Rock/Soil	0.5 - 1	10/5/2024	100
		CEM-WRA-0.5-2-X07	Waste Rock/Soil	0.5 - 1	10/5/2024	129
		CEM-WRA-0.5-2-X08	Waste Rock/Soil	0.5 - 1	10/5/2024	264
		CEM-WRA-0.5-2-X09	Waste Rock/Soil	0.5 - 1	10/5/2024	161
		CEM-WRA-0.5-2-X10	Waste Rock/Soil	0.5 - 1	10/5/2024	147
		CEM-WRA-0.5-2-XUCL	Waste Rock/Soil	0.5 - 1	10/5/2024	194.5
	CEM-WRA-3	CEM-WRA-0.5-3-X01	Waste Rock/Soil	0.5 - 1	10/5/2024	43
		CEM-WRA-0.5-3-X02	Waste Rock/Soil	0.5 - 1	10/5/2024	44
		CEM-WRA-0.5-3-X03	Waste Rock/Soil	0.5 - 1	10/5/2024	40
		CEM-WRA-0.5-3-X04	Waste Rock/Soil	0.5 - 1	10/5/2024	37
		CEM-WRA-0.5-3-XUCL	Waste Rock/Soil	0.5 - 1	10/5/2024	44.72

Table 2
Summary of XRF Measurements
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

AOI	Location	Field Sample ID	Material	Collection Depth (ft bgs)	Sample Date	Metals Arsenic
Tailings PRG						110
Waste Rock/Soil PRG						190
Central	CEM-WRA-4	CEM-WRA-0.5-4-X01	Waste Rock/Soil	0.5 - 1	10/5/2024	77
		CEM-WRA-0.5-4-X02	Waste Rock/Soil	0.5 - 1	10/5/2024	69
		CEM-WRA-0.5-4-X03	Waste Rock/Soil	0.5 - 1	10/5/2024	89
		CEM-WRA-0.5-4-X04	Waste Rock/Soil	0.5 - 1	10/5/2024	56
		CEM-WRA-0.5-4-XUCL	Waste Rock/Soil	0.5 - 1	10/5/2024	89.07
	CEM-WRA-4-DS	CEM-WRA-0.5-4-DS-X01	Waste Rock/Soil	0.5 - 1	10/5/2024	38
		CEM-WRA-0.5-4-DS-X02	Waste Rock/Soil	0.5 - 1	10/5/2024	31
		CEM-WRA-0.5-4-DS-X03	Waste Rock/Soil	0.5 - 1	10/5/2024	34
		CEM-WRA-0.5-4-DS-X04	Waste Rock/Soil	0.5 - 1	10/5/2024	30
		CEM-WRA-0.5-4-DS-XUCL	Waste Rock/Soil	0.5 - 1	10/5/2024	37.48
	CEM-WRB-1	CEM-WRB-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/5/2024	187
		CEM-WRB-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/5/2024	210
	CEM-WRB-1	CEM-WRB-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/5/2024	125
		CEM-WRB-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/5/2024	165
		CEM-WRB-0.5-1-X05	Waste Rock/Soil	0.5 - 1	10/5/2024	126
		CEM-WRB-0.5-1-X06	Waste Rock/Soil	0.5 - 1	10/5/2024	133
		CEM-WRB-0.5-1-X07	Waste Rock/Soil	0.5 - 1	10/5/2024	217
		CEM-WRB-0.5-1-X08	Waste Rock/Soil	0.5 - 1	10/5/2024	242
		CEM-WRB-0.5-1-X09	Waste Rock/Soil	0.5 - 1	10/5/2024	142
		CEM-WRB-0.5-1-X10	Waste Rock/Soil	0.5 - 1	10/5/2024	151
		CEM-WRB-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/5/2024	194.1
	CEM-WRC-1	CEM-WRC-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/5/2024	123
		CEM-WRC-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/5/2024	187
		CEM-WRC-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/5/2024	94
		CEM-WRC-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/5/2024	104
		CEM-WRC-0.5-1-X05	Waste Rock/Soil	0.5 - 1	10/5/2024	121
		CEM-WRC-0.5-1-X06	Waste Rock/Soil	0.5 - 1	10/5/2024	109
		CEM-WRC-0.5-1-X07	Waste Rock/Soil	0.5 - 1	10/5/2024	170
		CEM-WRC-0.5-1-X08	Waste Rock/Soil	0.5 - 1	10/5/2024	136
		CEM-WRC-0.5-1-X09	Waste Rock/Soil	0.5 - 1	10/5/2024	102
		CEM-WRC-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/5/2024	147.1
	CEM-WRC-2	CEM-WRC-0.5-2-X01	Waste Rock/Soil	0.5 - 1	10/5/2024	68
		CEM-WRC-0.5-2-X02	Waste Rock/Soil	0.5 - 1	10/5/2024	64
		CEM-WRC-0.5-2-X03	Waste Rock/Soil	0.5 - 1	10/5/2024	52
		CEM-WRC-0.5-2-X04	Waste Rock/Soil	0.5 - 1	10/5/2024	57
		CEM-WRC-0.5-2-XUCL	Waste Rock/Soil	0.5 - 1	10/5/2024	68.65
	CEM-WRD-1	CEM-WRD-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/5/2024	62
		CEM-WRD-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/5/2024	56
		CEM-WRD-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/5/2024	61
		CEM-WRD-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/5/2024	87
		CEM-WRD-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/5/2024	82.88
Golden Fraction	GF-DR-1	GF-DR-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/5/2024	39
		GF-DR-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/5/2024	57
		GF-DR-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/5/2024	83
		GF-DR-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/5/2024	51
		GF-DR-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/5/2024	79.36
	GF-WRA-1	GF-WRA-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/5/2024	401
		GF-WRA-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/5/2024	372
		GF-WRA-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/5/2024	352
		GF-WRA-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/5/2024	491
		GF-WRA-0.5-1-X05	Waste Rock/Soil	0.5 - 1	10/5/2024	269
		GF-WRA-0.5-1-X06	Waste Rock/Soil	0.5 - 1	10/5/2024	170
		GF-WRA-0.5-1-X07	Waste Rock/Soil	0.5 - 1	10/5/2024	460
		GF-WRA-0.5-1-X08	Waste Rock/Soil	0.5 - 1	10/5/2024	322
		GF-WRA-0.5-1-X09	Waste Rock/Soil	0.5 - 1	10/5/2024	324
		GF-WRA-0.5-1-X10	Waste Rock/Soil	0.5 - 1	10/5/2024	322
		GF-WRA-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/5/2024	401.7
	GF-WRA-2	GF-WRA-0.5-2-X01	Waste Rock/Soil	0.5 - 1	10/5/2024	188
		GF-WRA-0.5-2-X02	Waste Rock/Soil	0.5 - 1	10/5/2024	237
		GF-WRA-0.5-2-X03	Waste Rock/Soil	0.5 - 1	10/5/2024	279
		GF-WRA-0.5-2-X04	Waste Rock/Soil	0.5 - 1	10/5/2024	237
		GF-WRA-0.5-2-X05	Waste Rock/Soil	0.5 - 1	10/5/2024	266
		GF-WRA-0.5-2-XUCL	Waste Rock/Soil	0.5 - 1	10/5/2024	274.8
	GF-WRA-3	GF-WRA-0.5-3-X01	Waste Rock/Soil	0.5 - 1	10/5/2024	299
		GF-WRA-0.5-3-X02	Waste Rock/Soil	0.5 - 1	10/5/2024	378
		GF-WRA-0.5-3-X03	Waste Rock/Soil	0.5 - 1	10/5/2024	275
		GF-WRA-0.5-3-X04	Waste Rock/Soil	0.5 - 1	10/5/2024	416
		GF-WRA-0.5-3-X05	Waste Rock/Soil	0.5 - 1	10/5/2024	250
		GF-WRA-0.5-3-X06	Waste Rock/Soil	0.5 - 1	10/5/2024	269
		GF-WRA-0.5-3-X07	Waste Rock/Soil	0.5 - 1	10/5/2024	248
		GF-WRA-0.5-3-X08	Waste Rock/Soil	0.5 - 1	10/5/2024	269
		GF-WRA-0.5-3-X09	Waste Rock/Soil	0.5 - 1	10/5/2024	224
		GF-WRA-0.5-3-X10	Waste Rock/Soil	0.5 - 1	10/5/2024	296
		GF-WRA-0.5-3-XUCL	Waste Rock/Soil	0.5 - 1	10/5/2024	327.2

Table 2
Summary of XRF Measurements
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

AOI	Location	Field Sample ID	Material	Collection Depth (ft bgs)	Sample Date	Metals Arsenic
Tailings PRG						110
Waste Rock/Soil PRG						190
Golden Fraction	GF-WRB-1	GF-WRB-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/5/2024	117
		GF-WRB-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/5/2024	112
		GF-WRB-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/5/2024	144
		GF-WRB-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/5/2024	103
		GF-WRB-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/5/2024	139.8
	GF-WRB-2	GF-WRB-0.5-2-X01	Waste Rock/Soil	0.5 - 1	10/5/2024	87
		GF-WRB-0.5-2-X02	Waste Rock/Soil	0.5 - 1	10/5/2024	68
		GF-WRB-0.5-2-X03	Waste Rock/Soil	0.5 - 1	10/5/2024	75
		GF-WRB-0.5-2-X04	Waste Rock/Soil	0.5 - 1	10/5/2024	82
		GF-WRB-0.5-2-XUCL	Waste Rock/Soil	0.5 - 1	10/5/2024	87.75
	GF-WRB-3	GF-WRB-0.5-3-X01	Waste Rock/Soil	0.5 - 1	10/5/2024	75
		GF-WRB-0.5-3-X02	Waste Rock/Soil	0.5 - 1	10/5/2024	62
		GF-WRB-0.5-3-X03	Waste Rock/Soil	0.5 - 1	10/5/2024	87
		GF-WRB-0.5-3-X04	Waste Rock/Soil	0.5 - 1	10/5/2024	60
		GF-WRB-0.5-3-XUCL	Waste Rock/Soil	0.5 - 1	10/5/2024	58.79
	GF-WRC-1	GF-WRC-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/5/2024	81
		GF-WRC-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/5/2024	79
		GF-WRC-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/5/2024	102
		GF-WRC-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/5/2024	78
		GF-WRC-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/5/2024	98.42
	GF-WRC-2	GF-WRC-0.5-2-X01	Waste Rock/Soil	0.5 - 1	10/5/2024	85
		GF-WRC-0.5-2-X02	Waste Rock/Soil	0.5 - 1	10/5/2024	75
	GF-WRC-2	GF-WRC-0.5-2-X03	Waste Rock/Soil	0.5 - 1	10/5/2024	100
		GF-WRC-0.5-2-X04	Waste Rock/Soil	0.5 - 1	10/5/2024	88
		GF-WRC-0.5-2-XUCL	Waste Rock/Soil	0.5 - 1	10/5/2024	99.11
	GF-WRC-3	GF-WRC-0.5-3-X01	Waste Rock/Soil	0.5 - 1	10/5/2024	50
		GF-WRC-0.5-3-X02	Waste Rock/Soil	0.5 - 1	10/5/2024	47
		GF-WRC-0.5-3-X03	Waste Rock/Soil	0.5 - 1	10/5/2024	41
		GF-WRC-0.5-3-X04	Waste Rock/Soil	0.5 - 1	10/5/2024	46
		GF-WRC-0.5-3-XUCL	Waste Rock/Soil	0.5 - 1	10/5/2024	50.4
	GF-WRC-4	GF-WRC-0.5-4-X01	Waste Rock/Soil	0.5 - 1	10/5/2024	67
		GF-WRC-0.5-4-X02	Waste Rock/Soil	0.5 - 1	10/5/2024	42
		GF-WRC-0.5-4-X03	Waste Rock/Soil	0.5 - 1	10/5/2024	58
		GF-WRC-0.5-4-X04	Waste Rock/Soil	0.5 - 1	10/5/2024	54
		GF-WRC-0.5-4-XUCL	Waste Rock/Soil	0.5 - 1	10/5/2024	67.45
	GF-WRD-1	GF-WRD-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/5/2024	59
		GF-WRD-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/5/2024	60
		GF-WRD-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/5/2024	69
		GF-WRD-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/5/2024	60
		GF-WRD-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/5/2024	67.52
	GF-WRD-2	GF-WRD-0.5-2-X01	Waste Rock/Soil	0.5 - 1	10/5/2024	30
		GF-WRD-0.5-2-X02	Waste Rock/Soil	0.5 - 1	10/5/2024	42
		GF-WRD-0.5-2-X03	Waste Rock/Soil	0.5 - 1	10/5/2024	44
		GF-WRD-0.5-2-X04	Waste Rock/Soil	0.5 - 1	10/5/2024	38
		GF-WRD-0.5-2-XUCL	Waste Rock/Soil	0.5 - 1	10/5/2024	45.79
	GF-WRD-3	GF-WRD-0.5-3-X01	Waste Rock/Soil	0.5 - 1	10/5/2024	62
		GF-WRD-0.5-3-X02	Waste Rock/Soil	0.5 - 1	10/5/2024	55
		GF-WRD-0.5-3-X03	Waste Rock/Soil	0.5 - 1	10/5/2024	74
		GF-WRD-0.5-3-X04	Waste Rock/Soil	0.5 - 1	10/5/2024	56
		GF-WRD-0.5-3-X05	Waste Rock/Soil	0.5 - 1	10/5/2024	72.02
	GF-WRD-4	GF-WRD-0.5-4-X01	Waste Rock/Soil	0.5 - 1	10/5/2024	57
		GF-WRD-0.5-4-X02	Waste Rock/Soil	0.5 - 1	10/5/2024	49
		GF-WRD-0.5-4-X03	Waste Rock/Soil	0.5 - 1	10/5/2024	42
		GF-WRD-0.5-4-X04	Waste Rock/Soil	0.5 - 1	10/5/2024	55
		GF-WRD-0.5-4-XUCL	Waste Rock/Soil	0.5 - 1	10/5/2024	58.69
	GF-WRD-4-DS	GF-WRD-0.5-4-DS-X01	Waste Rock/Soil	0.5 - 1	10/5/2024	31
		GF-WRD-0.5-4-DS-X02	Waste Rock/Soil	0.5 - 1	10/5/2024	62
		GF-WRD-0.5-4-DS-X03	Waste Rock/Soil	0.5 - 1	10/5/2024	54
		GF-WRD-0.5-4-DS-X04	Waste Rock/Soil	0.5 - 1	10/5/2024	46
		GF-WRD-0.5-4-DS-XUCL	Waste Rock/Soil	0.5 - 1	10/5/2024	63.81
	GF-WRD-5	GF-WRD-0.5-5-X01	Waste Rock/Soil	0.5 - 1	10/5/2024	52
		GF-WRD-0.5-5-X02	Waste Rock/Soil	0.5 - 1	10/5/2024	55
		GF-WRD-0.5-5-X03	Waste Rock/Soil	0.5 - 1	10/5/2024	55
		GF-WRD-0.5-5-X04	Waste Rock/Soil	0.5 - 1	10/5/2024	62
		GF-WRD-0.5-5-XUCL	Waste Rock/Soil	0.5 - 1	10/5/2024	60.99
	GF-WRD-6	GF-WRD-0.5-6-X01	Waste Rock/Soil	0.5 - 1	10/5/2024	51
		GF-WRD-0.5-6-X02	Waste Rock/Soil	0.5 - 1	10/5/2024	80
		GF-WRD-0.5-6-X03	Waste Rock/Soil	0.5 - 1	10/5/2024	53
		GF-WRD-0.5-6-X04	Waste Rock/Soil	0.5 - 1	10/5/2024	52
		GF-WRD-0.5-6-XUCL	Waste Rock/Soil	0.5 - 1	10/5/2024	80

Table 2
Summary of XRF Measurements
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

AOI	Location	Field Sample ID	Material	Collection Depth (ft bgs)	Sample Date	Metals Arsenic
Tailings PRG						110
Waste Rock/Soil PRG						190
Granite Creek #5	GC5-WRA-1	GC5-WRA-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	86
		GC5-WRA-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	90
		GC5-WRA-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	89
		GC5-WRA-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	133
		GC5-WRA-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	125.9
	GC5-WRA-2	GC5-WRA-0.5-2-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	54
		GC5-WRA-0.5-2-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	71
		GC5-WRA-0.5-2-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	81
		GC5-WRA-0.5-2-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	70
		GC5-WRA-0.5-2-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	82.14
	GC5-WRA-3	GC5-WRA-0.5-3-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	416
		GC5-WRA-0.5-3-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	356
		GC5-WRA-0.5-3-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	296
		GC5-WRA-0.5-3-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	364
		GC5-WRA-0.5-3-X05	Waste Rock/Soil	0.5 - 1	10/4/2024	253
		GC5-WRA-0.5-3-X06	Waste Rock/Soil	0.5 - 1	10/4/2024	273
		GC5-WRA-0.5-3-X07	Waste Rock/Soil	0.5 - 1	10/4/2024	399
		GC5-WRA-0.5-3-X08	Waste Rock/Soil	0.5 - 1	10/4/2024	346
		GC5-WRA-0.5-3-X09	Waste Rock/Soil	0.5 - 1	10/4/2024	446
		GC5-WRA-0.5-3-X10	Waste Rock/Soil	0.5 - 1	10/4/2024	327
		GC5-WRA-0.5-3-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	383.7
	GC5-WRA-4	GC5-WRA-0.5-4-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	112
		GC5-WRA-0.5-4-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	230
		GC5-WRA-0.5-4-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	99
		GC5-WRA-0.5-4-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	136
		GC5-WRA-0.5-4-X05	Waste Rock/Soil	0.5 - 1	10/4/2024	163
		GC5-WRA-0.5-4-X06	Waste Rock/Soil	0.5 - 1	10/4/2024	81
		GC5-WRA-0.5-4-X07	Waste Rock/Soil	0.5 - 1	10/4/2024	101
		GC5-WRA-0.5-4-X08	Waste Rock/Soil	0.5 - 1	10/4/2024	167
		GC5-WRA-0.5-4-X09	Waste Rock/Soil	0.5 - 1	10/4/2024	302
		GC5-WRA-0.5-4-X10	Waste Rock/Soil	0.5 - 1	10/4/2024	106
		GC5-WRA-0.5-4-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	189.9
	GC5-WRA-4-DS	GC5-WRA-0.5-4-DS-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	74
		GC5-WRA-0.5-4-DS-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	76
		GC5-WRA-0.5-4-DS-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	56
		GC5-WRA-0.5-4-DS-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	65
		GC5-WRA-0.5-4-DS-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	78.55
	GC5-WRB-1	GC5-WRB-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	133
	GC5-WRB-1	GC5-WRB-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	162
		GC5-WRB-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	129
		GC5-WRB-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	132
		GC5-WRB-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	157.2
	GC5-WRB-2	GC5-WRB-0.5-2-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	52
		GC5-WRB-0.5-2-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	82
		GC5-WRB-0.5-2-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	86
		GC5-WRB-0.5-2-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	120
		GC5-WRB-0.5-2-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	117.8
Granite Creek #6	GC6-WRA-1	GC6-WRA-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	172
		GC6-WRA-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	189
		GC6-WRA-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	179
		GC6-WRA-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	239
		GC6-WRA-0.5-1-X05	Waste Rock/Soil	0.5 - 1	10/4/2024	193
		GC6-WRA-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	219.4
	GC6-WRA-2	GC6-WRA-0.5-2-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	257
		GC6-WRA-0.5-2-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	185
		GC6-WRA-0.5-2-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	156
		GC6-WRA-0.5-2-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	378
		GC6-WRA-0.5-2-X05	Waste Rock/Soil	0.5 - 1	10/4/2024	134
		GC6-WRA-0.5-2-X06	Waste Rock/Soil	0.5 - 1	10/4/2024	422
		GC6-WRA-0.5-2-X07	Waste Rock/Soil	0.5 - 1	10/4/2024	201
		GC6-WRA-0.5-2-X08	Waste Rock/Soil	0.5 - 1	10/4/2024	270
		GC6-WRA-0.5-2-X09	Waste Rock/Soil	0.5 - 1	10/4/2024	173
		GC6-WRA-0.5-2-X10	Waste Rock/Soil	0.5 - 1	10/4/2024	235
		GC6-WRA-0.5-2-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	296
	GC6-WTP-1	GC6-WTP-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	10
		GC6-WTP-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	7
		GC6-WTP-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	7
		GC6-WTP-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	5
		GC6-WTP-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	9.676
	GC6-WTP-2	GC6-WTP-0.5-2-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	11
		GC6-WTP-0.5-2-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	11
		GC6-WTP-0.5-2-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	16
		GC6-WTP-0.5-2-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	14
		GC6-WTP-0.5-2-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	15.88

Table 2
Summary of XRF Measurements
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

AOI	Location	Field Sample ID	Material	Collection Depth (ft bgs)	Sample Date	Metals Arsenic
Tailings PRG						110
Waste Rock/Soil PRG						190
Granite Creek #6	GC6-WTP-3	GC6-WTP-0.5-3-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	6
		GC6-WTP-0.5-3-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	7
		GC6-WTP-0.5-3-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	6
		GC6-WTP-0.5-3-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	7
		GC6-WTP-0.5-3-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	7.179
Granite Creek #7	GC7-WRA-1	GC7-WRA-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	13
		GC7-WRA-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	15
		GC7-WRA-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	17
		GC7-WRA-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	15
		GC7-WRA-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	16.92
	GC7-WRA-2	GC7-WRA-0.5-2-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	10
		GC7-WRA-0.5-2-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	11
		GC7-WRA-0.5-2-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	14
		GC7-WRA-0.5-2-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	15
		GC7-WRA-0.5-2-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	15.3
	GC7-WRA-3	GC7-WRA-0.5-3-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	31
		GC7-WRA-0.5-3-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	19
		GC7-WRA-0.5-3-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	27
		GC7-WRA-0.5-3-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	30
		GC7-WRA-0.5-3-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	33.15
	GC7-WRB-1	GC7-WRB-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	10
		GC7-WRB-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	10
		GC7-WRB-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	16
		GC7-WRB-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	11
		GC7-WRB-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	15.13
Granite Creek #7	GC7-WRB-2	GC7-WRB-0.5-2-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	11
		GC7-WRB-0.5-2-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	12
		GC7-WRB-0.5-2-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	10
		GC7-WRB-0.5-2-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	11
		GC7-WRB-0.5-2-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	11.96
Granite Creek Aq. St. 3	GC03-WRA	GC03-WRA-0.5-XUCL	Waste Rock/Soil	0.5 - 1	10/3/2024	43.57
	GC03-WRA-1	GC03-WRA-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	36
	GC03-WRA-2	GC03-WRA-0.5-2-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	30
	GC03-WRA-3	GC03-WRA-0.5-3-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	31
	GC03-WRA-4	GC03-WRA-0.5-4-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	45
	GC03-WRB	GC03-WRB-0.5-XUCL	Waste Rock/Soil	0.5 - 1	10/3/2024	<u>303.7</u>
	GC03-WRB-1	GC03-WRB-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	150
	GC03-WRB-2	GC03-WRB-0.5-2-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	142
	GC03-WRB-3	GC03-WRB-0.5-3-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	<u>304</u>
	GC03-WRB-4	GC03-WRB-0.5-4-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	141
	GC03-WRB-5	GC03-WRB-0.5-5-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	75
	GC03-WRB-6	GC03-WRB-0.5-6-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	<u>222</u>
	GC03-WRB-7	GC03-WRB-0.5-7-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	<u>222</u>
	GC03-WRB-8	GC03-WRB-0.5-8-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	<u>485</u>
Lwr Mon'tl	LMM-TLA-1	LMM-TLA-0.5-1-X01	Tailings	0.5 - 1	10/3/2024	<u>3805</u>
		LMM-TLA-0.5-1-X02	Tailings	0.5 - 1	10/3/2024	<u>3054</u>
		LMM-TLA-0.5-1-X03	Tailings	0.5 - 1	10/3/2024	<u>3451</u>
		LMM-TLA-0.5-1-X04	Tailings	0.5 - 1	10/3/2024	<u>3424</u>
		LMM-TLA-0.5-1-X05	Tailings	0.5 - 1	10/3/2024	<u>4114</u>
		LMM-TLA-0.5-1-X06	Tailings	0.5 - 1	10/3/2024	<u>4841</u>
	LMM-TLA-1	LMM-TLA-0.5-1-X07	Tailings	0.5 - 1	10/3/2024	<u>4155</u>
		LMM-TLA-0.5-1-X08	Tailings	0.5 - 1	10/3/2024	<u>4046</u>
		LMM-TLA-0.5-1-X09	Tailings	0.5 - 1	10/3/2024	<u>4066</u>
		LMM-TLA-0.5-1-X10	Tailings	0.5 - 1	10/3/2024	<u>3775</u>
		LMM-TLA-0.5-1-XUCL	Tailings	0.5 - 1	10/3/2024	<u>4160</u>
	LMM-TLA-2	LMM-TLA-0.5-2-X01	Tailings	0.5 - 1	10/3/2024	<u>6591</u>
		LMM-TLA-0.5-2-X02	Tailings	0.5 - 1	10/3/2024	<u>7810</u>
		LMM-TLA-0.5-2-X03	Tailings	0.5 - 1	10/3/2024	<u>4263</u>
		LMM-TLA-0.5-2-X04	Tailings	0.5 - 1	10/3/2024	<u>5524</u>
		LMM-TLA-0.5-2-X05	Tailings	0.5 - 1	10/3/2024	<u>9330</u>
		LMM-TLA-0.5-2-X06	Tailings	0.5 - 1	10/3/2024	<u>8150</u>
		LMM-TLA-0.5-2-X07	Tailings	0.5 - 1	10/3/2024	<u>8540</u>
		LMM-TLA-0.5-2-X08	Tailings	0.5 - 1	10/3/2024	<u>10034</u>
		LMM-TLA-0.5-2-X09	Tailings	0.5 - 1	10/3/2024	<u>10428</u>
		LMM-TLA-0.5-2-X10	Tailings	0.5 - 1	10/3/2024	<u>17380</u>
		LMM-TLA-0.5-2-XUCL	Tailings	0.5 - 1	10/3/2024	<u>10884</u>
	LMM-TLA-3	LMM-TLA-0.5-3-X01	Tailings	0.5 - 1	10/3/2024	10
		LMM-TLA-0.5-3-X02	Tailings	0.5 - 1	10/3/2024	12
		LMM-TLA-0.5-3-X03	Tailings	0.5 - 1	10/3/2024	13
		LMM-TLA-0.5-3-X04	Tailings	0.5 - 1	10/3/2024	11
		LMM-TLA-0.5-3-XUCL	Tailings	0.5 - 1	10/3/2024	13.02

Table 2
Summary of XRF Measurements
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

AOI	Location	Field Sample ID	Material	Collection Depth (ft bgs)	Sample Date	Metals Arsenic
Tailings PRG						110
Waste Rock/Soil PRG						190
Lwr Mon'tl	LMM-TLA-4	LMM-TLA-0.5-4-X01	Tailings	0.5 - 1	10/3/2024	1097
		LMM-TLA-0.5-4-X02	Tailings	0.5 - 1	10/3/2024	1213
		LMM-TLA-0.5-4-X03	Tailings	0.5 - 1	10/3/2024	732
		LMM-TLA-0.5-4-X04	Tailings	0.5 - 1	10/3/2024	493
		LMM-TLA-0.5-4-X05	Tailings	0.5 - 1	10/3/2024	738
		LMM-TLA-0.5-4-X06	Tailings	0.5 - 1	10/3/2024	461
		LMM-TLA-0.5-4-X07	Tailings	0.5 - 1	10/3/2024	555
		LMM-TLA-0.5-4-X08	Tailings	0.5 - 1	10/3/2024	570
		LMM-TLA-0.5-4-X09	Tailings	0.5 - 1	10/3/2024	476
		LMM-TLA-0.5-4-X10	Tailings	0.5 - 1	10/3/2024	496
		LMM-TLA-0.5-4-XUCL	Tailings	0.5 - 1	10/3/2024	838.9
	LMM-WRA-1	LMM-WRA-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	423
		LMM-WRA-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/3/2024	192
		LMM-WRA-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/3/2024	283
		LMM-WRA-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/3/2024	256
		LMM-WRA-0.5-1-X05	Waste Rock/Soil	0.5 - 1	10/3/2024	185
		LMM-WRA-0.5-1-X06	Waste Rock/Soil	0.5 - 1	10/3/2024	232
		LMM-WRA-0.5-1-X07	Waste Rock/Soil	0.5 - 1	10/3/2024	271
		LMM-WRA-0.5-1-X08	Waste Rock/Soil	0.5 - 1	10/3/2024	281
		LMM-WRA-0.5-1-X09	Waste Rock/Soil	0.5 - 1	10/3/2024	95
		LMM-WRA-0.5-1-X10	Waste Rock/Soil	0.5 - 1	10/3/2024	170
		LMM-WRA-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/3/2024	289.8
	LMM-WRA-2	LMM-WRA-0.5-2-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	318
		LMM-WRA-0.5-2-X02	Waste Rock/Soil	0.5 - 1	10/3/2024	299
		LMM-WRA-0.5-2-X03	Waste Rock/Soil	0.5 - 1	10/3/2024	239
		LMM-WRA-0.5-2-X04	Waste Rock/Soil	0.5 - 1	10/3/2024	209
		LMM-WRA-0.5-2-X05	Waste Rock/Soil	0.5 - 1	10/3/2024	280
		LMM-WRA-0.5-2-X06	Waste Rock/Soil	0.5 - 1	10/3/2024	330
		LMM-WRA-0.5-2-X07	Waste Rock/Soil	0.5 - 1	10/3/2024	531
		LMM-WRA-0.5-2-X08	Waste Rock/Soil	0.5 - 1	10/3/2024	457
		LMM-WRA-0.5-2-X09	Waste Rock/Soil	0.5 - 1	10/3/2024	213
		LMM-WRA-0.5-2-X10	Waste Rock/Soil	0.5 - 1	10/3/2024	329
		LMM-WRA-0.5-2-XUCL	Waste Rock/Soil	0.5 - 1	10/3/2024	380.3
	LMM-WRA-3	LMM-WRA-0.5-3-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	49
		LMM-WRA-0.5-3-X02	Waste Rock/Soil	0.5 - 1	10/3/2024	95
		LMM-WRA-0.5-3-X03	Waste Rock/Soil	0.5 - 1	10/3/2024	134
		LMM-WRA-0.5-3-X04	Waste Rock/Soil	0.5 - 1	10/3/2024	63
		LMM-WRA-0.5-3-X05	Waste Rock/Soil	0.5 - 1	10/3/2024	107
		LMM-WRA-0.5-3-X06	Waste Rock/Soil	0.5 - 1	10/3/2024	97
		LMM-WRA-0.5-3-X07	Waste Rock/Soil	0.5 - 1	10/3/2024	38
		LMM-WRA-0.5-3-X08	Waste Rock/Soil	0.5 - 1	10/3/2024	46
		LMM-WRA-0.5-3-X09	Waste Rock/Soil	0.5 - 1	10/3/2024	48
		LMM-WRA-0.5-3-X10	Waste Rock/Soil	0.5 - 1	10/3/2024	69
		LMM-WRA-0.5-3-XUCL	Waste Rock/Soil	0.5 - 1	10/3/2024	93.12
	LMM-WRA-3-DS	LMM-WRA-0.5-3-DS-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	47
		LMM-WRA-0.5-3-DS-X02	Waste Rock/Soil	0.5 - 1	10/3/2024	42
		LMM-WRA-0.5-3-DS-X03	Waste Rock/Soil	0.5 - 1	10/3/2024	50
		LMM-WRA-0.5-3-DS-X04	Waste Rock/Soil	0.5 - 1	10/3/2024	16
		LMM-WRA-0.5-3-DS-XUCL	Waste Rock/Soil	0.5 - 1	10/3/2024	57.01
	LMM-WRA-4	LMM-WRA-0.5-4-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	1750
		LMM-WRA-0.5-4-X02	Waste Rock/Soil	0.5 - 1	10/3/2024	2465
		LMM-WRA-0.5-4-X03	Waste Rock/Soil	0.5 - 1	10/3/2024	1445
		LMM-WRA-0.5-4-X04	Waste Rock/Soil	0.5 - 1	10/3/2024	2149
		LMM-WRA-0.5-4-X05	Waste Rock/Soil	0.5 - 1	10/3/2024	2991
		LMM-WRA-0.5-4-X06	Waste Rock/Soil	0.5 - 1	10/3/2024	1437
		LMM-WRA-0.5-4-X07	Waste Rock/Soil	0.5 - 1	10/3/2024	815
		LMM-WRA-0.5-4-X08	Waste Rock/Soil	0.5 - 1	10/3/2024	1453
		LMM-WRA-0.5-4-X09	Waste Rock/Soil	0.5 - 1	10/3/2024	697
		LMM-WRA-0.5-4-X10	Waste Rock/Soil	0.5 - 1	10/3/2024	735
		LMM-WRA-0.5-4-XUCL	Waste Rock/Soil	0.5 - 1	10/3/2024	2037
	LMM-WRB-1	LMM-WRB-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	735
		LMM-WRB-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/3/2024	869
		LMM-WRB-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/3/2024	864
		LMM-WRB-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/3/2024	738
		LMM-WRB-0.5-1-X05	Waste Rock/Soil	0.5 - 1	10/3/2024	978
	LMM-WRB-1	LMM-WRB-0.5-1-X06	Waste Rock/Soil	0.5 - 1	10/3/2024	645
		LMM-WRB-0.5-1-X07	Waste Rock/Soil	0.5 - 1	10/3/2024	923
		LMM-WRB-0.5-1-X08	Waste Rock/Soil	0.5 - 1	10/3/2024	898
		LMM-WRB-0.5-1-X09	Waste Rock/Soil	0.5 - 1	10/3/2024	964
		LMM-WRB-0.5-1-X10	Waste Rock/Soil	0.5 - 1	10/3/2024	827
		LMM-WRB-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/3/2024	906.9

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Wallowa-Whitman National Forest, Oregon

AOI	Location	Field Sample ID	Material	Collection Depth (ft bgs)	Sample Date	Metals Arsenic
Tailings PRG						110
Waste Rock/Soil PRG						190
Lwr Mon'tl	LMM-WRB-2	LMM-WRB-0.5-2-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	284
		LMM-WRB-0.5-2-X02	Waste Rock/Soil	0.5 - 1	10/3/2024	186
		LMM-WRB-0.5-2-X03	Waste Rock/Soil	0.5 - 1	10/3/2024	174
		LMM-WRB-0.5-2-X04	Waste Rock/Soil	0.5 - 1	10/3/2024	196
		LMM-WRB-0.5-2-X05	Waste Rock/Soil	0.5 - 1	10/3/2024	221
		LMM-WRB-0.5-2-X06	Waste Rock/Soil	0.5 - 1	10/3/2024	236
		LMM-WRB-0.5-2-X07	Waste Rock/Soil	0.5 - 1	10/3/2024	184
		LMM-WRB-0.5-2-X08	Waste Rock/Soil	0.5 - 1	10/3/2024	142
		LMM-WRB-0.5-2-X09	Waste Rock/Soil	0.5 - 1	10/3/2024	148
		LMM-WRB-0.5-2-X10	Waste Rock/Soil	0.5 - 1	10/3/2024	182
		LMM-WRB-0.5-2-XUCL	Waste Rock/Soil	0.5 - 1	10/3/2024	219.8
	LMM-WRB-3	LMM-WRB-0.5-3-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	112
		LMM-WRB-0.5-3-X02	Waste Rock/Soil	0.5 - 1	10/3/2024	97
		LMM-WRB-0.5-3-X03	Waste Rock/Soil	0.5 - 1	10/3/2024	149
		LMM-WRB-0.5-3-X04	Waste Rock/Soil	0.5 - 1	10/3/2024	92
		LMM-WRB-0.5-3-XUCL	Waste Rock/Soil	0.5 - 1	10/3/2024	142.8
	LMM-WRB-3-DS	LMM-WRB-0.5-3-DS-X01	Waste Rock/Soil	0.5 - 1	10/3/2024	18
		LMM-WRB-0.5-3-DS-X02	Waste Rock/Soil	0.5 - 1	10/3/2024	14
		LMM-WRB-0.5-3-DS-X03	Waste Rock/Soil	0.5 - 1	10/3/2024	19
		LMM-WRB-0.5-3-DS-X04	Waste Rock/Soil	0.5 - 1	10/3/2024	19
		LMM-WRB-0.5-3-DS-XUCL	Waste Rock/Soil	0.5 - 1	10/3/2024	20.3
Sheridan	SH-WRA-1	SH-WRA-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	12
		SH-WRA-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	9
		SH-WRA-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	13
		SH-WRA-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	12
		SH-WRA-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	13.54
	SH-WRA-2	SH-WRA-0.5-2-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	12
		SH-WRA-0.5-2-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	21
		SH-WRA-0.5-2-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	15
		SH-WRA-0.5-2-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	13
		SH-WRA-0.5-2-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	19.99
	SH-WRB-1	SH-WRB-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	30
		SH-WRB-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	23
		SH-WRB-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	19
		SH-WRB-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	26
		SH-WRB-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	29.88
	SH-WRB-2	SH-WRB-0.5-2-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	59
		SH-WRB-0.5-2-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	65
		SH-WRB-0.5-2-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	66
		SH-WRB-0.5-2-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	62
		SH-WRB-0.5-2-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	66.72
	SH-WRC-1	SH-WRC-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	14
		SH-WRC-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	12
		SH-WRC-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	21
		SH-WRC-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	21
		SH-WRC-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	22.52
	SH-WRC-2	SH-WRC-0.5-2-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	21
		SH-WRC-0.5-2-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	14
		SH-WRC-0.5-2-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	16
		SH-WRC-0.5-2-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	21
		SH-WRC-0.5-2-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	22.19
Tillicum	TL-WRA-1	TL-WRA-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	131
		TL-WRA-0.5-1-DUP-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	165
		TL-WRA-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	176
		TL-WRA-0.5-1-DUP-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	157
		TL-WRA-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	155
		TL-WRA-0.5-1-DUP-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	181
		TL-WRA-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	152
		TL-WRA-0.5-1-DUP-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	133
		TL-WRA-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	175.2
		TL-WRA-0.5-1-DUP-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	182.5
	TL-WRA-1-DS	TL-WRA-0.5-1-DS-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	185
		TL-WRA-0.5-1-DS-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	175
		TL-WRA-0.5-1-DS-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	156
		TL-WRA-0.5-1-DS-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	150
		TL-WRA-0.5-1-DS-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	185.7
	TL-WRA-1-DS-2	TL-WRA-0.5-1-DS-2-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	185
		TL-WRA-0.5-1-DS-2-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	161
		TL-WRA-0.5-1-DS-2-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	178
		TL-WRA-0.5-1-DS-2-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	177
		TL-WRA-0.5-1-DS-2-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	187.2

Table 2
Summary of XRF Measurements
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

AOI	Location	Field Sample ID	Material	Collection Depth (ft bgs)	Sample Date	Metals
						Arsenic
Tailings PRG						110
Waste Rock/Soil PRG						190
Tillicum	TL-WRA-2	TL-WRA-0.5-2-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	253
		TL-WRA-0.5-2-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	299
		TL-WRA-0.5-2-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	261
		TL-WRA-0.5-2-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	299
		TL-WRA-0.5-2-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	306.8
	TL-WRA-3	TL-WRA-0.5-3-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	367
		TL-WRA-0.5-3-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	335
		TL-WRA-0.5-3-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	394
		TL-WRA-0.5-3-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	438
	TL-WRA-3	TL-WRA-0.5-3-X05	Waste Rock/Soil	0.5 - 1	10/4/2024	408
		TL-WRA-0.5-3-X06	Waste Rock/Soil	0.5 - 1	10/4/2024	347
		TL-WRA-0.5-3-X07	Waste Rock/Soil	0.5 - 1	10/4/2024	371
		TL-WRA-0.5-3-X08	Waste Rock/Soil	0.5 - 1	10/4/2024	376
		TL-WRA-0.5-3-X09	Waste Rock/Soil	0.5 - 1	10/4/2024	321
		TL-WRA-0.5-3-X10	Waste Rock/Soil	0.5 - 1	10/4/2024	353
		TL-WRA-0.5-3-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	391.4
	TL-WRA-4	TL-WRA-0.5-4-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	147
		TL-WRA-0.5-4-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	125
		TL-WRA-0.5-4-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	171
		TL-WRA-0.5-4-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	193
		TL-WRA-0.5-4-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	193.6
	TL-WRB-1	TL-WRB-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	67
		TL-WRB-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	73
		TL-WRB-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	67
		TL-WRB-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	72
		TL-WRB-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	73.52
	TL-WRB-2	TL-WRB-0.5-2-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	129
		TL-WRB-0.5-2-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	126
		TL-WRB-0.5-2-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	157
		TL-WRB-0.5-2-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	106
		TL-WRB-0.5-2-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	154.2
	TL-WRB-3	TL-WRB-0.5-3-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	119
		TL-WRB-0.5-3-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	138
		TL-WRB-0.5-3-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	113
		TL-WRB-0.5-3-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	128
		TL-WRB-0.5-3-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	137.3
	TL-WRB-4	TL-WRB-0.5-4-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	105
		TL-WRB-0.5-4-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	184
		TL-WRB-0.5-4-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	113
		TL-WRB-0.5-4-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	170
		TL-WRB-0.5-4-X05	Waste Rock/Soil	0.5 - 1	10/4/2024	179
		TL-WRB-0.5-4-X06	Waste Rock/Soil	0.5 - 1	10/4/2024	161
		TL-WRB-0.5-4-X07	Waste Rock/Soil	0.5 - 1	10/4/2024	182
		TL-WRB-0.5-4-X08	Waste Rock/Soil	0.5 - 1	10/4/2024	131
		TL-WRB-0.5-4-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	174.6
	TL-WRC-1	TL-WRC-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	145
		TL-WRC-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	145
		TL-WRC-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	142
		TL-WRC-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	99
		TL-WRC-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	159.3
	TL-WRC-2	TL-WRC-0.5-2-X01	Waste Rock/Soil	0.5 - 1	10/4/2024	203
		TL-WRC-0.5-2-X02	Waste Rock/Soil	0.5 - 1	10/4/2024	204
		TL-WRC-0.5-2-X03	Waste Rock/Soil	0.5 - 1	10/4/2024	188
		TL-WRC-0.5-2-X04	Waste Rock/Soil	0.5 - 1	10/4/2024	205
		TL-WRC-0.5-2-XUCL	Waste Rock/Soil	0.5 - 1	10/4/2024	209.5
Upr Mon'tl	UMM-FLT	UMM-FLT-0-1	Tailings	0.5 - 1	10/2/2024	18300
	UMM-TLA-1	UMM-TLA-0.5-1-X01	Tailings	0.5 - 1	10/2/2024	104
		UMM-TLA-0.5-1-X02	Tailings	0.5 - 1	10/2/2024	72
		UMM-TLA-0.5-1-X03	Tailings	0.5 - 1	10/2/2024	53
		UMM-TLA-0.5-1-X04	Tailings	0.5 - 1	10/2/2024	95
		UMM-TLA-0.5-1-X05	Tailings	0.5 - 1	10/2/2024	96
		UMM-TLA-0.5-1-XUCL	Tailings	0.5 - 1	10/2/2024	104.1
	UMM-TLA-2	UMM-TLA-0.5-2-X01	Tailings	0.5 - 1	10/2/2024	322
		UMM-TLA-0.5-2-X02	Tailings	0.5 - 1	10/2/2024	317
		UMM-TLA-0.5-2-X03	Tailings	0.5 - 1	10/2/2024	316
		UMM-TLA-0.5-2-X04	Tailings	0.5 - 1	10/2/2024	388
		UMM-TLA-0.5-2-XUCL	Tailings	0.5 - 1	10/2/2024	376.9
	UMM-TLA-3	UMM-TLA-0.5-3-X01	Tailings	0.5 - 1	10/2/2024	100
		UMM-TLA-0.5-3-X02	Tailings	0.5 - 1	10/2/2024	104
		UMM-TLA-0.5-3-X03	Tailings	0.5 - 1	10/2/2024	147
		UMM-TLA-0.5-3-X04	Tailings	0.5 - 1	10/2/2024	55
		UMM-TLA-0.5-3-X05	Tailings	0.5 - 1	10/2/2024	63
		UMM-TLA-0.5-3-X06	Tailings	0.5 - 1	10/2/2024	144
		UMM-TLA-0.5-3-X07	Tailings	0.5 - 1	10/2/2024	11
		UMM-TLA-0.5-3-X08	Tailings	0.5 - 1	10/2/2024	13
		UMM-TLA-0.5-3-X09	Tailings	0.5 - 1	10/2/2024	13
		UMM-TLA-0.5-3-X10	Tailings	0.5 - 1	10/2/2024	152
		UMM-TLA-0.5-3-XUCL	Tailings	0.5 - 1	10/2/2024	113.3

Table 2
Summary of XRF Measurements
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

AOI	Location	Field Sample ID	Material	Collection Depth (ft bgs)	Sample Date	Metals Arsenic
Tailings PRG						110
Waste Rock/Soil PRG						190
Upr Mon'tl	UMM-TLA-4	UMM-TLA-0.5-4-X01	Tailings	0.5 - 1	10/2/2024	72
		UMM-TLA-0.5-4-DUP-X01	Tailings	0.5 - 1	10/2/2024	81
		UMM-TLA-0.5-4-X02	Tailings	0.5 - 1	10/2/2024	59
		UMM-TLA-0.5-4-DUP-X02	Tailings	0.5 - 1	10/2/2024	72
		UMM-TLA-0.5-4-X03	Tailings	0.5 - 1	10/2/2024	85
		UMM-TLA-0.5-4-DUP-X03	Tailings	0.5 - 1	10/2/2024	64
		UMM-TLA-0.5-4-X04	Tailings	0.5 - 1	10/2/2024	86
		UMM-TLA-0.5-4-DUP-X04	Tailings	0.5 - 1	10/2/2024	73
		UMM-TLA-0.5-4-XUCL	Tailings	0.5 - 1	10/2/2024	90.46
		UMM-TLA-0.5-4-DUP-XUCL	Tailings	0.5 - 1	10/2/2024	80.68
	UMM-TLA-5	UMM-TLA-0.5-5-X01	Tailings	0.5 - 1	10/2/2024	38
		UMM-TLA-0.5-5-DUP-X01	Tailings	0.5 - 1	10/2/2024	33
		UMM-TLA-0.5-5-X02	Tailings	0.5 - 1	10/2/2024	39
		UMM-TLA-0.5-5-DUP-X02	Tailings	0.5 - 1	10/2/2024	47
		UMM-TLA-0.5-5-X03	Tailings	0.5 - 1	10/2/2024	46
		UMM-TLA-0.5-5-DUP-X03	Tailings	0.5 - 1	10/2/2024	44
		UMM-TLA-0.5-5-X04	Tailings	0.5 - 1	10/2/2024	31
	UMM-TLA-5	UMM-TLA-0.5-5-DUP-X04	Tailings	0.5 - 1	10/2/2024	35
		UMM-TLA-0.5-5-XUCL	Tailings	0.5 - 1	10/2/2024	45.72
		UMM-TLA-0.5-5-DUP-XUCL	Tailings	0.5 - 1	10/2/2024	47.75
	UMM-TLA-6	UMM-TLA-0.5-6-X01	Tailings	0.5 - 1	10/2/2024	2576
		UMM-TLA-0.5-6-X02	Tailings	0.5 - 1	10/2/2024	3177
		UMM-TLA-0.5-6-X03	Tailings	0.5 - 1	10/2/2024	3357
		UMM-TLA-0.5-6-X04	Tailings	0.5 - 1	10/2/2024	3096
		UMM-TLA-0.5-6-X05	Tailings	0.5 - 1	10/2/2024	3018
		UMM-TLA-0.5-6-X06	Tailings	0.5 - 1	10/2/2024	2930
		UMM-TLA-0.5-6-X07	Tailings	0.5 - 1	10/2/2024	3402
		UMM-TLA-0.5-6-X08	Tailings	0.5 - 1	10/2/2024	2821
		UMM-TLA-0.5-6-X09	Tailings	0.5 - 1	10/2/2024	3293
		UMM-TLA-0.5-6-X10	Tailings	0.5 - 1	10/2/2024	3070
		UMM-TLA-0.5-6-XUCL	Tailings	0.5 - 1	10/2/2024	3221
	UMM-TLB-1	UMM-TLB-0.5-1-X01	Tailings	0.5 - 1	10/2/2024	2731
		UMM-TLB-0.5-1-X02	Tailings	0.5 - 1	10/2/2024	2881
		UMM-TLB-0.5-1-X03	Tailings	0.5 - 1	10/2/2024	3414
		UMM-TLB-0.5-1-X04	Tailings	0.5 - 1	10/2/2024	3611
		UMM-TLB-0.5-1-X05	Tailings	0.5 - 1	10/2/2024	3164
		UMM-TLB-0.5-1-X06	Tailings	0.5 - 1	10/2/2024	3822
		UMM-TLB-0.5-1-X07	Tailings	0.5 - 1	10/2/2024	2765
		UMM-TLB-0.5-1-X08	Tailings	0.5 - 1	10/2/2024	2889
		UMM-TLB-0.5-1-X09	Tailings	0.5 - 1	10/2/2024	2806
		UMM-TLB-0.5-1-X10	Tailings	0.5 - 1	10/2/2024	3115
		UMM-TLB-0.5-1-XUCL	Tailings	0.5 - 1	10/2/2024	3341
	UMM-TLB-2	UMM-TLB-0.5-2-X01	Tailings	0.5 - 1	10/2/2024	519
		UMM-TLB-0.5-2-X02	Tailings	0.5 - 1	10/2/2024	510
		UMM-TLB-0.5-2-X03	Tailings	0.5 - 1	10/2/2024	2130
		UMM-TLB-0.5-2-X04	Tailings	0.5 - 1	10/2/2024	2073
		UMM-TLB-0.5-2-X05	Tailings	0.5 - 1	10/2/2024	2865
		UMM-TLB-0.5-2-X06	Tailings	0.5 - 1	10/2/2024	606
		UMM-TLB-0.5-2-X07	Tailings	0.5 - 1	10/2/2024	676
		UMM-TLB-0.5-2-X08	Tailings	0.5 - 1	10/2/2024	271
		UMM-TLB-0.5-2-X09	Tailings	0.5 - 1	10/2/2024	221
		UMM-TLB-0.5-2-X10	Tailings	0.5 - 1	10/2/2024	467
		UMM-TLB-0.5-2-XUCL	Tailings	0.5 - 1	10/2/2024	2473
	UMM-TLB-3	UMM-TLB-0.5-3-X01	Tailings	0.5 - 1	10/2/2024	471
		UMM-TLB-0.5-3-X02	Tailings	0.5 - 1	10/2/2024	674
		UMM-TLB-0.5-3-X03	Tailings	0.5 - 1	10/2/2024	526
		UMM-TLB-0.5-3-X04	Tailings	0.5 - 1	10/2/2024	504
		UMM-TLB-0.5-3-X05	Tailings	0.5 - 1	10/2/2024	730
		UMM-TLB-0.5-3-X06	Tailings	0.5 - 1	10/2/2024	377
		UMM-TLB-0.5-3-X07	Tailings	0.5 - 1	10/2/2024	1143
		UMM-TLB-0.5-3-X08	Tailings	0.5 - 1	10/2/2024	1098
		UMM-TLB-0.5-3-X09	Tailings	0.5 - 1	10/2/2024	401
		UMM-TLB-0.5-3-X10	Tailings	0.5 - 1	10/2/2024	367
		UMM-TLB-0.5-3-XUCL	Tailings	0.5 - 1	10/2/2024	794.4
	UMM-TLB-4	UMM-TLB-0.5-4-X01	Tailings	0.5 - 1	10/2/2024	2033
		UMM-TLB-0.5-4-X02	Tailings	0.5 - 1	10/2/2024	1571
		UMM-TLB-0.5-4-X03	Tailings	0.5 - 1	10/2/2024	1251
		UMM-TLB-0.5-4-X04	Tailings	0.5 - 1	10/2/2024	1374
		UMM-TLB-0.5-4-X05	Tailings	0.5 - 1	10/2/2024	1777
		UMM-TLB-0.5-4-X06	Tailings	0.5 - 1	10/2/2024	1354
		UMM-TLB-0.5-4-X07	Tailings	0.5 - 1	10/2/2024	1334
		UMM-TLB-0.5-4-X08	Tailings	0.5 - 1	10/2/2024	1127
		UMM-TLB-0.5-4-X09	Tailings	0.5 - 1	10/2/2024	1211
		UMM-TLB-0.5-4-X10	Tailings	0.5 - 1	10/2/2024	1713
		UMM-TLB-0.5-4-XUCL	Tailings	0.5 - 1	10/2/2024	1642

Table 2
Summary of XRF Measurements
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

AOI	Location	Field Sample ID	Material	Collection Depth (ft bgs)	Sample Date	Metals Arsenic
Tailings PRG						110
Waste Rock/Soil PRG						190
Upr Mon'tl	UMM-TLC-1	UMM-TLC-0.5-1-X01	Tailings	0.5 - 1	10/2/2024	987
		UMM-TLC-0.5-1-X02	Tailings	0.5 - 1	10/2/2024	746
		UMM-TLC-0.5-1-X03	Tailings	0.5 - 1	10/2/2024	897
		UMM-TLC-0.5-1-X04	Tailings	0.5 - 1	10/2/2024	410
		UMM-TLC-0.5-1-X05	Tailings	0.5 - 1	10/2/2024	1366
		UMM-TLC-0.5-1-X06	Tailings	0.5 - 1	10/2/2024	1347
		UMM-TLC-0.5-1-X07	Tailings	0.5 - 1	10/2/2024	1403
		UMM-TLC-0.5-1-X08	Tailings	0.5 - 1	10/2/2024	1969
		UMM-TLC-0.5-1-X09	Tailings	0.5 - 1	10/2/2024	960
		UMM-TLC-0.5-1-X10	Tailings	0.5 - 1	10/2/2024	643
		UMM-TLC-0.5-1-XUCL	Tailings	0.5 - 1	10/2/2024	1336
	UMM-TLC-2	UMM-TLC-0.5-2-X01	Tailings	0.5 - 1	10/2/2024	2564
		UMM-TLC-0.5-2-X02	Tailings	0.5 - 1	10/2/2024	2682
		UMM-TLC-0.5-2-X03	Tailings	0.5 - 1	10/2/2024	2880
		UMM-TLC-0.5-2-X04	Tailings	0.5 - 1	10/2/2024	3389
		UMM-TLC-0.5-2-X05	Tailings	0.5 - 1	10/2/2024	2771
		UMM-TLC-0.5-2-X06	Tailings	0.5 - 1	10/2/2024	2930
		UMM-TLC-0.5-2-X07	Tailings	0.5 - 1	10/2/2024	2642
		UMM-TLC-0.5-2-X08	Tailings	0.5 - 1	10/2/2024	2125
		UMM-TLC-0.5-2-X09	Tailings	0.5 - 1	10/2/2024	1794
		UMM-TLC-0.5-2-X10	Tailings	0.5 - 1	10/2/2024	2435
		UMM-TLC-0.5-2-XUCL	Tailings	0.5 - 1	10/2/2024	2877
	UMM-WRA-1	UMM-WRA-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/2/2024	1127
		UMM-WRA-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/2/2024	654
		UMM-WRA-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/2/2024	661
		UMM-WRA-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/2/2024	597
		UMM-WRA-0.5-1-X05	Waste Rock/Soil	0.5 - 1	10/2/2024	1876
		UMM-WRA-0.5-1-X06	Waste Rock/Soil	0.5 - 1	10/2/2024	712
	UMM-WRA-1	UMM-WRA-0.5-1-X07	Waste Rock/Soil	0.5 - 1	10/2/2024	672
		UMM-WRA-0.5-1-X08	Waste Rock/Soil	0.5 - 1	10/2/2024	604
		UMM-WRA-0.5-1-X09	Waste Rock/Soil	0.5 - 1	10/2/2024	1234
		UMM-WRA-0.5-1-X10	Waste Rock/Soil	0.5 - 1	10/2/2024	922
		UMM-WRA-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/2/2024	1143
	UMM-WRA-1-DS	UMM-WRA-0.5-1-DS-X01	Waste Rock/Soil	0.5 - 1	10/2/2024	44
		UMM-WRA-0.5-1-DS-X02	Waste Rock/Soil	0.5 - 1	10/2/2024	30
		UMM-WRA-0.5-1-DS-X03	Waste Rock/Soil	0.5 - 1	10/2/2024	65
		UMM-WRA-0.5-1-DS-X04	Waste Rock/Soil	0.5 - 1	10/2/2024	45
		UMM-WRA-0.5-1-DS-X05	Waste Rock/Soil	0.5 - 1	10/2/2024	75
		UMM-WRA-0.5-1-DS-X06	Waste Rock/Soil	0.5 - 1	10/2/2024	61
		UMM-WRA-0.5-1-DS-X07	Waste Rock/Soil	0.5 - 1	10/2/2024	44
		UMM-WRA-0.5-1-DS-XUCL	Waste Rock/Soil	0.5 - 1	10/2/2024	63.38
	UMM-WRA-2	UMM-WRA-0.5-2-X01	Waste Rock/Soil	0.5 - 1	10/2/2024	768
		UMM-WRA-0.5-2-X02	Waste Rock/Soil	0.5 - 1	10/2/2024	306
		UMM-WRA-0.5-2-X03	Waste Rock/Soil	0.5 - 1	10/2/2024	357
		UMM-WRA-0.5-2-X04	Waste Rock/Soil	0.5 - 1	10/2/2024	310
		UMM-WRA-0.5-2-X05	Waste Rock/Soil	0.5 - 1	10/2/2024	409
		UMM-WRA-0.5-2-X06	Waste Rock/Soil	0.5 - 1	10/2/2024	352
		UMM-WRA-0.5-2-X07	Waste Rock/Soil	0.5 - 1	10/2/2024	252
		UMM-WRA-0.5-2-X08	Waste Rock/Soil	0.5 - 1	10/2/2024	279
		UMM-WRA-0.5-2-X09	Waste Rock/Soil	0.5 - 1	10/2/2024	409
		UMM-WRA-0.5-2-X10	Waste Rock/Soil	0.5 - 1	10/2/2024	509
		UMM-WRA-0.5-2-XUCL	Waste Rock/Soil	0.5 - 1	10/2/2024	482.6
	UMM-WRA-2-DS	UMM-WRA-0.5-2-DS-X01	Waste Rock/Soil	0.5 - 1	10/2/2024	58
		UMM-WRA-0.5-2-DS-X02	Waste Rock/Soil	0.5 - 1	10/2/2024	51
		UMM-WRA-0.5-2-DS-X03	Waste Rock/Soil	0.5 - 1	10/2/2024	68
		UMM-WRA-0.5-2-DS-X04	Waste Rock/Soil	0.5 - 1	10/2/2024	52
		UMM-WRA-0.5-2-DS-XUCL	Waste Rock/Soil	0.5 - 1	10/2/2024	66.43
	UMM-WRA-3	UMM-WRA-0.5-3-X01	Waste Rock/Soil	0.5 - 1	10/2/2024	1142
		UMM-WRA-0.5-3-X02	Waste Rock/Soil	0.5 - 1	10/2/2024	735
		UMM-WRA-0.5-3-X03	Waste Rock/Soil	0.5 - 1	10/2/2024	978
		UMM-WRA-0.5-3-X04	Waste Rock/Soil	0.5 - 1	10/2/2024	1093
		UMM-WRA-0.5-3-X05	Waste Rock/Soil	0.5 - 1	10/2/2024	1287
		UMM-WRA-0.5-3-X06	Waste Rock/Soil	0.5 - 1	10/2/2024	1376
		UMM-WRA-0.5-3-X07	Waste Rock/Soil	0.5 - 1	10/2/2024	894
		UMM-WRA-0.5-3-X08	Waste Rock/Soil	0.5 - 1	10/2/2024	128
		UMM-WRA-0.5-3-X09	Waste Rock/Soil	0.5 - 1	10/2/2024	716
		UMM-WRA-0.5-3-X10	Waste Rock/Soil	0.5 - 1	10/2/2024	1282
		UMM-WRA-0.5-3-XUCL	Waste Rock/Soil	0.5 - 1	10/2/2024	1178

Table 2
Summary of XRF Measurements
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

AOI	Location	Field Sample ID	Material	Collection Depth (ft bgs)	Sample Date	Metals Arsenic
Tailings PRG						110
Waste Rock/Soil PRG						190
Upr Mon'tl	UMM-WRA-4	UMM-WRA-0.5-4-X01	Waste Rock/Soil	0.5 - 1	10/2/2024	320
		UMM-WRA-0.5-4-X02	Waste Rock/Soil	0.5 - 1	10/2/2024	256
		UMM-WRA-0.5-4-X03	Waste Rock/Soil	0.5 - 1	10/2/2024	310
		UMM-WRA-0.5-4-X04	Waste Rock/Soil	0.5 - 1	10/2/2024	246
		UMM-WRA-0.5-4-X05	Waste Rock/Soil	0.5 - 1	10/2/2024	278
		UMM-WRA-0.5-4-XUCL	Waste Rock/Soil	0.5 - 1	10/2/2024	313
	UMM-WRA-4-DS	UMM-WRA-0.5-4-DS-X01	Waste Rock/Soil	0.5 - 1	10/2/2024	53
		UMM-WRA-0.5-4-DS-X02	Waste Rock/Soil	0.5 - 1	10/2/2024	58
		UMM-WRA-0.5-4-DS-X03	Waste Rock/Soil	0.5 - 1	10/2/2024	60
		UMM-WRA-0.5-4-DS-X04	Waste Rock/Soil	0.5 - 1	10/2/2024	57
		UMM-WRA-0.5-4-DS-XUCL	Waste Rock/Soil	0.5 - 1	10/2/2024	60.46
	UMM-WRA-5	UMM-WRA-0.5-5-X01	Waste Rock/Soil	0.5 - 1	10/2/2024	76
		UMM-WRA-0.5-5-X02	Waste Rock/Soil	0.5 - 1	10/2/2024	53
		UMM-WRA-0.5-5-X03	Waste Rock/Soil	0.5 - 1	10/2/2024	67
		UMM-WRA-0.5-5-X04	Waste Rock/Soil	0.5 - 1	10/2/2024	58
		UMM-WRA-0.5-5-XUCL	Waste Rock/Soil	0.5 - 1	10/2/2024	75.44
	UMM-WRA-6	UMM-WRA-0.5-6-X01	Waste Rock/Soil	0.5 - 1	10/2/2024	1119
		UMM-WRA-0.5-6-X02	Waste Rock/Soil	0.5 - 1	10/2/2024	679
		UMM-WRA-0.5-6-X03	Waste Rock/Soil	0.5 - 1	10/2/2024	572
		UMM-WRA-0.5-6-X04	Waste Rock/Soil	0.5 - 1	10/2/2024	669
		UMM-WRA-0.5-6-X05	Waste Rock/Soil	0.5 - 1	10/2/2024	905
		UMM-WRA-0.5-6-X06	Waste Rock/Soil	0.5 - 1	10/2/2024	304
		UMM-WRA-0.5-6-X07	Waste Rock/Soil	0.5 - 1	10/2/2024	419
		UMM-WRA-0.5-6-X08	Waste Rock/Soil	0.5 - 1	10/2/2024	657
		UMM-WRA-0.5-6-X09	Waste Rock/Soil	0.5 - 1	10/2/2024	483
		UMM-WRA-0.5-6-X10	Waste Rock/Soil	0.5 - 1	10/2/2024	905
		UMM-WRA-0.5-6-XUCL	Waste Rock/Soil	0.5 - 1	10/2/2024	815
	UMM-WRA-7	UMM-WRA-0.5-7-X01	Waste Rock/Soil	0.5 - 1	10/2/2024	975
		UMM-WRA-0.5-7-X02	Waste Rock/Soil	0.5 - 1	10/2/2024	447
		UMM-WRA-0.5-7-X03	Waste Rock/Soil	0.5 - 1	10/2/2024	566
		UMM-WRA-0.5-7-X04	Waste Rock/Soil	0.5 - 1	10/2/2024	490
		UMM-WRA-0.5-7-X05	Waste Rock/Soil	0.5 - 1	10/2/2024	326
		UMM-WRA-0.5-7-X06	Waste Rock/Soil	0.5 - 1	10/2/2024	506
		UMM-WRA-0.5-7-X07	Waste Rock/Soil	0.5 - 1	10/2/2024	506
		UMM-WRA-0.5-7-X08	Waste Rock/Soil	0.5 - 1	10/2/2024	422
		UMM-WRA-0.5-7-X09	Waste Rock/Soil	0.5 - 1	10/2/2024	608
		UMM-WRA-0.5-7-X10	Waste Rock/Soil	0.5 - 1	10/2/2024	434
		UMM-WRA-0.5-7-XUCL	Waste Rock/Soil	0.5 - 1	10/2/2024	629.8
	UMM-WRA-8	UMM-WRA-0.5-8-X01	Waste Rock/Soil	0.5 - 1	10/2/2024	601
		UMM-WRA-0.5-8-X02	Waste Rock/Soil	0.5 - 1	10/2/2024	873
		UMM-WRA-0.5-8-X03	Waste Rock/Soil	0.5 - 1	10/2/2024	549
		UMM-WRA-0.5-8-X04	Waste Rock/Soil	0.5 - 1	10/2/2024	532
		UMM-WRA-0.5-8-X05	Waste Rock/Soil	0.5 - 1	10/2/2024	634
		UMM-WRA-0.5-8-X06	Waste Rock/Soil	0.5 - 1	10/2/2024	807
		UMM-WRA-0.5-8-X07	Waste Rock/Soil	0.5 - 1	10/2/2024	593
		UMM-WRA-0.5-8-X08	Waste Rock/Soil	0.5 - 1	10/2/2024	672
	UMM-WRA-8	UMM-WRA-0.5-8-X09	Waste Rock/Soil	0.5 - 1	10/2/2024	593
		UMM-WRA-0.5-8-X10	Waste Rock/Soil	0.5 - 1	10/2/2024	602
		UMM-WRA-0.5-8-XUCL	Waste Rock/Soil	0.5 - 1	10/2/2024	709.8
	UMM-WRB-1	UMM-WRB-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/2/2024	12620
		UMM-WRB-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/2/2024	9000
		UMM-WRB-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/2/2024	16800
		UMM-WRB-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/2/2024	11060
		UMM-WRB-0.5-1-X05	Waste Rock/Soil	0.5 - 1	10/2/2024	13550
		UMM-WRB-0.5-1-X06	Waste Rock/Soil	0.5 - 1	10/2/2024	13770
		UMM-WRB-0.5-1-X07	Waste Rock/Soil	0.5 - 1	10/2/2024	8550
		UMM-WRB-0.5-1-X08	Waste Rock/Soil	0.5 - 1	10/2/2024	16020
		UMM-WRB-0.5-1-X09	Waste Rock/Soil	0.5 - 1	10/2/2024	13720
		UMM-WRB-0.5-1-X10	Waste Rock/Soil	0.5 - 1	10/2/2024	10030
		UMM-WRB-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/2/2024	14142
	UMM-WRB-2	UMM-WRB-0.5-2-X01	Waste Rock/Soil	0.5 - 1	10/2/2024	2151
		UMM-WRB-0.5-2-X02	Waste Rock/Soil	0.5 - 1	10/2/2024	1862
		UMM-WRB-0.5-2-X03	Waste Rock/Soil	0.5 - 1	10/2/2024	1412
		UMM-WRB-0.5-2-X04	Waste Rock/Soil	0.5 - 1	10/2/2024	2565
		UMM-WRB-0.5-2-X05	Waste Rock/Soil	0.5 - 1	10/2/2024	1692
		UMM-WRB-0.5-2-X06	Waste Rock/Soil	0.5 - 1	10/2/2024	1422
		UMM-WRB-0.5-2-X07	Waste Rock/Soil	0.5 - 1	10/2/2024	1474
		UMM-WRB-0.5-2-X08	Waste Rock/Soil	0.5 - 1	10/2/2024	1744
		UMM-WRB-0.5-2-X09	Waste Rock/Soil	0.5 - 1	10/2/2024	1326
		UMM-WRB-0.5-2-X10	Waste Rock/Soil	0.5 - 1	10/2/2024	1911
		UMM-WRB-0.5-2-XUCL	Waste Rock/Soil	0.5 - 1	10/2/2024	1980
	UMM-WRB-2-DS	UMM-WRB-0.5-2-DS-X01	Waste Rock/Soil	0.5 - 1	10/2/2024	67
		UMM-WRB-0.5-2-DS-X02	Waste Rock/Soil	0.5 - 1	10/2/2024	66
		UMM-WRB-0.5-2-DS-X03	Waste Rock/Soil	0.5 - 1	10/2/2024	78
		UMM-WRB-0.5-2-DS-X04	Waste Rock/Soil	0.5 - 1	10/2/2024	65
		UMM-WRB-0.5-2-DS-XUCL	Waste Rock/Soil	0.5 - 1	10/2/2024	76.13

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Summary of XRF Measurements
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Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

AOI	Location	Field Sample ID	Material	Collection Depth (ft bgs)	Sample Date	Metals Arsenic
Tailings PRG						110
Waste Rock/Soil PRG						190
Upr Mon'tl	UMM-WRB-3	UMM-WRB-0.5-3-X01	Waste Rock/Soil	0.5 - 1	10/2/2024	711
		UMM-WRB-0.5-3-X02	Waste Rock/Soil	0.5 - 1	10/2/2024	862
		UMM-WRB-0.5-3-X03	Waste Rock/Soil	0.5 - 1	10/2/2024	1206
		UMM-WRB-0.5-3-X04	Waste Rock/Soil	0.5 - 1	10/2/2024	765
		UMM-WRB-0.5-3-X05	Waste Rock/Soil	0.5 - 1	10/2/2024	943
		UMM-WRB-0.5-3-X06	Waste Rock/Soil	0.5 - 1	10/2/2024	683
		UMM-WRB-0.5-3-X07	Waste Rock/Soil	0.5 - 1	10/2/2024	859
		UMM-WRB-0.5-3-X08	Waste Rock/Soil	0.5 - 1	10/2/2024	992
		UMM-WRB-0.5-3-X09	Waste Rock/Soil	0.5 - 1	10/2/2024	1011
		UMM-WRB-0.5-3-X10	Waste Rock/Soil	0.5 - 1	10/2/2024	753
		UMM-WRB-0.5-3-XUCL	Waste Rock/Soil	0.5 - 1	10/2/2024	972.7
Upr Upr Mon'tl	UMM-WRB-4	UMM-WRB-0.5-4-X01	Waste Rock/Soil	0.5 - 1	10/2/2024	586
		UMM-WRB-0.5-4-X02	Waste Rock/Soil	0.5 - 1	10/2/2024	453
		UMM-WRB-0.5-4-X03	Waste Rock/Soil	0.5 - 1	10/2/2024	523
		UMM-WRB-0.5-4-X04	Waste Rock/Soil	0.5 - 1	10/2/2024	743
		UMM-WRB-0.5-4-X05	Waste Rock/Soil	0.5 - 1	10/2/2024	686
		UMM-WRB-0.5-4-X06	Waste Rock/Soil	0.5 - 1	10/2/2024	891
		UMM-WRB-0.5-4-X07	Waste Rock/Soil	0.5 - 1	10/2/2024	729
		UMM-WRB-0.5-4-X08	Waste Rock/Soil	0.5 - 1	10/2/2024	531
		UMM-WRB-0.5-4-X09	Waste Rock/Soil	0.5 - 1	10/2/2024	818
		UMM-WRB-0.5-4-X10	Waste Rock/Soil	0.5 - 1	10/2/2024	643
		UMM-WRB-0.5-4-XUCL	Waste Rock/Soil	0.5 - 1	10/2/2024	741.1
	UUMM-WRA-1	UUMM-WRA-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/2/2024	911
		UUMM-WRA-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/2/2024	975
		UUMM-WRA-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/2/2024	1067
		UUMM-WRA-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/2/2024	1270
		UUMM-WRA-0.5-1-X05	Waste Rock/Soil	0.5 - 1	10/2/2024	1230
		UUMM-WRA-0.5-1-X06	Waste Rock/Soil	0.5 - 1	10/2/2024	1190
		UUMM-WRA-0.5-1-X07	Waste Rock/Soil	0.5 - 1	10/2/2024	1114
		UUMM-WRA-0.5-1-X08	Waste Rock/Soil	0.5 - 1	10/2/2024	981
		UUMM-WRA-0.5-1-X09	Waste Rock/Soil	0.5 - 1	10/2/2024	1160
		UUMM-WRA-0.5-1-X10	Waste Rock/Soil	0.5 - 1	10/2/2024	1124
		UUMM-WRA-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/2/2024	1170
	UUMM-WRA-2	UUMM-WRA-0.5-2-X01	Waste Rock/Soil	0.5 - 1	10/2/2024	2693
		UUMM-WRA-0.5-2-X02	Waste Rock/Soil	0.5 - 1	10/2/2024	1872
		UUMM-WRA-0.5-2-X03	Waste Rock/Soil	0.5 - 1	10/2/2024	3092
		UUMM-WRA-0.5-2-X04	Waste Rock/Soil	0.5 - 1	10/2/2024	2717
		UUMM-WRA-0.5-2-X05	Waste Rock/Soil	0.5 - 1	10/2/2024	2058
		UUMM-WRA-0.5-2-X06	Waste Rock/Soil	0.5 - 1	10/2/2024	2077
		UUMM-WRA-0.5-2-X07	Waste Rock/Soil	0.5 - 1	10/2/2024	1447
		UUMM-WRA-0.5-2-X08	Waste Rock/Soil	0.5 - 1	10/2/2024	1538
		UUMM-WRA-0.5-2-X09	Waste Rock/Soil	0.5 - 1	10/2/2024	2066
		UUMM-WRA-0.5-2-X10	Waste Rock/Soil	0.5 - 1	10/2/2024	1549
		UUMM-WRA-0.5-2-XUCL	Waste Rock/Soil	0.5 - 1	10/2/2024	2435
	UUMM-WRA-3	UUMM-WRA-0.5-3-X01	Waste Rock/Soil	0.5 - 1	10/2/2024	1490
		UUMM-WRA-0.5-3-X02	Waste Rock/Soil	0.5 - 1	10/2/2024	1442
		UUMM-WRA-0.5-3-X03	Waste Rock/Soil	0.5 - 1	10/2/2024	1557
		UUMM-WRA-0.5-3-X04	Waste Rock/Soil	0.5 - 1	10/2/2024	1816
		UUMM-WRA-0.5-3-X05	Waste Rock/Soil	0.5 - 1	10/2/2024	1409
		UUMM-WRA-0.5-3-X06	Waste Rock/Soil	0.5 - 1	10/2/2024	1673
		UUMM-WRA-0.5-3-X07	Waste Rock/Soil	0.5 - 1	10/2/2024	1402
		UUMM-WRA-0.5-3-X08	Waste Rock/Soil	0.5 - 1	10/2/2024	1730
		UUMM-WRA-0.5-3-X09	Waste Rock/Soil	0.5 - 1	10/2/2024	1937
		UUMM-WRA-0.5-3-X10	Waste Rock/Soil	0.5 - 1	10/2/2024	1382
		UUMM-WRA-0.5-3-XUCL	Waste Rock/Soil	0.5 - 1	10/2/2024	1697
	UUMM-WRA-3-DS	UUMM-WRA-0.5-3-DS-X01	Waste Rock/Soil	0.5 - 1	10/2/2024	21
	UUMM-WRA-3-DS	UUMM-WRA-0.5-3-DS-X02	Waste Rock/Soil	0.5 - 1	10/2/2024	35
		UUMM-WRA-0.5-3-DS-X03	Waste Rock/Soil	0.5 - 1	10/2/2024	22
		UUMM-WRA-0.5-3-DS-X04	Waste Rock/Soil	0.5 - 1	10/2/2024	19
		UUMM-WRA-0.5-3-DS-XUCL	Waste Rock/Soil	0.5 - 1	10/2/2024	32.81
	UUMM-WRB-1	UUMM-WRB-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/2/2024	103
		UUMM-WRB-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/2/2024	135
		UUMM-WRB-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/2/2024	96
		UUMM-WRB-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/2/2024	202
		UUMM-WRB-0.5-1-X05	Waste Rock/Soil	0.5 - 1	10/2/2024	147
		UUMM-WRB-0.5-1-X06	Waste Rock/Soil	0.5 - 1	10/2/2024	109
		UUMM-WRB-0.5-1-X07	Waste Rock/Soil	0.5 - 1	10/2/2024	173
		UUMM-WRB-0.5-1-X08	Waste Rock/Soil	0.5 - 1	10/2/2024	184
		UUMM-WRB-0.5-1-X09	Waste Rock/Soil	0.5 - 1	10/2/2024	123
		UUMM-WRB-0.5-1-X10	Waste Rock/Soil	0.5 - 1	10/2/2024	106
		UUMM-WRB-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/2/2024	159.5

Table 2
Summary of XRF Measurements
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

AOI	Location	Field Sample ID	Material	Collection Depth (ft bgs)	Sample Date	Metals Arsenic
Tailings PRG						110
Waste Rock/Soil PRG						190
Upr Upr Mon'tl	UUMM-WRC-1	UUMM-WRC-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/2/2024	20
		UUMM-WRC-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/2/2024	18
		UUMM-WRC-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/2/2024	16
		UUMM-WRC-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/2/2024	17
		UUMM-WRC-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/2/2024	19.76
	UUMM-WRD-1	UUMM-WRD-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/2/2024	269
		UUMM-WRD-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/2/2024	282
		UUMM-WRD-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/2/2024	279
		UUMM-WRD-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/2/2024	334
		UUMM-WRD-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/2/2024	325.4
	UUMM-WRE-1	UUMM-WRE-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/2/2024	24
		UUMM-WRE-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/2/2024	25
		UUMM-WRE-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/2/2024	24
		UUMM-WRE-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/2/2024	26
		UUMM-WRE-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/2/2024	25.88
	UUMM-WRF-1	UUMM-WRF-0.5-1-X01	Waste Rock/Soil	0.5 - 1	10/2/2024	786
		UUMM-WRF-0.5-1-X02	Waste Rock/Soil	0.5 - 1	10/2/2024	430
		UUMM-WRF-0.5-1-X03	Waste Rock/Soil	0.5 - 1	10/2/2024	372
		UUMM-WRF-0.5-1-X04	Waste Rock/Soil	0.5 - 1	10/2/2024	551
		UUMM-WRF-0.5-1-X05	Waste Rock/Soil	0.5 - 1	10/2/2024	640
		UUMM-WRF-0.5-1-X06	Waste Rock/Soil	0.5 - 1	10/2/2024	454
		UUMM-WRF-0.5-1-X07	Waste Rock/Soil	0.5 - 1	10/2/2024	290
		UUMM-WRF-0.5-1-X08	Waste Rock/Soil	0.5 - 1	10/2/2024	468
		UUMM-WRF-0.5-1-X09	Waste Rock/Soil	0.5 - 1	10/2/2024	569
		UUMM-WRF-0.5-1-X10	Waste Rock/Soil	0.5 - 1	10/2/2024	534
		UUMM-WRF-0.5-1-XUCL	Waste Rock/Soil	0.5 - 1	10/2/2024	590.8

Note:
1. All concentrations reported in mg/kg (ppm); detection limits in parentheses.
2. Underlined concentrations for results from Tailings exceed the Tailings PRG.
3. Underlined concentrations for results from Waste Rock/Soil exceed the Waste Rock/Soil PRG.
Aq = Aquatic
Mon’tl = Monumental
PRG = Preliminary Remediation Goal
St = Station

Table 3
Summary of Soil Analytical Results
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

AOI	Company	Location	Collection Depth (ft bgs)	Sample Date	Metals													
					Aluminum	Antimony	Arsenic	Arsenic, IVBA	Arsenic, Total IVBA	Barium	Beryllium	Cadmium	Calcium	Chromium (total)	Cobalt	Copper	Iron	Lead
PRG for SAP					--	4895	82	--	--	--	24468	9113	--	--	3681	489424	--	--
Tailings PRG					--	--	110	--	--	--	--	--	--	--	--	--	--	--
Waste Rock/Soil PRG					--	--	190	--	--	--	--	--	--	--	--	--	--	--
ODEQ Blue Mountain Region Clean Fill					--	1.3	14	--	--	950	2.6	0.69	--	190	--	120	--	21
ODEQ Eco RBC Plant Direct Toxicity					--	11	18	--	--	110	2.5	32	--	--	13	70	--	120
ODEQ Eco RBC Inverts Direct Toxicity					--	78	6.8	--	--	330	40	140	--	--	--	80	--	1700
ODEQ Eco RBC Bird					--	--	15	--	--	630	--	0.29	--	23	76	14	--	11
ODEQ Eco RBC Mammal					--	0.27	19	--	--	1800	21	0.27	--	34	230	42	--	56
ODEQ Excavation Worker RCB					--	--	420	--	--	--	19000	9700	--	--	--	390000	--	800
Background	EA	BG-SSS-19	0.5	7/19/2003	24400	0.84 J	4.5	NA	NA	288	1.2	0.43 J	1830	31.3	11.3	30.7	24600	8.4
		BG-SSS-34	0.5	7/15/2003	26400	ND (0.38)	3.4	NA	NA	187	0.72	0.35 J	1130	5.7	5.5	8.9	10800	3.8
		BG-SSS-35	0.5	7/15/2003	31200	ND (0.4)	5.5	NA	NA	268	1	0.54	2110	6.2	6.7	15.4	12400	5.9
		BG-SSS-36	0.5	7/15/2003	19400	ND (0.33)	11.4	NA	NA	319	0.55	ND (0.026)	2080	27.4	10.2	11	17700	6.3
	CES	BGS-01	0.5 - 1	6/26/2007	NA	ND (0.2)	6.2	NA	NA	NA	0.6 J	*1.1*	NA	12	NA	8	22900	8.04
		BGS-02	0.5 - 1	6/26/2007	NA	ND (0.2)	7.8	NA	NA	NA	0.6 J	*1.45*	NA	7	NA	10	13600	5.98
		BGS-03	0.5 - 1	6/26/2007	NA	0.2 J	5.4	NA	NA	NA	0.4 J	0.39	NA	11	NA	8	20300	4.58
		BGS-04	0.5 - 1	6/26/2007	NA	ND (0.2)	9	NA	NA	NA	0.8 J	*2.03*	NA	15	NA	24	16800	7.62
		BGS-05	0.5 - 1	6/26/2007	NA	0.3 J	11.8	NA	NA	NA	0.9 J	*1.85*	NA	7	NA	31	13400	7.92
		BGS-06	0.5 - 1	6/27/2007	NA	0.2 J	*15.3*	NA	NA	NA	0.4 J	0.51	NA	15	NA	5	29800	4.86
		BGS-07	0.5 - 1	6/27/2007	NA	ND (0.2)	5	NA	NA	NA	0.6 J	*1.01*	NA	12	NA	30	13600	5.93
		BGS-08	0.5 - 1	6/27/2007	NA	0.3 J	*43.5*	NA	NA	NA	0.4 J	*1.11*	NA	70	NA	67	35300	7.3
Cap Martin	EA	TA-SUS-22	1.5	7/15/2003	12500	0.68 J	6.3	NA	NA	155	0.38 J	ND (0.03)	1940	5.2	8	3.3	16300	2.8
		WP-SUS-20	4	7/15/2003	15600	0.38 J	10.1	NA	NA	180	0.48	ND (0.027)	2850	8.4	9.1	5.5	19700	3.6
		WP-SUS-21	2.5	7/15/2003	10400	*2 J*	*198*	NA	NA	177	0.5	*14.1*	6320	5.5	7.4	43.5	20700	*44.1*
		WP-SUS-39	2	7/15/2003	14900	0.61 J	*17.5*	NA	NA	167	0.44	ND (0.025)	905	9.7	9.6	11	19600	4.2
	CES	CM-WR1-1	0.5	6/21/2007	NA	0.3 J	*19.6*	NA	NA	NA	ND (0.2)	0.17 J	NA	11	NA	4 J	20500	5.71
		CM-WR2-1	0.5	6/21/2007	NA	ND (0.2)	9.7	NA	NA	NA	ND (0.2)	0.33	NA	9	NA	3 J	15500	4.26
		CM-WR2-2	0.5	6/21/2007	NA	ND (0.2)	*26.5*	NA	NA	NA	ND (0.2)	0.2 J	NA	11	NA	4 J	12400	4.68
		CM-WR3-1	0.5	6/21/2007	NA	0.9 J	*131*	NA	NA	NA	0.7 J	0.27 J	NA	3 J	NA	3	16800	12.9
		CM-WR4-1	0.5	6/21/2007	NA	ND (1)	*257*	NA	NA	NA	0.3 J	*8.48*	NA	6	NA	12	28800	*105*
	TEI	CM-WRC-4	0.5 - 1	10/3/2024	NA	NA	*292 (0.42)*	33.1 (1.9)	650 (4.9)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Central	EA	TA-SUS-33	1.5	7/10/2003	11100	1.3 J	*27.4*	NA	NA	124	0.2 J	0.36 J	1380	9.8	7.2	12.6	16900	9.9
		WP-SSS-31	0.5	7/10/2003	11100	*5.9 J*	*295*	NA	NA	223	0.28 J	*3.4*	2110	10.4	8.5	56.2	31400	*358*
		WP-SUS-31	4.5	7/10/2003	10900	*2.3 J*	*150*	NA	NA	179	0.29 J	*2.2*	2270	8.4	8.1	30.6	26500	*53*
		WP-SUS-32	4	7/10/2003	17600	*1.8 J*	*106*	NA	NA	225	0.3 J	*1.1*	1900	13.3	9.9	16.3	28200	*22.9*
	TEI	CEM-WRA-2	0.5 - 1	10/5/2024	NA	NA	*299 (8.3)*	44.5 (2)	794 (5)	NA	NA	NA	NA	NA	NA	NA	NA	NA
		CEM-WRA-4-DS	0.5 - 1	10/2/2024	NA	NA	*32.6 (0.4)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		CEM-WRB-1	0.5 - 1	10/5/2024	NA	NA	*151 (8.6)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		CEM-WRC-1	0.5 - 1	10/5/2024	NA	NA	*110 (8)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 3
Summary of Soil Analytical Results
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

AOI	Company	Location	Collection Depth (ft bgs)	Sample Date	Metals													
					Aluminum	Antimony	Arsenic	Arsenic, IVBA	Arsenic, Total IVBA	Barium	Beryllium	Cadmium	Calcium	Chromium (total)	Cobalt	Copper	Iron	Lead
PRG for SAP					--	4895	82	--	--	--	24468	9113	--	--	3681	489424	--	--
Tailings PRG					--	--	110	--	--	--	--	--	--	--	--	--	--	--
Waste Rock/Soil PRG					--	--	190	--	--	--	--	--	--	--	--	--	--	--
ODEQ Blue Mountain Region Clean Fill					--	1.3	14	--	--	950	2.6	0.69	--	190	--	120	--	21
ODEQ Eco RBC Plant Direct Toxicity					--	11	18	--	--	110	2.5	32	--	--	13	70	--	120
ODEQ Eco RBC Inverts Direct Toxicity					--	78	6.8	--	--	330	40	140	--	--	--	80	--	1700
ODEQ Eco RBC Bird					--	--	15	--	--	630	--	0.29	--	23	76	14	--	11
ODEQ Eco RBC Mammal					--	0.27	19	--	--	1800	21	0.27	--	34	230	42	--	56
ODEQ Excavation Worker RCB					--	--	420	--	--	--	19000	9700	--	--	--	390000	--	800
Golden Fraction	CES	GF-WR-01	1	6/25/2007	NA	0.6 J	*28.7*	NA	NA	NA	0.3 J	*1*	NA	20	NA	12	26300	14.8
		GF-WR-2	0.5	6/25/2007	NA	*30 J*	***1340***	NA	NA	NA	ND (0.2)	*1.36*	NA	6	NA	114	97300	***2430***
		GF-WR2-1	0.5	6/21/2007	NA	*3.1*	*141*	NA	NA	NA	0.3 J	*4.07*	NA	12	NA	22	30500	*143*
		GF-WR-3	0.5	6/25/2007	NA	*1.5*	*89*	NA	NA	NA	0.3 J	*0.85*	NA	18	NA	15	35600	4.89
	TEI	GF-DR-1	0.5 - 1	10/5/2024	NA	NA	*58.3 (8.4)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		GF-WRA-1	0.5 - 1	10/5/2024	NA	NA	*332 (7.8)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		GF-WRD-4-DS	0.5 - 1	10/5/2024	NA	NA	*55.2 (8.5)*	12.3 (2)	137 (4.9)	NA	NA	NA	NA	NA	NA	NA	NA	NA
		GF-WRD-6	0.5 - 1	10/5/2024	NA	NA	*66.6 (7.9)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Granite Creek #5	CES	GC5-WR-01	0.5	6/26/2007	NA	*1.4*	*155*	NA	NA	NA	0.3 J	*3.35*	NA	13	NA	34	27300	*35.8*
		GC5-WR-02	0.5	6/26/2007	NA	*2.4*	*170*	NA	NA	NA	0.4 J	*4.77*	NA	18	NA	61	30600	*88.5*
	TEI	GC5-WRA-3	0.5 - 1	10/4/2024	NA	NA	***421 (8)***	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		GC5-WRA-4	0.5 - 1	10/4/2024	NA	NA	*160 (7.8)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		GC5-WRA-4-DS	0.5 - 1	10/4/2024	NA	NA	*81.3 (7.9)*	10.4 (1.9)	221 (5)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Granite Creek #6	CES	GC6-WR-01	0.5	6/24/2007	NA	ND (0.2)	9.3	NA	NA	NA	ND (0.2)	0.21	NA	9	NA	14	20700	1.49
		GC6-WR-02	0.5	6/24/2007	NA	ND (0.2)	6.6	NA	NA	NA	0.3 J	0.24	NA	10	NA	6	21400	3.37
		GC6-WR-03	0.5	6/24/2007	NA	ND (0.2)	1.7	NA	NA	NA	ND (0.2)	0.29 J	NA	ND (1)	NA	4 J	2650	0.85
	TEI	GC6-WRA-1	0.5 - 1	10/4/2024	NA	NA	*257 (8.5)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		GC6-WRA-2	0.5 - 1	10/4/2024	NA	NA	***504 (8.5)***	29.3 (2)	759 (4.9)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Granite Creek 7	CES	GC7-WR-01	0.5	6/24/2007	NA	*19*	*185*	NA	NA	NA	0.4 J	*1.84*	NA	6	NA	120	22600	*81.7*
		GC7-WR-02	0.5	6/24/2007	NA	*2.5*	*142*	NA	NA	NA	0.6 J	0.5	NA	7	NA	17	28500	19
		GC7-WR-03	0.5	6/24/2007	NA	*7.6*	*220*	NA	NA	NA	0.6 J	*0.76*	NA	3	NA	66	25100	17.1
		GC7-WR-04	0.5	6/24/2007	NA	0.4 J	*22.9*	NA	NA	NA	0.3 J	0.27 J	NA	9	NA	9	22500	4.94
	TEI	GC7-WRA-3	0.5 - 1	10/4/2024	NA	NA	*26.9 (8.5)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		GC7-WRB-1	0.5 - 1	10/4/2024	NA	NA	7.43 (0.43)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Granite Creek Aq. St. 3	CES	GC3-WR-01	0.5	6/24/2007	NA	*7.2*	*337*	NA	NA	NA	0.3 J	*7.97*	NA	7	NA	57	29900	*152*

Table 3
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Wallowa-Whitman National Forest, Oregon

AOI	Company	Location	Collection Depth (ft bgs)	Sample Date	Metals													
					Aluminum	Antimony	Arsenic	Arsenic, IVBA	Arsenic, Total IVBA	Barium	Beryllium	Cadmium	Calcium	Chromium (total)	Cobalt	Copper	Iron	Lead
PRG for SAP					--	4895	82	--	--	--	24468	9113	--	--	3681	489424	--	--
Tailings PRG					--	--	110	--	--	--	--	--	--	--	--	--	--	--
Waste Rock/Soil PRG					--	--	190	--	--	--	--	--	--	--	--	--	--	--
ODEQ Blue Mountain Region Clean Fill					--	1.3	14	--	--	950	2.6	0.69	--	190	--	120	--	21
ODEQ Eco RBC Plant Direct Toxicity					--	11	18	--	--	110	2.5	32	--	--	13	70	--	120
ODEQ Eco RBC Inverts Direct Toxicity					--	78	6.8	--	--	330	40	140	--	--	--	80	--	1700
ODEQ Eco RBC Bird					--	--	15	--	--	630	--	0.29	--	23	76	14	--	11
ODEQ Eco RBC Mammal					--	0.27	19	--	--	1800	21	0.27	--	34	230	42	--	56
ODEQ Excavation Worker RCB					--	--	420	--	--	--	19000	9700	--	--	--	390000	--	800
Lwr Mon'tl	EA	ML-SSS-38	0.5	7/9/2003	1110	78.3	4470	NA	NA	51.7	0.033 J	0.22 J	308 J	2.3	0.6 J	26.6	16500	856
		WP-SSS-15	0.5	7/9/2003	3740	5 J	573	NA	NA	149	0.25 J	1.4	5570	3.5	6.4	14.6	18900	12.4
		WP-SUS-15	4	7/9/2003	4800	5.3 J	544	NA	NA	176	0.25 J	1.1	7180	4.4	6.6	18.2	20900	25
	CES	MMDGA-T-46	3.5	9/30/2009	NA	NA	3340	NA	NA	NA	NA	NA	NA	NA	NA	152	NA	627
		MMDGA-WR-18	3.5	9/29/2009	NA	NA	2700	NA	NA	NA	NA	NA	NA	NA	NA	45	NA	589
		MMDGA-WR-19	3	9/29/2009	NA	NA	223	NA	NA	NA	NA	NA	NA	NA	NA	9.4	NA	16.1
		MMDGA-WR-20	3	9/29/2009	NA	NA	4610	NA	NA	NA	NA	NA	NA	NA	NA	220	NA	3210
		MMDGA-WR-21	1	9/29/2009	NA	NA	258	NA	NA	NA	NA	NA	NA	NA	NA	13.9	NA	12
		MMDGA-WR-24	0.5	9/29/2009	NA	NA	8150	NA	NA	NA	NA	NA	NA	NA	NA	48	NA	712
		MMDGA-WR-25	0.5	9/29/2009	NA	NA	9360	NA	NA	NA	NA	NA	NA	NA	NA	60.5	NA	453
		MMDGA-WR-26	0.5	9/29/2009	NA	NA	5690	NA	NA	NA	NA	NA	NA	NA	NA	135	NA	578
	TEI	LMM-WRA-3	0.5 - 1	10/3/2024	NA	NA	125 (0.44)	16.6 (2)	328 (4.9)	NA	NA	NA	NA	NA	NA	NA	NA	NA
		LMM-WRA-3-DS	0.5 - 1	10/3/2024	NA	NA	21.6 (0.44)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		LMM-WRA-4	0.5 - 1	10/3/2024	NA	NA	2290 (8.8)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			0.5 - 1	10/3/2024	NA	NA	2570 (8.5)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		LMM-WRB-1	0.5 - 1	10/3/2024	NA	NA	1090 (0.42)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			0.5 - 1	10/3/2024	NA	NA	802 (0.42)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		LMM-WRB-3-DS	0.5 - 1	10/3/2024	NA	NA	29.1 (0.41)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sheridan	EA	TA-SUS-25	1.5	7/14/2003	17500	0.94 J	26	NA	NA	269	0.55	ND (0.027)	1930	8.6	10.5	10.2	20600	10.4
		WP-SUS-23	3.5	7/14/2003	11900	6	81.8	NA	NA	188	0.48	0.63	2920	6.7	8.6	30.5	20100	15.6
	CES	SM-WR2-1	0.5	6/21/2007	NA	ND (0.2)	16.8	NA	NA	NA	ND (0.2)	0.23 J	NA	9	NA	7	20700	11.1
	TEI	SH-WRB-2	0.5 - 1	10/4/2024	NA	NA	80.8 (0.39)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		SH-WRC-1	0.5 - 1	10/4/2024	NA	NA	14.4 (0.44)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tillicum	EA	TA-SSS-30	0.4	7/12/2003	11600	1.6 J	58.6	NA	NA	201	0.2 J	6.2	3480	8.8	8.8	10.4	22900	40.9
		WP-SSS-27	0.8	7/12/2003	9660	2.4 J	88	NA	NA	177	0.2 J	3.4	2600	5.9	8.2	27.5	20000	375
		WP-SSS-28	0.8	7/12/2003	3550	1.3 J	183	NA	NA	32.8	0.43 J	2.8	26500	1.4	4.7	14.4	19300	52.2
		WP-SUS-26	3	7/12/2003	8350	1.7 J	156	NA	NA	138	0.29 J	7.5	3120	4.3	6.7	32.3	23800	120
		WP-SUS-27	4.5	7/12/2003	11700	1.8 J	35.7	NA	NA	206	0.21 J	1.9	1830	6.8	8.2	15.2	21300	27.8
	CES	TILL-WR-01	0	6/26/2007	NA	5.5	371	NA	NA	NA	0.7 J	15.6	NA	2 J	NA	27	24600	184
	TEI	TL-WRA-1-DS-2	0.5 - 1	10/4/2024	NA	NA	267 (0.44)	14.4 (1.9)	550 (4.9)	NA	NA	NA	NA	NA	NA	NA	NA	NA
		TL-WRA-3	0.5 - 1	10/4/2024	NA	NA	454 (0.42)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		TL-WRB-4	0.5 - 1	10/4/2024	NA	NA	194 (0.42)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

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					Aluminum	Antimony	Arsenic	Arsenic, IVBA	Arsenic, Total IVBA	Barium	Beryllium	Cadmium	Calcium	Chromium (total)	Cobalt	Copper	Iron	Lead
PRG for SAP					--	4895	82	--	--	--	24468	9113	--	--	3681	489424	--	--
Tailings PRG					--	--	110	--	--	--	--	--	--	--	--	--	--	--
Waste Rock/Soil PRG					--	--	190	--	--	--	--	--	--	--	--	--	--	--
ODEQ Blue Mountain Region Clean Fill					--	1.3	14	--	--	950	2.6	0.69	--	190	--	120	--	21
ODEQ Eco RBC Plant Direct Toxicity					--	11	18	--	--	110	2.5	32	--	--	13	70	--	120
ODEQ Eco RBC Inverts Direct Toxicity					--	78	6.8	--	--	330	40	140	--	--	--	80	--	1700
ODEQ Eco RBC Bird					--	--	15	--	--	630	--	0.29	--	23	76	14	--	11
ODEQ Eco RBC Mammal					--	0.27	19	--	--	1800	21	0.27	--	34	230	42	--	56
ODEQ Excavation Worker RCB					--	--	420	--	--	--	19000	9700	--	--	--	390000	--	800
Upr Mon'tl	EA	ML-SSS-12	0.7	7/9/2003	13300	4 J	73	NA	NA	322	0.32 J	0.65	3050	8.4	10.4	14.2	32000	27.5
		ML-SSS-16	0.5	7/10/2003	6180	368	7500	NA	NA	129	0.25 J	8.1	1610	7.7	1.6 J	80	16300	1350
		WP-SSS-13	1	7/9/2003	4220	11.6	860	NA	NA	189	0.087 J	ND (0.064)	523 J	3.6	3.6 J	12.5	21500	31.3
		WP-SSS-14	0.7	7/10/2003	3190	2.5 J	616	NA	NA	69.8	0.26 J	8.5	5980	2.3	5 J	7.4	13600	15
		WP-SSS-17	1	7/9/2003	10600	241	11400	NA	NA	73.2	0.3 J	23.4	3610	2.1	2.7 J	698	16300	2120
		WP-SUS-14	3.5	7/10/2003	4680	5.8 J	355	NA	NA	166	0.23 J	0.52	10100	3.3	6.4	8	18800	36.9
	CES	MMDGA-T-13	1	9/29/2009	NA	NA	10200	NA	NA	NA	NA	NA	NA	NA	NA	58.4	NA	1200
		MMDGA-T-34	0.25	9/30/2009	NA	NA	1900	NA	NA	NA	NA	NA	NA	NA	NA	119	NA	478
		MMDGA-T-34	2	9/30/2009	NA	NA	9610	NA	NA	NA	NA	NA	NA	NA	NA	440	NA	2340
		MMDGA-T-35	1	9/30/2009	NA	NA	4770	NA	NA	NA	NA	NA	NA	NA	NA	247	NA	1240
		MMDGA-T-37	0.25	9/30/2009	NA	NA	1360	NA	NA	NA	NA	NA	NA	NA	NA	128	NA	334
		MMDGA-T-40	2	9/30/2009	NA	NA	6310	NA	NA	NA	NA	NA	NA	NA	NA	460	NA	1140
		MMDGA-T-41	2	9/30/2009	NA	NA	8750	NA	NA	NA	NA	NA	NA	NA	NA	700	NA	1680
		MMDGA-T-9	1	9/29/2009	NA	NA	2440	NA	NA	NA	NA	NA	NA	NA	NA	75.3	NA	549
		MMDGA-WR-2	4	9/28/2009	NA	NA	164	NA	NA	NA	NA	NA	NA	NA	NA	15.2	NA	11.3
		MMDGA-WR-28	0.5	9/29/2009	NA	NA	740	NA	NA	NA	NA	NA	NA	NA	NA	8.1	NA	10.4
		MMDGA-WR-3	4	9/28/2009	NA	NA	2240	NA	NA	NA	NA	NA	NA	NA	NA	70.6	NA	479
		MMDGA-WR-5	1	9/28/2009	NA	NA	2920	NA	NA	NA	NA	NA	NA	NA	NA	51.1	NA	231
	TEI	UMM-TLA-6	0.5 - 1	10/2/2024	NA	NA	3270 (8.1)	1350 (2)	5560 (4.9)	NA	NA	NA	NA	NA	NA	NA	NA	589 (0.81)
		UMM-TLB-1	0.5 - 1	10/2/2024	NA	NA	6130 (11)	1840 (2)	4420 (4.9)	NA	NA	NA	NA	NA	NA	NA	NA	1710 (1.1)
		UMM-TLB-4	0.5 - 1	10/2/2024	NA	NA	1540 (8)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-TLC-1	0.5 - 1	10/2/2024	NA	NA	5290 (9.9)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-TLC-2	0.5 - 1	10/2/2024	NA	NA	4980 (10)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-WRA-1	0.5 - 1	10/2/2024	NA	NA	1300 (8.4)	12.7 (2)	1590 (4.9)	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-WRA-1-DS	0.5 - 1	10/2/2024	NA	NA	37.5 (0.41)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-WRA-3	0.5 - 1	10/2/2024	NA	NA	1210 (0.45)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-WRB-1	0.5 - 1	10/2/2024	NA	NA	14000 (41)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5210 (4.1)
		UMM-WRB-2	0.5 - 1	10/2/2024	NA	NA	1800 (8.2)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-WRB-2-DS	0.5 - 1	10/2/2024	NA	NA	79.2 (0.45)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Upr Upr Mon'tl	TEI	UUMM-WRA-2	0.5 - 1	10/2/2024	NA	NA	1940 (8.8)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UUMM-WRA-3	0.5 - 1	10/2/2024	NA	NA	1710 (9.1)	176 (1.9)	3440 (4.9)	NA	NA	NA	NA	NA	NA	NA	NA	NA
			0.5 - 1	10/2/2024	NA	NA	1470 (8)	162 (2)	3280 (5)	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UUMM-WRA-3-DS	0.5 - 1	10/2/2024	NA	NA	16 (0.44)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UUMM-WRD-1	0.5 - 1	10/2/2024	NA	NA	269 (0.45)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UUMM-WRF-1	0.5 - 1	10/2/2024	NA	NA	715 (0.44)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

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AOI	Company	Location	Collection Depth (ft bgs)	Sample Date	Metals												
					Lead, IVBA	Lead, Total IVBA	Magnesium	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Vanadium	Zinc
PRG for SAP					--	--	--	--	2153	244668	--	61175	61145	--	--	61218	--
Tailings PRG					--	--	--	--	--	--	--	--	--	--	--	--	--
Waste Rock/Soil PRG					--	--	--	--	--	--	--	--	--	--	--	--	--
ODEQ Blue Mountain Region Clean Fill					--	--	--	1800	1.4	92	--	0.93	0.51	--	--	400	160
ODEQ Eco RBC Plant Direct Toxicity					--	--	--	220	34	38	--	0.52	560	--	0.05	60	160
ODEQ Eco RBC Inverts Direct Toxicity					--	--	--	450	0.05	280	--	4.1	--	--	--	--	120
ODEQ Eco RBC Bird					--	--	--	1300	0.013	20	--	0.71	2.6	--	4.5	4.7	46
ODEQ Eco RBC Mammal					--	--	--	1400	1.7	10	--	0.63	14	--	0.42	280	79
ODEQ Excavation Worker RCB					--	--	--	230000	2900	190000	--	--	49000	--	--	--	--
Background	EA	BG-SSS-19	0.5	7/19/2003	NA	NA	2630	837	0.14	23.4	1570	0.76	0.26 J	806	0.97	47.8	105
		BG-SSS-34	0.5	7/15/2003	NA	NA	880	429	0.032 J	5.2	848	0.61	0.28 J	1220	ND (0.28)	24.9	50.2
		BG-SSS-35	0.5	7/15/2003	NA	NA	1560	156	0.035 J	5.6	1140	0.42 J	*0.62 J*	1450	ND (0.29)	26.5	43.2
		BG-SSS-36	0.5	7/15/2003	NA	NA	4930	610	0.027 J	23.4	3920	0.24 J	0.48 J	1180	ND (0.24)	47.2	61.3
	CES	BGS-01	0.5 - 1	6/26/2007	NA	NA	NA	716	0.06 J	7	NA	0.37	0.29	NA	NA	NA	71
		BGS-02	0.5 - 1	6/26/2007	NA	NA	NA	668	ND (0.04)	6	NA	0.28 J	0.51	NA	NA	NA	61
		BGS-03	0.5 - 1	6/26/2007	NA	NA	NA	644	0.05 J	8	NA	0.15 J	0.2	NA	NA	NA	71
		BGS-04	0.5 - 1	6/26/2007	NA	NA	NA	848	0.06 J	23	NA	0.36	*0.63*	NA	NA	NA	126
		BGS-05	0.5 - 1	6/26/2007	NA	NA	NA	319	0.06 J	10	NA	0.77	*0.58*	NA	NA	NA	44
		BGS-06	0.5 - 1	6/27/2007	NA	NA	NA	644	ND (0.04)	7	NA	0.24 J	0.32	NA	NA	NA	88
		BGS-07	0.5 - 1	6/27/2007	NA	NA	NA	606	0.07 J	13	NA	0.39	0.23	NA	NA	NA	60
		BGS-08	0.5 - 1	6/27/2007	NA	NA	NA	1060	0.08 J	70	NA	0.38	*0.53*	NA	NA	NA	145
Cap Martin	EA	TA-SUS-22	1.5	7/15/2003	NA	NA	5180	408	0.058	3.8 J	3720	0.24 J	0.28 J	982	ND (0.28)	40.6	41.8
		WP-SUS-20	4	7/15/2003	NA	NA	5320	270	0.026 J	4.3	4080	ND (0.31)	*0.63 J*	1100	ND (0.25)	52.2	48.6
		WP-SUS-21	2.5	7/15/2003	NA	NA	2980	504	0.3	4.1	3240	0.4 J	*4.2*	122 J	0.45 J	33.9	*495*
		WP-SUS-39	2	7/15/2003	NA	NA	4560	321	0.064	4.8	3560	0.4 J	*0.79 J*	1060	ND (0.23)	52.2	50.5
	CES	CM-WR1-1	0.5	6/21/2007	NA	NA	NA	312	0.06 J	3 J	NA	0.3	0.14	NA	NA	NA	39
		CM-WR2-1	0.5	6/21/2007	NA	NA	NA	234	ND (0.04)	3 J	NA	0.23 J	0.08 J	NA	NA	NA	34
		CM-WR2-2	0.5	6/21/2007	NA	NA	NA	198	0.07 J	4 J	NA	0.23 J	0.19	NA	NA	NA	25
		CM-WR3-1	0.5	6/21/2007	NA	NA	NA	69.4	0.09 J	2 J	NA	0.58	*0.92*	NA	NA	NA	50
		CM-WR4-1	0.5	6/21/2007	NA	NA	NA	657	0.06 J	5 J	NA	0.46	*1.42*	NA	NA	NA	*330*
	TEI	CM-WRC-4	0.5 - 1	10/3/2024	2.95 (0.19)	10.3 (0.49)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Central	EA	TA-SUS-33	1.5	7/10/2003	NA	NA	4650	378	0.12	6.9	2750	0.52	ND (0.21)	805	0.34 J	44.2	63.2
		WP-SSS-31	0.5	7/10/2003	NA	NA	4860	1260	0.27	9.6	2840	*1.6*	*2.7*	787	3.3	96.1	*203*
		WP-SUS-31	4.5	7/10/2003	NA	NA	3450	833	0.19	8	1770	*1*	*1.9*	425 J	2.5	59.4	137
		WP-SUS-32	4	7/10/2003	NA	NA	6300	697	0.12	9.7	4030	*1*	0.28 J	1040	1.3	73.7	96.2
	TEI	CEM-WRA-2	0.5 - 1	10/5/2024	21.9 (0.2)	78.5 (0.5)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		CEM-WRA-4-DS	0.5 - 1	10/2/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		CEM-WRB-1	0.5 - 1	10/5/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		CEM-WRC-1	0.5 - 1	10/5/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

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					Lead, IVBA	**Lead, Total IVBA**	**Magnesium**	**Manganese**	**Mercury**	**Nickel**	**Potassium**	**Selenium**	**Silver**	**Sodium**	**Thallium**	**Vanadium**	**Zinc**
PRG for SAP					--	--	--	--	2153	244668	--	61175	61145	--	--	61218	--
Tailings PRG					--	--	--	--	--	--	--	--	--	--	--	--	--
Waste Rock/Soil PRG					--	--	--	--	--	--	--	--	--	--	--	--	--
ODEQ Blue Mountain Region Clean Fill					--	--	--	1800	1.4	92	--	0.93	0.51	--	--	400	160
ODEQ Eco RBC Plant Direct Toxicity					--	--	--	220	34	38	--	0.52	560	--	0.05	60	160
ODEQ Eco RBC Inverts Direct Toxicity					--	--	--	450	0.05	280	--	4.1	--	--	--	--	120
ODEQ Eco RBC Bird					--	--	--	1300	0.013	20	--	0.71	2.6	--	4.5	4.7	46
ODEQ Eco RBC Mammal					--	--	--	1400	1.7	10	--	0.63	14	--	0.42	280	79
ODEQ Excavation Worker RCB					--	--	--	230000	2900	190000	--	--	49000	--	--	--	--
Golden Fraction	CES	GF-WR-01	1	6/25/2007	NA	NA	NA	692	NDH (0.04)	6	NA	0.23 J	*0.58*	NA	NA	NA	*191*
		GF-WR-2	0.5	6/25/2007	NA	NA	NA	97.5	*2.61*	1	NA	*3.26*	*52*	NA	NA	NA	*305*
		GF-WR2-1	0.5	6/21/2007	NA	NA	NA	718	0.19 J	7	NA	0.39	*7.95*	NA	NA	NA	*201*
		GF-WR-3	0.5	6/25/2007	NA	NA	NA	544	NDH (0.04)	8	NA	0.34	*0.64*	NA	NA	NA	94
	TEI	GF-DR-1	0.5 - 1	10/5/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		GF-WRA-1	0.5 - 1	10/5/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		GF-WRD-4-DS	0.5 - 1	10/5/2024	8.94 (0.2)	25.6 (0.49)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		GF-WRD-6	0.5 - 1	10/5/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Granite Creek #5	CES	GC5-WR-01	0.5	6/26/2007	NA	NA	NA	821	0.08 JH	8	NA	0.4	*1.2*	NA	NA	NA	*221*
		GC5-WR-02	0.5	6/26/2007	NA	NA	NA	929	0.07 JH	8	NA	0.55	*5.05*	NA	NA	NA	*250*
	TEI	GC5-WRA-3	0.5 - 1	10/4/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		GC5-WRA-4	0.5 - 1	10/4/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		GC5-WRA-4-DS	0.5 - 1	10/4/2024	26.4 (0.19)	70.4 (0.5)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Granite Creek #6	CES	GC6-WR-01	0.5	6/24/2007	NA	NA	NA	497	1.21 H	4 J	NA	0.25 J	0.08 J	NA	NA	NA	59
		GC6-WR-02	0.5	6/24/2007	NA	NA	NA	367	0.09 JH	4 J	NA	0.26 J	0.09 J	NA	NA	NA	62
		GC6-WR-03	0.5	6/24/2007	NA	NA	NA	25.3	NDH (0.05)	ND (1)	NA	0.17 J	0.08 J	NA	NA	NA	4 J
	TEI	GC6-WRA-1	0.5 - 1	10/4/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		GC6-WRA-2	0.5 - 1	10/4/2024	150 (0.2)	360 (0.49)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Granite Creek 7	CES	GC7-WR-01	0.5	6/24/2007	NA	NA	NA	661	0.24 H	5 J	NA	0.35	*20.4*	NA	NA	NA	134
		GC7-WR-02	0.5	6/24/2007	NA	NA	NA	593	0.24	5	NA	0.4	*1.79*	NA	NA	NA	84
		GC7-WR-03	0.5	6/24/2007	NA	NA	NA	608	0.42	0.4	NA	0.45	*4.08*	NA	NA	NA	83
		GC7-WR-04	0.5	6/24/2007	NA	NA	NA	443	NDH (0.04)	4 J	NA	0.26	0.34	NA	NA	NA	61
	TEI	GC7-WRA-3	0.5 - 1	10/4/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		GC7-WRB-1	0.5 - 1	10/4/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Granite Creek Aq. St. 3	CES	GC3-WR-01	0.5	6/24/2007	NA	NA	NA	1070	0.29 H	4 J	NA	0.27 J	*19.1*	NA	NA	NA	*377*

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Wallowa-Whitman National Forest, Oregon

AOI	Company	Location	Collection Depth (ft bgs)	Sample Date	Metals												
					Lead, IVBA	Lead, Total IVBA	Magnesium	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Vanadium	Zinc
PRG for SAP					--	--	--	--	2153	244668	--	61175	61145	--	--	61218	--
Tailings PRG					--	--	--	--	--	--	--	--	--	--	--	--	--
Waste Rock/Soil PRG					--	--	--	--	--	--	--	--	--	--	--	--	--
ODEQ Blue Mountain Region Clean Fill					--	--	--	1800	1.4	92	--	0.93	0.51	--	--	400	160
ODEQ Eco RBC Plant Direct Toxicity					--	--	--	220	34	38	--	0.52	560	--	0.05	60	160
ODEQ Eco RBC Inverts Direct Toxicity					--	--	--	450	0.05	280	--	4.1	--	--	--	--	120
ODEQ Eco RBC Bird					--	--	--	1300	0.013	20	--	0.71	2.6	--	4.5	4.7	46
ODEQ Eco RBC Mammal					--	--	--	1400	1.7	10	--	0.63	14	--	0.42	280	79
ODEQ Excavation Worker RCB					--	--	--	230000	2900	190000	--	--	49000	--	--	--	--
Lwr Mon'tl	EA	ML-SSS-38	0.5	7/9/2003	NA	NA	212 J	30.9	0.37	2.2 J	836	0.86	*48*	193 J	ND (0.46)	5.1 J	65
		WP-SSS-15	0.5	7/9/2003	NA	NA	3690	757	0.14	4.8	2010	0.9	*7.1*	385 J	1.5	24.7	107
		WP-SUS-15	4	7/9/2003	NA	NA	4940	776	0.33	6	2730	*0.99*	*6.4*	478	1.8	30.3	130
	CES	MMDGA-T-46	3.5	9/30/2009	NA	NA	NA	208	*95*	NA	NA	NA	*54.9*	NA	NA	NA	*1500*
		MMDGA-WR-18	3.5	9/29/2009	NA	NA	NA	51.1	0.42	NA	NA	NA	*48.8*	NA	NA	NA	152
		MMDGA-WR-19	3	9/29/2009	NA	NA	NA	277	0.17 J	NA	NA	NA	*1.14*	NA	NA	NA	63
		MMDGA-WR-20	3	9/29/2009	NA	NA	NA	185	1.28	NA	NA	NA	*343*	NA	NA	NA	*1140*
		MMDGA-WR-21	1	9/29/2009	NA	NA	NA	784	0.36	NA	NA	NA	*2.6*	NA	NA	NA	132
		MMDGA-WR-24	0.5	9/29/2009	NA	NA	NA	342	*2.99*	NA	NA	NA	*21.9*	NA	NA	NA	78
		MMDGA-WR-25	0.5	9/29/2009	NA	NA	NA	207	0.53	NA	NA	NA	*9.47*	NA	NA	NA	69
		MMDGA-WR-26	0.5	9/29/2009	NA	NA	NA	713	0.84	NA	NA	NA	*40*	NA	NA	NA	*2030*
	TEI	LMM-WRA-3	0.5 - 1	10/3/2024	10.8 (0.2)	32 (0.49)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		LMM-WRA-3-DS	0.5 - 1	10/3/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		LMM-WRA-4	0.5 - 1	10/3/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			0.5 - 1	10/3/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		LMM-WRB-1	0.5 - 1	10/3/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			0.5 - 1	10/3/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		LMM-WRB-3-DS	0.5 - 1	10/3/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sheridan	EA	TA-SUS-25	1.5	7/14/2003	NA	NA	6310	444	0.048	5.3	4900	0.24 J	*1.4*	1330	ND (0.26)	58.5	66.9
		WP-SUS-23	3.5	7/14/2003	NA	NA	5200	782	0.36	5.2	3320	0.48	*32.5*	676	0.76 J	50.8	87.8
	CES	SM-WR2-1	0.5	6/21/2007	NA	NA	NA	278	0.15 J	5 J	NA	0.25 J	0.16	NA	NA	NA	67
	TEI	SH-WRB-2	0.5 - 1	10/4/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		SH-WRC-1	0.5 - 1	10/4/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tillicum	EA	TA-SSS-30	0.4	7/12/2003	NA	NA	6290	579	0.12	5.7	3490	0.45 J	0.29 J	927	0.98 J	51.6	*297*
		WP-SSS-27	0.8	7/12/2003	NA	NA	4330	556	0.38	4.3	2610	0.84	*1.8*	590	1.8	36.5	*322*
		WP-SSS-28	0.8	7/12/2003	NA	NA	1740	890	0.21	4	1410	0.78	*1.2*	38.5 J	2	11.7	*183*
		WP-SUS-26	3	7/12/2003	NA	NA	3220	660	0.1	3.9 J	1980	*1.1*	*2.2*	271 J	2.3	34.5	*356*
		WP-SUS-27	4.5	7/12/2003	NA	NA	5880	603	0.029 J	5.2	3820	*0.95*	ND (0.24)	947	1.6	51.8	157
	CES	TILL-WR-01	0	6/26/2007	NA	NA	NA	1020	0.46 H	4 J	NA	0.84	*3.34*	NA	NA	NA	*525*
	TEI	TL-WRA-1-DS-2	0.5 - 1	10/4/2024	83.3 (0.19)	218 (0.49)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		TL-WRA-3	0.5 - 1	10/4/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		TL-WRB-4	0.5 - 1	10/4/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

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AOI	Company	Location	Collection Depth (ft bgs)	Sample Date	Metals												
					Lead, IVBA	Lead, Total IVBA	Magnesium	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Vanadium	Zinc
PRG for SAP					--	--	--	--	2153	244668	--	61175	61145	--	--	61218	--
Tailings PRG					--	--	--	--	--	--	--	--	--	--	--	--	--
Waste Rock/Soil PRG					--	--	--	--	--	--	--	--	--	--	--	--	--
ODEQ Blue Mountain Region Clean Fill					--	--	--	1800	1.4	92	--	0.93	0.51	--	--	400	160
ODEQ Eco RBC Plant Direct Toxicity					--	--	--	220	34	38	--	0.52	560	--	0.05	60	160
ODEQ Eco RBC Inverts Direct Toxicity					--	--	--	450	0.05	280	--	4.1	--	--	--	--	120
ODEQ Eco RBC Bird					--	--	--	1300	0.013	20	--	0.71	2.6	--	4.5	4.7	46
ODEQ Eco RBC Mammal					--	--	--	1400	1.7	10	--	0.63	14	--	0.42	280	79
ODEQ Excavation Worker RCB					--	--	--	230000	2900	190000	--	--	49000	--	--	--	--
Upr Mon'tl	EA	ML-SSS-12	0.7	7/9/2003	NA	NA	5730	730	*56*	7.3	4270	*1.1*	*1.8*	1080	2.5	66.2	*211*
		ML-SSS-16	0.5	7/10/2003	NA	NA	678	100	*3.1*	2.5 J	2550	*1.6*	*156*	370 J	1.1 J	15.6	*432*
		WP-SSS-13	1	7/9/2003	NA	NA	2270	115	0.5	2.6 J	2950	0.83	*21.2*	557	0.57 J	26.1	55
		WP-SSS-14	0.7	7/10/2003	NA	NA	2450	691	0.51	4.7	1650	0.7	*1.5*	ND (23.6)	1.2	15	*857*
		WP-SSS-17	1	7/9/2003	NA	NA	3200	321	*784*	3.2 J	3480	0.75	*319*	3240	1.6	14.9	*2410*
		WP-SUS-14	3.5	7/10/2003	NA	NA	4100	511	0.61	4.6	2920	0.61	*11.6*	516	1.7	25.4	107
	CES	MMDGA-T-13	1	9/29/2009	NA	NA	NA	381	*8*	NA	NA	NA	*35*	NA	NA	NA	*674*
		MMDGA-T-34	0.25	9/30/2009	NA	NA	NA	398	*190*	NA	NA	NA	*85*	NA	NA	NA	*816*
		MMDGA-T-34	2	9/30/2009	NA	NA	NA	400	*770*	NA	NA	NA	*229*	NA	NA	NA	*3490*
		MMDGA-T-35	1	9/30/2009	NA	NA	NA	281	*270*	NA	NA	NA	*144*	NA	NA	NA	*1760*
		MMDGA-T-37	0.25	9/30/2009	NA	NA	NA	781	*101*	NA	NA	NA	*51.1*	NA	NA	NA	*764*
		MMDGA-T-40	2	9/30/2009	NA	NA	NA	565	*254*	NA	NA	NA	*214*	NA	NA	NA	*3030*
		MMDGA-T-41	2	9/30/2009	NA	NA	NA	575	*222*	NA	NA	NA	*303*	NA	NA	NA	*4900*
		MMDGA-T-9	1	9/29/2009	NA	NA	NA	246	*12*	NA	NA	NA	*80.1*	NA	NA	NA	*294*
		MMDGA-WR-2	4	9/28/2009	NA	NA	NA	1200	0.88	NA	NA	NA	*0.82*	NA	NA	NA	116
		MMDGA-WR-28	0.5	9/29/2009	NA	NA	NA	197	0.15 J	NA	NA	NA	*2.58*	NA	NA	NA	52
		MMDGA-WR-3	4	9/28/2009	NA	NA	NA	865	1.09	NA	NA	NA	*48.1*	NA	NA	NA	*844*
		MMDGA-WR-5	1	9/28/2009	NA	NA	NA	313	0.4	NA	NA	NA	*39.8*	NA	NA	NA	*248*
	TEI	UMM-TLA-6	0.5 - 1	10/2/2024	69.2 (0.2)	1110 (0.49)	NA	NA	*9.23 (0.19)*	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-TLB-1	0.5 - 1	10/2/2024	241 (0.2)	840 (0.49)	NA	NA	*387 (11)*	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-TLB-4	0.5 - 1	10/2/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-TLC-1	0.5 - 1	10/2/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-TLC-2	0.5 - 1	10/2/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-WRA-1	0.5 - 1	10/2/2024	66 (0.2)	249 (0.49)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-WRA-1-DS	0.5 - 1	10/2/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-WRA-3	0.5 - 1	10/2/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-WRB-1	0.5 - 1	10/2/2024	NA	NA	NA	NA	0.663 (0.098)	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-WRB-2	0.5 - 1	10/2/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UMM-WRB-2-DS	0.5 - 1	10/2/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Upr Upr Mon'tl	TEI	UUMM-WRA-2	0.5 - 1	10/2/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UUMM-WRA-3	0.5 - 1	10/2/2024	12.6 (0.19)	340 (0.49)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			0.5 - 1	10/2/2024	7.14 (0.2)	340 (0.5)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UUMM-WRA-3-DS	0.5 - 1	10/2/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UUMM-WRD-1	0.5 - 1	10/2/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		UUMM-WRF-1	0.5 - 1	10/2/2024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

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AOI	Company	Location	Collection Depth (ft bgs)	Sample Date	Metals													
					Aluminum	Antimony	Arsenic	Arsenic, IVBA	Arsenic, Total IVBA	Barium	Beryllium	Cadmium	Calcium	Chromium (total)	Cobalt	Copper	Iron	Lead
PRG for SAP					--	4895	82	--	--	--	24468	9113	--	--	3681	489424	--	--
Tailings PRG					--	--	110	--	--	--	--	--	--	--	--	--	--	--
Waste Rock/Soil PRG					--	--	190	--	--	--	--	--	--	--	--	--	--	--
ODEQ Blue Mountain Region Clean Fill					--	1.3	14	--	--	950	2.6	0.69	--	190	--	120	--	21
ODEQ Eco RBC Plant Direct Toxicity					--	11	18	--	--	110	2.5	32	--	--	13	70	--	120
ODEQ Eco RBC Inverts Direct Toxicity					--	78	6.8	--	--	330	40	140	--	--	--	80	--	1700
ODEQ Eco RBC Bird					--	--	15	--	--	630	--	0.29	--	23	76	14	--	11
ODEQ Eco RBC Mammal					--	0.27	19	--	--	1800	21	0.27	--	34	230	42	--	56
ODEQ Excavation Worker RCB					--	--	420	--	--	--	19000	9700	--	--	--	390000	--	800

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AOI	Company	Location	Collection Depth (ft bgs)	Sample Date	Metals													
					Aluminum	Antimony	Arsenic	Arsenic, IVBA	Arsenic, Total IVBA	Barium	Beryllium	Cadmium	Calcium	Chromium (total)	Cobalt	Copper	Iron	Lead
PRG for SAP					--	4895	82	--	--	--	24468	9113	--	--	3681	489424	--	--
Tailings PRG					--	--	110	--	--	--	--	--	--	--	--	--	--	--
Waste Rock/Soil PRG					--	--	190	--	--	--	--	--	--	--	--	--	--	--
ODEQ Blue Mountain Region Clean Fill					--	1.3	14	--	--	950	2.6	0.69	--	190	--	120	--	21
ODEQ Eco RBC Plant Direct Toxicity					--	11	18	--	--	110	2.5	32	--	--	13	70	--	120
ODEQ Eco RBC Inverts Direct Toxicity					--	78	6.8	--	--	330	40	140	--	--	--	80	--	1700
ODEQ Eco RBC Bird					--	--	15	--	--	630	--	0.29	--	23	76	14	--	11
ODEQ Eco RBC Mammal					--	0.27	19	--	--	1800	21	0.27	--	34	230	42	--	56
ODEQ Excavation Worker RCB					--	--	420	--	--	--	19000	9700	--	--	--	390000	--	800

Note:
1. All concentrations reported in mg/kg (ppm); detection limits in parentheses.
2. ODEQ does not provide a Eco Soil RBC for aluminum, but states that it is toxic if soil has a pH < 5.5.
3. Iron is a narrative criterion.
4. Underlined concentrations exceed the PRG for SAP.
5. Double underlined concentrations for results from Tailings exceed the Tailings PRG.
6. Double underlined concentrations for results from Waste Rock/Soil exceed the Waste Rock/Soil PRG.
7. Italicized concentrations exceed the ODEQ Blue Mountain Region Clean Fill.
8. Grey shaded concentrations exceed one or more of the ODEQ Eco RBC (i.e., plant, inverts, bird, or mammal).
9. Boldfaced concentrations exceed the ODEQ Excavation Worker RCB.

CES - Cascade Earth Scienes
EA - EA Engineering, Science, and Technology, Inc.
Eco - Ecological
J - Estimated Concentration
H - Storage and Preservation Times were Not Met
Mon'tl - Monumental
ND - Not Detected
NA - Not Analyzed
ODEQ - Oregon Department of Environmental Quality
PRG - Preliminary Remediation Goal
RBC - Risk-Based Concentration
SAP - Sampling and Analysis Plan
St - Station
TEI - Terraphase Engineering Inc.

Table 4
Waste Rock/Tailings Pile UCL Calculations
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

Area of Interest	Feature	UCL (mg/kg)	Maximum Arsenic Concentration (mg/kg)	Distribution	Sample Size	Number of Locations
Central Mine	CEM-WRA	239.5	299	Normal	7	7
	CEM-WRB	185.8	242	Normal	13	3
	CEM-WRC	124.5	187	Normal	16	3
	CEM-WRD	82.88	87	Normal	4	1
Cap Martin Mine	CM-PS	36.61	38.61	Normal	7	3
	CM-WRA	12.61	19.6	Normal	12	4
	CM-WRB	13.26	17.5	Normal	11	3
	CM-WRC	243.5	365.8	Normal	9	9
Granite Creek Aquatic Station 03	GC03-WRA	43.57	45	Normal	4	4
	GC03-WRB	309.3	485	Normal	9	9
Granite Creek #5 Mine	GC5-WRA	293.2	421	Normal	8	8
	GC5-WRB	137.1	162	Normal	10	2
Granite Creek #6 Mine	GC6-WRA	286.6	504	Normal	17	4
	GC6-WTP	10.02	16	Normal	14	5
Granite Creek #7 Mine	GC7-WRA	22.44	31	Normal	14	5
	GC7-WRB	176.6	220	Normal	6	6
Golden Fraction Mine	GF-WRA	332	491	Normal	26	4
	GF-WRB	115.9	141	Normal	7	7
	GF-WRC	274	1340	Nonparametric	17	5
	GF-WRC-Rev	77.26	102	Normal	16	4
	GF-WRD	72.49	80	Normal	7	7

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Area of Interest	Feature	UCL (mg/kg)	Maximum Arsenic Concentration (mg/kg)	Distribution	Sample Size	Number of Locations
Lower Monumental Mine	LMM-TLA	8099	10884	Normal	7	7
	LMM-WRA	2683	4610	Gamma	13	13
	LMM-WRB	7612	8150	Gamma	6	6
Sheridan Mine	SH-WRA	33.18	81.8	Nonparametric	10	4
	SH-WRB	62.2	80.8	Normal	9	3
	SH-WRC	19.5	21	Normal	9	3
Tillicum Mine	TL-WRA	357.7	454	Normal	7	7
	TL-WRB	165.1	194	Normal	7	7
	TL-WRC	188.1	205	Normal	9	3
Upper Monumental Mine	UMM-TLA	7487	10200	Normal	6	6
	UMM-TLB	6067	11400	Normal	12	12
	UMM-TLC	3238	8750	Gamma	23	5
	UMM-WRA	1261	2920	Normal	16	16
	UMM-WRB	13851	14142	Lognormal	7	7
Upper Upper Monumental Mine	UUMM-WRA	2091	2435	Normal	6	6
	UUMM-WRB	159.5	202	Normal	10	1
	UUMM-WRC	19.76	20	Normal	4	1
	UUMM-WRD	312.5	334	Normal	5	2
	UUMM-WRE	25.88	26	Normal	4	1
	UUMM-WRF	608.4	786	Normal	11	2

Note:
UCL =Calculated 95 percent upper concentration level, estimate of the mean
mg/kg = milligrams per kilogram
Shaded cells represent features with UCLs above preliminary remediation goals

Table 5
Summary of Sediment Analytical Results
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AOI	Company	Location	Sample Date	Metals											
				Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium (total)	Cobalt	Copper	Iron	Lead
PRG for SAP				--	4895	82	--	24468	9113	--	--	3681	489424	--	--
Tailings PRG				--	--	110	--	--	--	--	--	--	--	--	--
ODEQ Blue Mountain Region Clean Fill				--	1.3	14	950	2.6	0.69	--	190	--	120	--	21
ODEQ Eco RBC FW				--	3	6	--	--	0.6	--	37	--	36	--	35
USEPA R4 Eco SV FW Non-Narcotic Mode of Action				25000	2	9.8	20	--	1	--	43.4	50	31.6	20000	35.8
USEPA R4 Eco SV FW Aquatic Non-Narcotic Mode of Action				--	--	--	--	--	--	--	--	--	--	--	--
USEPA R4 Eco SV FW Wildlife Non-Narcotic Mode of Action				--	--	--	--	--	--	--	--	--	--	--	--
Granite Creek	EA	ST-PSD-03	7/15/2003	4360	1.2 J	*13.8*	76.3	0.32 J	ND (0.053)	2050	*45.6*	6.4	2.5	40000	4.4
		ST-PSD-04	7/15/2003	6260	**1.5 J**	***19.5***	127	0.38 J	ND (0.053)	1650	5.2	6.3	3.1	11600	4.9
		ST-PSD-05	7/14/2003	6670	ND (0.39)	***18.7***	126	0.27 J	ND (0.062)	1820	7	5.7	2.4 J	14500	6.4
		ST-PSD-06	7/14/2003	9210	ND (0.41)	***18.6***	170	0.36 J	ND (0.065)	2130	8.1	8.2	3	18800	4.9
		ST-PSD-07	7/12/2003	6980	ND (0.36)	***21.9***	127	0.3 J	ND (0.057)	2040	11.5	5.7	10.6	19100	5.3
		ST-PSD-08	7/12/2003	11700	ND (0.55)	***25.9***	217	0.47 J	ND (0.086)	2990	10.7	9.6	7.8	24600	6.7
		ST-PSD-09	7/11/2003	3990	ND (0.42)	*9.6*	52.3	0.11 J	0.069 J	1240	2.3	1.9 J	1.5 J	5650	2.2
		ST-PSD-10	7/10/2003	6680	0.74 J	***22.5***	109	0.29 J	0.12 J	1710	9	5.1 J	12.2	16100	8
		ST-PSD-53	7/19/2003	10200	**2 J**	***130***	139	0.24 J	***0.96***	2180	10.4	6.9	18.1	21600	***38.2***
		ST-PSD-54	7/17/2003	8910	***5.1 J***	***303***	144	0.26 J	***2.8***	2740	10.9	6.5	28	18900	***148***
		ST-RSD-03	7/15/2003	3820	ND (0.4)	***17.4***	68.2	0.2 J	ND (0.062)	1430	12.9	3.7 J	1.3 J	15400	4.1
		ST-RSD-04	7/15/2003	5940	ND (0.41)	***44.2***	92.5	0.23 J	0.074 J	2070	6.1	4.7 J	2.1 J	12400	6.3
		ST-RSD-05	7/14/2003	6030	ND (0.4)	***23***	105	0.24 J	ND (0.063)	1950	9.7	4.6 J	2.9	15200	3.8
		ST-RSD-06	7/14/2003	4640	0.92 J	*9.3*	92.1	0.32 J	ND (0.059)	1900	24.9	6	2.4 J	29900	4.4
		ST-RSD-07	7/12/2003	9650	ND (0.42)	***19.3***	174	0.39 J	ND (0.066)	2330	10.1	8	3.5	22000	4.3
		ST-RSD-08	7/12/2003	8350	ND (0.4)	***14.8***	158	0.39 J	ND (0.063)	2310	15.3	8.2	7.7	25300	5.7
		ST-RSD-09	7/11/2003	6190	0.56 J	***57.9***	101	0.27 J	*0.62*	1820	10	5.2	7.7	16900	***52.4***
		ST-RSD-10	7/10/2003	6850	1 J	***29***	116	0.36 J	ND (0.068)	2300	24.3	7.9	8.9	33700	9.5
		ST-RSD-53	7/19/2003	9670	***2.3 J***	***126***	127	0.25 J	***1.2***	2230	9.9	6.2	18.6	19000	***44.3***
		ST-RSD-54	7/17/2003	7770	***5.1 J***	***246***	126	0.21 J	***1.8***	1750	8.3	6.4	30	18300	***121***
	CES	GC-ABS-01	6/26/2007	NA	1.2	***27.9***	NA	0.2 J	0.44	NA	25	NA	4 J	36000	12.5
		GC-ABS-02	6/26/2007	NA	1.2	***127***	NA	ND (0.2)	***0.9***	NA	12	NA	7	26600	***45.3***
		GC-ABS-03	6/26/2007	NA	0.7 J	***25***	NA	ND (0.2)	***0.85***	NA	*42*	NA	3 J	54600	15.1
		GC-ABS-04	6/27/2007	NA	**1.7**	***67.4***	NA	0.3 J	***1.49***	NA	18	NA	10	29400	***45.8***
		GC-SS-01	6/25/2007	NA	ND (0.2)	*7.5*	NA	0.3 J	0.22 J	NA	9	NA	3 J	9320	1.89
		GC-SS-02	6/25/2007	NA	0.3 J	*6.3*	NA	0.6 J	0.12 J	NA	9	NA	2 J	13700	2.04
		GC-SS-03	6/25/2007	NA	0.3 J	***36.5***	NA	0.8 J	0.17 J	NA	10	NA	3 J	16600	2.63
	TEI	CS-SD-1	10/5/2024	NA	0.26 (0.13)	5.8 (1.3)	NA	NA	0.234 (0.053)	NA	7.81 (0.53)	NA	NA	NA	4.12 (0.13)
		CS-SD-2	10/3/2024	NA	0.038 J (0.054)	4.52 (0.54)	NA	NA	0.038 (0.022)	NA	2.49 (0.22)	NA	NA	NA	0.927 (0.054)
		CS-SD-3	10/3/2024	NA	0.069 (0.063)	*11.7 (0.63)*	NA	NA	0.062 (0.025)	NA	4.9 (0.25)	NA	NA	NA	1.53 (0.063)
		CS-SD-4	10/3/2024	NA	0.892 (0.058)	***32.7 (0.58)***	NA	NA	***1.09 (0.023)***	NA	9.05 (0.23)	NA	NA	NA	**25.6 (0.058)**
		CS-SD-5	10/4/2024	NA	0.146 (0.051)	***14.1 (0.51)***	NA	NA	0.169 (0.02)	NA	5.03 (0.2)	NA	NA	NA	2.79 (0.051)
		CS-SD-6	10/4/2024	NA	0.147 (0.045)	***16.6 (0.45)***	NA	NA	0.146 (0.018)	NA	4.76 (0.18)	NA	NA	NA	2.74 (0.045)
		CS-SD-7	10/4/2024	NA	0.355 (0.048)	***24.2 (0.48)***	NA	NA	0.538 (0.019)	NA	10.6 (0.19)	NA	NA	NA	12.1 (0.048)
		CS-SD-7 (DUP)	10/4/2024	NA	0.334 (0.054)	***24.3 (0.54)***	NA	NA	0.446 (0.022)	NA	9.1 (0.22)	NA	NA	NA	12.8 (0.054)
		CS-SD-8	10/5/2024	NA	0.406 (0.058)	***35.2 (0.58)***	NA	NA	0.316 (0.023)	NA	9.13 (0.23)	NA	NA	NA	10.7 (0.058)

Table 5
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AOI	Company	Location	Sample Date	Metls										
				Magnesium	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Vanadium	Zinc
PRG for SAP				--	--	2153	244668	--	61175	61145	--	--	61218	--
Tailings PRG				--	--	--	--	--	--	--	--	--	--	--
ODEQ Blue Mountain Region Clean Fill				--	1800	1.4	92	--	0.93	0.51	--	--	400	160
ODEQ Eco RBC FW				--	1100	0.2	18	--	--	4.5	--	--	--	123
USEPA R4 Eco SV FW Non-Narcotic Mode of Action				--	460	--	22.7	--	0.72	1	--	--	--	121
USEPA R4 Eco SV FW Aquatic Non-Narcotic Mode of Action				--	--	0.18	--	--	--	--	--	--	--	--
USEPA R4 Eco SV FW Wildlife Non-Narcotic Mode of Action				--	--	0.17	--	--	0.8	--	--	--	--	--
Granite Creek	EA	ST-PSD-03	7/15/2003	1520	162	ND (0.019)	5.5	950	0.88	0.22 J	ND (41.6)	1.8	154	23
		ST-PSD-04	7/15/2003	3330	159	ND (0.02)	4.3	2020	0.34 J	**0.58 J**	ND (41.9)	ND (0.25)	28.5	43.7
		ST-PSD-05	7/14/2003	3530	187	ND (0.021)	3.2 J	2190	0.5 J	**0.64 J**	ND (48.9)	ND (0.29)	36.6	41.9
		ST-PSD-06	7/14/2003	5550	343	0.027 J	4.4	3000	0.57	**0.54 J**	ND (50.9)	0.5 J	45.3	63.3
		ST-PSD-07	7/12/2003	3080	202	0.087	3.6 J	2100	0.4 J	**0.83 J**	ND (44.8)	0.3 J	57.5	62.6
		ST-PSD-08	7/12/2003	6100	342	0.12	5.7 J	3870	0.73	**0.63 J**	ND (68)	0.44 J	61.9	94.2
		ST-PSD-09	7/11/2003	1370	100	ND (0.019)	1.1 J	762	0.29 J	ND (0.1)	230 J	ND (0.31)	13	20.7
		ST-PSD-10	7/10/2003	2840	177	0.07	3.2 J	2000	0.63	0.49 J	79.7 J	ND (0.33)	46	50.2
		ST-PSD-53	7/19/2003	4790	364	0.11	6.2	2840	0.44 J	**1.8**	ND (45.2)	0.69 J	52.1	*150*
		ST-PSD-54	7/17/2003	3460	611	*0.32*	7.6	2400	0.8	***7.9***	70.2 J	ND (0.67)	43	***186***
		ST-RSD-03	7/15/2003	1600	171	ND (0.019)	2.2 J	1070	0.43 J	ND (0.094)	96.8 J	ND (0.29)	50.2	21.8
		ST-RSD-04	7/15/2003	3390	203	ND (0.021)	2.7 J	1320	0.35 J	**0.86 J**	120 J	ND (0.31)	29.5	34
		ST-RSD-05	7/14/2003	2600	169	ND (0.023)	3.1 J	1630	0.41 J	ND (0.094)	76 J	ND (0.29)	45.9	38.7
		ST-RSD-06	7/14/2003	2220	156	0.037 J	4.3	1420	0.63	0.24 J	ND (46.8)	1.1	113	35.6
		ST-RSD-07	7/12/2003	5160	277	0.05	4.4	3500	0.37 J	**1.9**	ND (52.2)	0.59 J	58.5	57.7
		ST-RSD-08	7/12/2003	5210	283	0.058	4.8	3330	0.34 J	**0.73 J**	ND (49.8)	0.69 J	76.2	58.1
		ST-RSD-09	7/11/2003	3130	177	0.031 J	3.2 J	1920	0.4 J	**1**	ND (44.1)	0.51 J	51.2	75.1
		ST-RSD-10	7/10/2003	3490	193	0.034 J	5.2	2410	0.58	**0.92 J**	ND (53.2)	1.4	117	64.9
		ST-RSD-53	7/19/2003	4030	360	0.12	6.5	2550	0.42 J	***4.9***	45.9	0.73 J	45.9	*148*
		ST-RSD-54	7/17/2003	3380	560	0.12	7.3	2340	0.63	***6.3***	79.5 J	0.76 J	38.3	*151*
	CES	GC-ABS-01	6/26/2007	NA	243	*0.23*	3 J	NA	0.28 J	**1.15**	NA	NA	NA	77
		GC-ABS-02	6/26/2007	NA	376	0.12 J	4 J	NA	0.28 J	**3.27**	NA	NA	NA	99
		GC-ABS-03	6/26/2007	NA	320	0.09 J	3 J	NA	0.38	**0.68**	NA	NA	NA	84
		GC-ABS-04	6/27/2007	NA	414	ND (0.05)	5	NA	0.64	**2.4**	NA	NA	NA	120
		GC-SS-01	6/25/2007	NA	165	0.07 J	1 J	NA	0.31	0.12	NA	NA	NA	25
		GC-SS-02	6/25/2007	NA	213	ND (0.04)	ND (1)	NA	0.09 J	0.05 J	NA	NA	NA	36
		GC-SS-03	6/25/2007	NA	298	0.1 JH	ND (1)	NA	0.15 J	0.13	NA	NA	NA	36
	TEI	CS-SD-1	10/5/2024	NA	NA	0.031 J (0.053)	NA	NA	NA	0.282 (0.053)	NA	NA	NA	45 (1.3)
		CS-SD-2	10/3/2024	NA	NA	ND (0.024)	NA	NA	NA	0.043 (0.022)	NA	NA	NA	16.9 (0.54)
		CS-SD-3	10/3/2024	NA	NA	*0.923 (0.027)*	NA	NA	NA	0.112 (0.025)	NA	NA	NA	29.7 (0.63)
		CS-SD-4	10/3/2024	NA	NA	0.011 J (0.029)	NA	NA	NA	**0.961 (0.023)**	NA	NA	NA	47.2 (0.58)
		CS-SD-5	10/4/2024	NA	NA	0.056 (0.025)	NA	NA	NA	**0.582 (0.02)**	NA	NA	NA	32.7 (0.51)
		CS-SD-6	10/4/2024	NA	NA	0.033 (0.021)	NA	NA	NA	0.2 (0.018)	NA	NA	NA	37.1 (0.45)
		CS-SD-7	10/4/2024	NA	NA	0.097 (0.023)	NA	NA	NA	**1.1 (0.019)**	NA	NA	NA	***168 (0.48)***
		CS-SD-7 (DUP)	10/4/2024	NA	NA	0.099 (0.024)	NA	NA	NA	**1.62 (0.022)**	NA	NA	NA	102 (0.54)
		CS-SD-8	10/5/2024	NA	NA	0.096 (0.026)	NA	NA	NA	**1.26 (0.023)**	NA	NA	NA	103 (0.58)

Table 5
Summary of Sediment Notes Analytical Results
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AOI	Company	Location	Sample Date	Metals											
				Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium (total)	Cobalt	Copper	Iron	Lead
PRG for SAP				--	4895	82	--	24468	9113	--	--	3681	489424	--	--
Tailings PRG				--	--	110	--	--	--	--	--	--	--	--	--
ODEQ Blue Mountain Region Clean Fill				--	1.3	14	950	2.6	0.69	--	190	--	120	--	21
ODEQ Eco RBC FW				--	3	6	--	--	0.6	--	37	--	36	--	35
USEPA R4 Eco SV FW Non-Narcotic Mode of Action				25000	2	9.8	20	--	1	--	43.4	50	31.6	20000	35.8
USEPA R4 Eco SV FW Aquatic Non-Narcotic Mode of Action				--	--	--	--	--	--	--	--	--	--	--	--
USEPA R4 Eco SV FW Wildlife Non-Narcotic Mode of Action				--	--	--	--	--	--	--	--	--	--	--	--

Note:
1. All concentrations reported in mg/kg (ppm); detection limits in parentheses.
2. Underlined concentrations exceed the PRG for SAP.
3. Double underlined concentrations exceed the Tailings PRG.
4. Boldfaced concentrations exceed the ODEQ Blue Mountain Region Clean Fill.
5. Italicized concentrations exceed the ODEQ Eco RBC FW.
6. Grey shaded concentrations exceed the USEPA R4 Eco SV FW Non-Narcotic Mode of Action.
7. Blue shaded concentrations exceed the USEPA R4 Eco SV FW Aquatic Non-Narcotic Mode of Action.
8. Red colored concentrations exceed the USEPA R4 Eco SV FW Wildlife Non-Narcotic Mode of Action.

CES = Cascade Earth Scienes
EA = EA Engineering, Science, and Technology, Inc.
Eco = Ecological
FW = Freshwater
ND = Not Detected
NA = Not Analyzed
J = Estimated Concentration
ODEQ = Oregon Department of Environmental Quality
PRG = Preliminary Remediation Goal
RBC = Risk-Based Concentration
SAP = Sampling and Analysis Plan
SV = Screening Value
TEI = Terraphase Engineering Inc.
USEPA R4 = United States Environmental Protection Agency Region 4

Table 6
Summary of Surface Water Analytical Results
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

				Physical Properties	Metals								
AOI	**Company**	**Location**	**Sample Date**	**Hardness (total)**	**Aluminum**	**Antimony**	**Arsenic**	**Barium**	**Cadmium**	**Calcium**	**Chromium (total)**	**Copper**	**Iron**
Eco RBC FW Aquatic Chronic Exposure				--	0.32	0.19	0.15	0.22	0.000094	120	11	0.0014	1
Eco RBC FW Aquatic Acute Exposure				--	0.69	0.9	0.34	2	0.00049	--	16	0.0023	--
Eco RBC FW Wildlife Chronic Exposure				--	--	--	--	--	--	--	--	--	--
Eco RBC FW Wildlife Acute Exposure				--	--	--	--	--	--	--	--	--	--
Cap Martin	CES	CM-AS-01	6/21/2007	NA	NA	ND (0.0004)	ND (0.0005)	NA	ND (0.0001)	9.8	ND (0.01)	ND (0.0005)	0.65
		CM-AS-02	6/21/2007	NA	NA	ND (0.0004)	0.0013	NA	0.0001 J	9.9	ND (0.01)	ND (0.0005)	2.03
Granite Creek	EA	ST-SFW-03	7/15/2003	NA	ND (0.0236)	ND (0.0047)	ND (0.0048)	0.0349 J	ND (0.0006)	5.56	ND (0.0014)	ND (0.0024)	ND (0.0333)
		ST-SFW-04	7/15/2003	NA	0.126 J	ND (0.0047)	ND (0.0048)	0.0415 J	ND (0.0006)	7.06	ND (0.0014)	ND (0.0024)	0.0941 J
		ST-SFW-05	7/13/2003	NA	ND (0.0236)	ND (0.0047)	ND (0.0048)	0.0385 J	ND (0.0006)	7.13	ND (0.0014)	ND (0.0024)	ND (0.0333)
		ST-SFW-06	7/13/2003	NA	ND (0.0236)	ND (0.0047)	ND (0.0048)	0.0456 J	ND (0.0006)	8.45	ND (0.0014)	ND (0.0024)	ND (0.0333)
		ST-SFW-07	7/12/2003	NA	ND (0.0631)	ND (0.005)	ND (0.006)	0.0455 J	ND (0.0012)	8.7	ND (0.0019)	ND (0.0033)	ND (0.0667)
		ST-SFW-08	7/12/2003	NA	ND (0.0236)	ND (0.0047)	ND (0.0048)	0.0485 J	ND (0.0006)	9.01	ND (0.0014)	ND (0.0024)	ND (0.0333)
		ST-SFW-09	7/11/2003	NA	ND (0.0631)	ND (0.005)	ND (0.006)	0.0509 J	ND (0.0012)	9.69	ND (0.0019)	ND (0.0033)	ND (0.0667)
		ST-SFW-10	7/10/2003	NA	ND (0.0631)	ND (0.005)	ND (0.006)	0.0529 J	ND (0.0012)	9.91	ND (0.0019)	ND (0.0033)	ND (0.0667)
		ST-SFW-53	7/17/2003	NA	0.0793 J	ND (0.0047)	0.0131	0.055 J	ND (0.0006)	15.3	ND (0.0014)	ND (0.0024)	ND (0.0168)
		ST-SFW-54	7/17/2003	NA	0.0264 J	ND (0.0038)	0.0096 J	0.051 J	ND (0.0003)	15.9	0.00074 J	ND (0.0014)	0.0323 J
	CES	GC-SW-01	6/25/2007	NA	NA	ND (0.0004)	0.0006 J	NA	ND (0.0001)	4.5	ND (0.01)	ND (0.0005)	0.03 J
		GC-SW-02	6/25/2007	NA	NA	ND (0.0004)	ND (0.0005)	NA	ND (0.0001)	4.5	ND (0.01)	ND (0.0005)	0.04 J
		GC-SW-03	6/5/2007	NA	NA	ND (0.0004)	0.0006 J	NA	ND (0.0001)	4.7	ND (0.01)	ND (0.0005)	0.1
	TEI	CS-SW-1	10/5/2024	18.1 (0.09)	NA	0.000036 J (0.00005)	0.00036 J (0.0005)	NA	ND (0.00002)	5.59 (0.02)	0.00011 J (0.0002)	NA	NA
		CS-SW-2	10/3/2024	19.7 (0.09)	NA	0.000025 J (0.00005)	0.00067 (0.0005)	NA	ND (0.00002)	6.07 (0.02)	0.00011 J (0.0002)	NA	NA
		CS-SW-2 (DUP)	10/3/2024	19.3 (0.09)	NA	0.000031 J (0.00005)	0.00061 (0.0005)	NA	ND (0.00002)	5.92 (0.02)	0.00011 J (0.0002)	NA	NA
		CS-SW-3	10/3/2024	21 (0.09)	NA	0.000038 J (0.00005)	0.00087 (0.0005)	NA	ND (0.00002)	6.49 (0.02)	0.00012 J (0.0002)	NA	NA
		CS-SW-4	10/3/2024	27.5 (0.09)	NA	0.000036 J (0.00005)	0.00092 (0.0005)	NA	ND (0.00002)	8.41 (0.02)	0.00014 J (0.0002)	NA	NA
		CS-SW-5	10/4/2024	31.8 (0.09)	NA	0.000098 (0.00005)	0.00178 (0.0005)	NA	0.00001 J (0.00002)	9.55 (0.02)	0.00011 J (0.0002)	NA	NA
		CS-SW-6	10/4/2024	32.3 (0.09)	NA	0.000076 (0.00005)	0.00204 (0.0005)	NA	ND (0.00002)	9.71 (0.02)	0.00011 J (0.0002)	NA	NA
		CS-SW-7	10/4/2024	36.3 (0.09)	NA	0.000104 (0.00005)	0.00199 (0.0005)	NA	0.000019 J (0.00002)	10.9 (0.02)	0.00009 J (0.0002)	NA	NA
		CS-SW-8	10/5/2024	36.7 (0.09)	NA	0.000108 (0.00005)	0.00221 (0.0005)	NA	0.00002 J (0.00002)	10.9 (0.02)	0.00011 J (0.0002)	NA	NA
Granite Creek #5	CES	GC5-AS-01	6/24/2007	NA	NA	0.0009 J	0.0046	NA	0.0007	22.7	ND (0.01)	0.0038	1.74
Golden Fraction	CES	GF-AS-01	6/25/2007	NA	NA	0.0007 J	0.0119	NA	ND (0.0001)	28.2	ND (0.01)	0.0007 J	1.87
Lwr Mon'tl	EA	SP-SFW-19	7/19/2003	NA	ND (0.0631)	ND (0.005)	0.0214	0.0995 J	ND (0.0012)	22.6	ND (0.0019)	ND (0.0033)	ND (0.0667)
	CES	MMDGA-AS-01	9/28/2009	NA	NA	NA	0.0218	NA	NA	NA	NA	NA	0.13
		MMDGA-SP-02	9/28/2009	NA	NA	NA	0.0199	NA	NA	NA	NA	NA	0.06
		MMDGA-SW-02	9/28/2009	NA	NA	NA	0.0242	NA	NA	NA	NA	NA	ND (0.02)
Upr Mon'tl	EA	SP-SFW-18	7/9/2003	NA	ND (0.0631)	ND (0.005)	0.0818	0.0677 J	ND (0.0012)	17.4	ND (0.0019)	ND (0.0033)	ND (0.0667)
	EA	SP-SFW-51	7/10/2003	NA	ND (0.0631)	ND (0.005)	ND (0.006)	0.0756 J	ND (0.0012)	17.8	ND (0.0019)	ND (0.0033)	ND (0.0667)
	CES	MMDGA-AS-02	9/28/2009	NA	NA	NA	0.0272	NA	NA	NA	NA	NA	0.33
	CES	MMDGA-SP-01	9/28/2009	NA	NA	NA	0.105	NA	NA	NA	NA	NA	5.61
	CES	MMDGA-SW-01	9/28/2009	NA	NA	NA	0.051	NA	NA	NA	NA	NA	4.22

Table 6
Summary of Surface Water Analytical Results
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

				Metals								
AOI	**Company**	**Location**	**Sample Date**	**Lead**	**Magnesium**	**Manganese**	**Mercury**	**Potassium**	**Selenium**	**Silver**	**Sodium**	**Zinc**
Eco RBC FW Aquatic Chronic Exposure				0.00054	82	0.093	0.000012	53	0.0046	0.0001	680	0.036
Eco RBC FW Aquatic Acute Exposure				0.014	--	1.7	0.0014	--	0.02	0.0003	--	0.036
Eco RBC FW Wildlife Chronic Exposure				--	--	--	0.0000013	--	--	--	--	--
Eco RBC FW Wildlife Acute Exposure				--	--	--	0.000012	--	--	--	--	--
Cap Martin	CES	CM-AS-01	6/21/2007	0.0001 J	2	0.021 J	0.00000095	NA	ND (0.0001)	ND (0.00005)	NA	1.31
		CM-AS-02	6/21/2007	0.0001 J	2.1	0.026 J	**0.00000574**	NA	ND (0.0001)	ND (0.00005)	NA	ND (0.01)
Granite Creek	EA	ST-SFW-03	7/15/2003	ND (0.0013)	0.998 J	ND (0.0007)	ND (0.0001)	1.21 J	ND (0.0034)	ND (0.0022)	2.81 J	0.002 J
		ST-SFW-04	7/15/2003	ND (0.0013)	1.32 J	0.0057 J	ND (0.0001)	1.75 J	ND (0.0034)	ND (0.0022)	3.16 J	0.0026 J
		ST-SFW-05	7/13/2003	ND (0.0013)	1.33 J	0.00088 J	ND (0.0001)	2.34 J	ND (0.0034)	ND (0.0022)	3.26 J	0.0025 J
		ST-SFW-06	7/13/2003	ND (0.0013)	1.72 J	0.00072 J	ND (0.0001)	1.99 J	ND (0.0034)	ND (0.0022)	3.22 J	0.0023 J
		ST-SFW-07	7/12/2003	0.0017 J	1.76 J	ND (0.0019)	ND (0.0001)	1.59 J	ND (0.0017)	ND (0.0029)	3.16 J	0.0029 J
		ST-SFW-08	7/12/2003	ND (0.0013)	1.82 J	0.0011 J	ND (0.0001)	2.67 J	ND (0.0034)	ND (0.0022)	3.42 J	0.003 J
		ST-SFW-09	7/11/2003	ND (0.0015)	2.01 J	ND (0.0019)	ND (0.0001)	1.62 J	ND (0.0017)	ND (0.0029)	3.24 J	0.0033 J
		ST-SFW-10	7/10/2003	ND (0.0015)	2.07 J	ND (0.0019)	ND (0.0001)	1.63 J	ND (0.0017)	ND (0.0029)	3.14 J	0.0035 J
		ST-SFW-53	7/17/2003	ND (0.0013)	3.54 J	0.0103 J	***0.0002 J***	1.87 J	ND (0.0017)	ND (0.0022)	3.38 J	0.0031 J
		ST-SFW-54	7/17/2003	ND (0.0013)	4.04 J	0.0067 J	***0.0001 J***	2.49 J	ND (0.0017)	ND (0.0009)	3.65 J	ND (0.0057)
	CES	GC-SW-01	6/25/2007	0.0001 J	0.7 J	ND (0.005)	ND (0.0000001)	NA	ND (0.0001)	ND (0.00005)	NA	ND (0.01)
		GC-SW-02	6/25/2007	ND (0.0001)	0.8 J	ND (0.005)	0.00000048	NA	ND (0.0001)	ND (0.00005)	NA	0.01 J
		GC-SW-03	6/5/2007	0.0001 J	0.9 J	ND (0.005)	0.00000048	NA	ND (0.0001)	ND (0.00005)	NA	0.01 J
	TEI	CS-SW-1	10/5/2024	0.000013 J (0.00002)	0.996 (0.01)	NA	ND (0.0002)	NA	NA	ND (0.00002)	NA	ND (0.002)
		CS-SW-2	10/3/2024	0.000012 J (0.00002)	1.11 (0.01)	NA	ND (0.0002)	NA	NA	ND (0.00002)	NA	ND (0.002)
		CS-SW-2 (DUP)	10/3/2024	0.000007 J (0.00002)	1.09 (0.01)	NA	ND (0.0002)	NA	NA	ND (0.00002)	NA	ND (0.002)
		CS-SW-3	10/3/2024	0.000012 J (0.00002)	1.17 (0.01)	NA	ND (0.0002)	NA	NA	ND (0.00002)	NA	ND (0.002)
		CS-SW-4	10/3/2024	ND (0.00002)	1.59 (0.01)	NA	ND (0.0002)	NA	NA	ND (0.00002)	NA	ND (0.002)
		CS-SW-5	10/4/2024	0.000018 J (0.00002)	1.93 (0.01)	NA	ND (0.0002)	NA	NA	ND (0.00002)	NA	0.0018 J (0.002)
		CS-SW-6	10/4/2024	0.000013 J (0.00002)	1.96 (0.01)	NA	ND (0.0002)	NA	NA	ND (0.00002)	NA	0.0007 J (0.002)
		CS-SW-7	10/4/2024	0.000022 (0.00002)	2.2 (0.01)	NA	ND (0.0002)	NA	NA	ND (0.00002)	NA	0.0008 J (0.002)
		CS-SW-8	10/5/2024	0.000084 (0.00002)	2.31 (0.01)	NA	ND (0.0002)	NA	NA	ND (0.00002)	NA	0.0008 J (0.002)
Granite Creek #5	CES	GC5-AS-01	6/24/2007	0.009	4.9	0.01 J	***0.000141***	NA	0.0005 J	0.00009 J	NA	0.02 J
Golden Fraction	CES	GF-AS-01	6/25/2007	0.0002 J	6.7	0.374	**0.00000194**	NA	ND (0.0001)	ND (0.00005)	NA	ND (0.01)
Lwr Mon'tl	EA	SP-SFW-19	7/19/2003	0.0023 J	7.15	0.0067 J	ND (0.0001)	2.72 J	0.0026 J	ND (0.0029)	3.31 J	0.0156 J
	CES	MMDGA-AS-01	9/28/2009	ND (0.0001)	NA	NA	NA	NA	NA	NA	NA	0.004 J
		MMDGA-SP-02	9/28/2009	ND (0.0001)	NA	NA	NA	NA	NA	NA	NA	0.004 J
		MMDGA-SW-02	9/28/2009	0.0003 J	NA	NA	NA	NA	NA	NA	NA	0.009 J
Upr Mon'tl	EA	SP-SFW-18	7/9/2003	ND (0.0015)	4.66 J	0.0029 J	ND (0.0000001)	2.44 J	ND (0.0017)	ND (0.0029)	2.94 J	0.0276
	EA	SP-SFW-51	7/10/2003	0.0021 J	4.53 J	0.0554	ND (0.0000001)	1.61 J	ND (0.0017)	ND (0.0029)	2.63 J	0.005 J
	CES	MMDGA-AS-02	9/28/2009	0.0004 J	NA	NA	NA	NA	NA	NA	NA	0.014
	CES	MMDGA-SP-01	9/28/2009	0.0294	NA	NA	NA	NA	NA	NA	NA	0.12
	CES	MMDGA-SW-01	9/28/2009	0.0118	NA	NA	NA	NA	NA	NA	NA	0.028

Table 6
Summary of Surface Water Analytical Results
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

AOI	Company	Location	Sample Date	Physical Properties	Metals								
				Hardness (total)	Aluminum	Antimony	Arsenic	Barium	Cadmium	Calcium	Chromium (total)	Copper	Iron
Eco RBC FW Aquatic Chronic Exposure				--	0.32	0.19	0.15	0.22	0.000094	120	11	0.0014	1
Eco RBC FW Aquatic Acute Exposure				--	0.69	0.9	0.34	2	0.00049	--	16	0.0023	--
Eco RBC FW Wildlife Chronic Exposure				--	--	--	--	--	--	--	--	--	--
Eco RBC FW Wildlife Acute Exposure				--	--	--	--	--	--	--	--	--	--

Note:
1. All concentrations reported in mg/L; detection limits in parentheses.
2. Only compounds with at least one detection are shown.
3. The numbers presented for Chromium (total) are the criteria established by ODEQ for Chromium VI.
4. Grey-shaded concentrations exceed the Eco RBC FW Aquatic Chronic Exposure.
5. Underlined concentrations exceed the Eco RBC FW Aquatic Acute Exposure.
6. Boldfaced concentrations exceed the Eco RBC FW Wildlife Chronic Exposure.
7. Italicized concentrations exceed the Eco RBC FW Wildlife Acute Exposure.

CES = Cascade Earth Scienes
EA = EA Engineering, Science, and Technology, Inc.
Eco = Ecological
FW = Freshwater
ND = Not Detected
NA = Not Analyzed
J = Estimated Concentration
Mon'tl = Monumental
ODEQ =Oregon Department of Environmental Quality
RBC = Risk-Based Concentration
TEI = Terraphase Engineering Inc.

Table 7
In Vitro Bioaccessibility (IVBA) and Relative Bioavailability (RBA) Calculations
Supplemental Site Investigation Report
Upper Granite Creek Watershed Mines
Wallowa-Whitman National Forest, Oregon

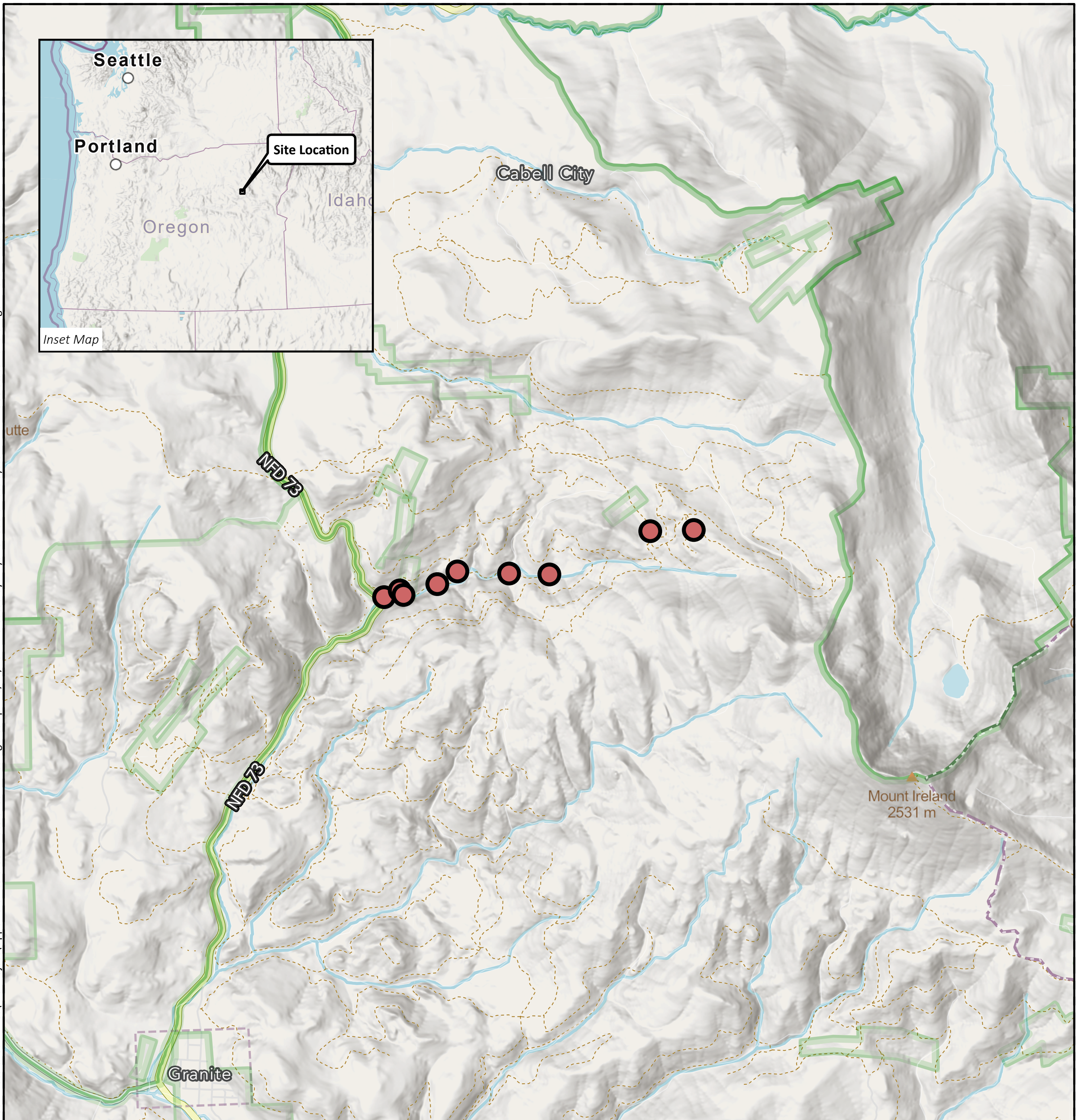
Material	Waste Rock	Waste Rock	Waste Rock	Waste Rock	Waste Rock	Waste Rock	Waste Rock	Native Soil	Native Soil	Native Soil	Tailings	Tailings
Location	**CEM-WRA-2**	**CM-WRC-4**	**GC6-WRA-2**	**LMM-WRA-3**	**UMM-WRA-1**	**UUMM-WRA-3**	**UUMM-WRA-3**	**GC5-WRA-4-DS**	**GF-WRD-4-DS**	**TL-WRA-1-DS-2**	**UMM-TLA-6**	**UMM-TLB-1**
Mine Site	**Central**	**Cap Martin**	**Granite Creek #6**	**Lwr Mon'tl**	**Upr Mon'tl**	**Upr Upr Mon'tl**	**Upr Upr Mon'tl**	**Granite Creek #5**	**Golden Fraction**	**Tillicum**	**Upr Mon'tl**	**Upr Mon'tl**
Depth (ft bgs)	**0.5 - 1.0**	**0.5 - 1.0**	**0.5 - 1.0**	**0.5 - 1.0**	**0.5 - 1.0**	**0.5 - 1.0**	**0.5 - 1.0**	**0.5 - 1.0**	**0.5 - 1.0**	**0.5 - 1.0**	**0.5 - 1.0**	**0.5 - 1.0**
Sample Date	**10/5/2024**	**10/3/2024**	**10/4/2024**	**10/3/2024**	**10/2/2024**	**10/2/2024**	**10/2/2024**	**10/4/2024**	**10/5/2024**	**10/4/2024**	**10/2/2024**	**10/2/2024**
Comments							**Field Duplicate**					
Metals												
Arsenic, IVBA	44.5	33.1	29.3	16.6	12.7	176	162	10.4	12.3	14.4	1350	1840
Arsenic, Total IVBA	794	650	759	328	1590	3440	3280	221	137	550	5560	4420
IVBA fraction:	0.056	0.051	0.039	0.051	0.0080	0.051	0.049	0.047	0.090	0.026	0.24	0.42
RBA fraction:	0.074	0.070	0.060	0.070	0.036	0.070	0.069	0.067	0.10	0.051	0.22	0.36

RBA: 0.077 *Waste Rock/Native Soil*

RBA: 0.36 *Tailings*

Note:
1 All concentrations reported in mg/kg (ppm).
2 Arsenic, IVBA is the bioaccessible arsenic concentration in soil.
3 Arsenic, Total IVBA is the total arsenic concentration in soil.
IVBA = In Vitro Bioaccessibility
Lwr = lower
Mon'tl = monumental
RBA = Relative Bioavailability
Upr = upper

Figures



0 2,500 5,000 10,000
Feet

1 inch = 5,000 feet

N

Legend

Mine Sites

Base Map: Open Street Maps

SAFETY FIRST

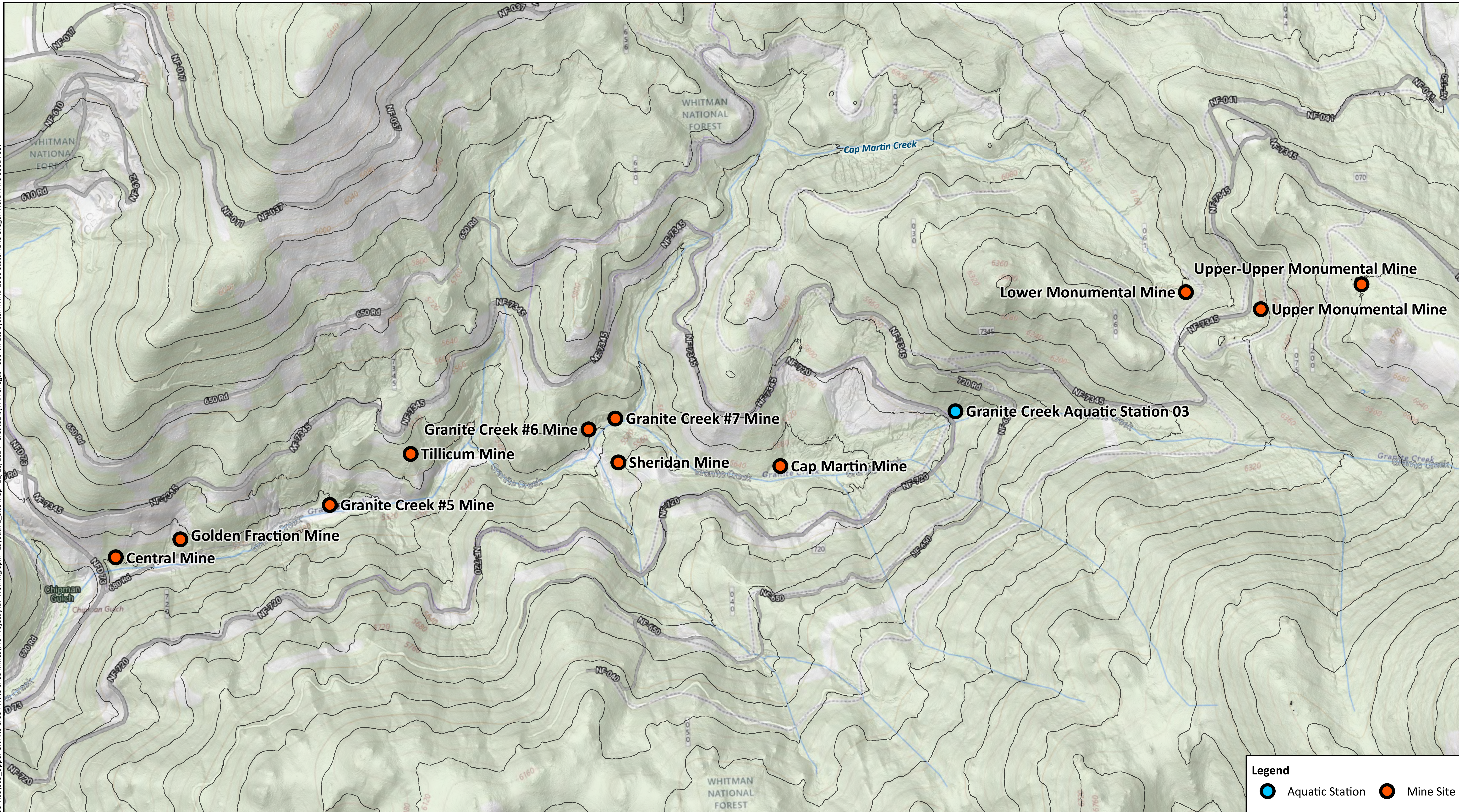
terraphase engineering

CLIENT:	USDA Forest Service
PROJECT:	Upper Granite Creek Watershed Mines Granite, Oregon
PROJECT NUMBER:	O031.005

Site Location

FIGURE 1

File: N:\GIS\Prj\O031_USDA Forest Service\005_Upper Granite Creek Watershed Mines\Pro Project\Upper Granite Creek Watershed Mines Figures.aprx 8/21/2024 Created by: BryanO Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet



Basemap Source: USGS Topo

0 400 800 1,600 Feet

1 inch = 800 feet

N

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CLIENT: USDA Forest Service

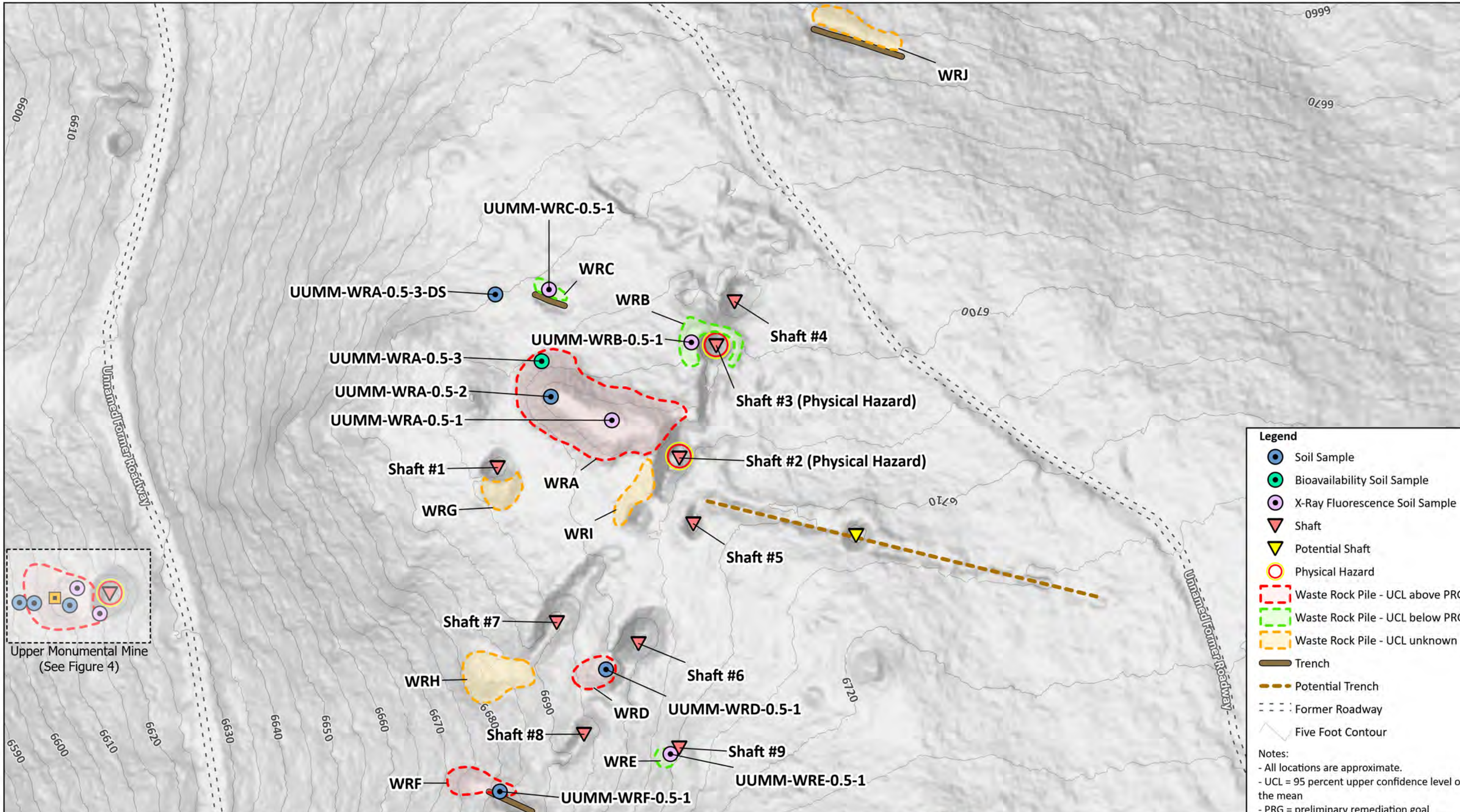
PROJECT: Upper Granite Creek Watershed Mines Granite, Oregon

PROJECT NUMBER: O031.005

Site Layout

FIGURE 2

File: N:\GIS\Prj\O031_USDA Forest Service\005_Upper Granite Creek Watershed Mines\Pro Project\ALV Working.aprx Layout:F2_Site Map 12/10/2024 Created by: A.Venegas Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet



0 25 50 100 Feet

1 inch = 50 feet

N

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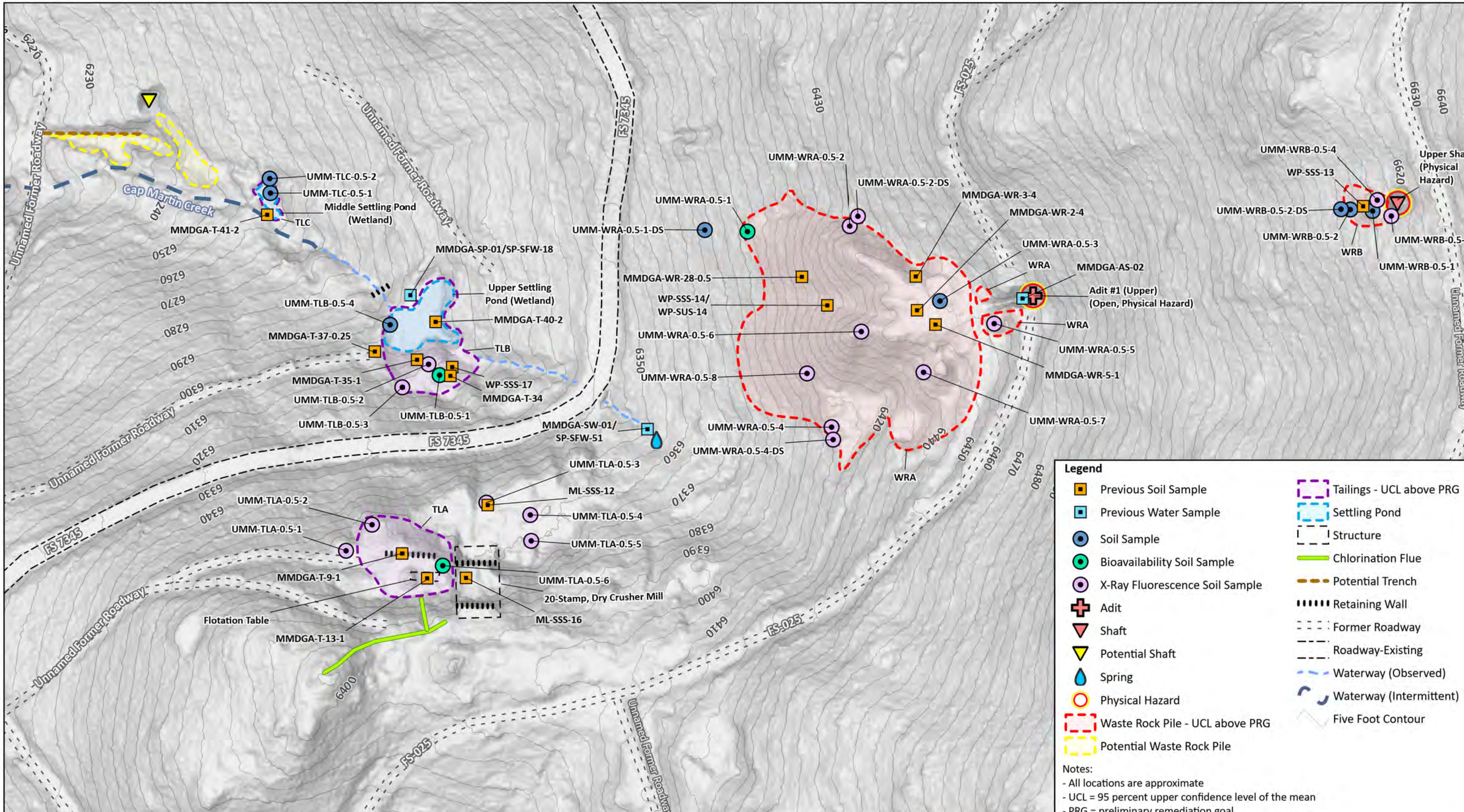
terraphase engineering

CLIENT:	USDA Forest Service
PROJECT:	Upper Granite Creek Watershed Mines, Granite, Oregon
PROJECT NUMBER:	O031.005

Upper-Upper Monumental Mine

FIGURE 3



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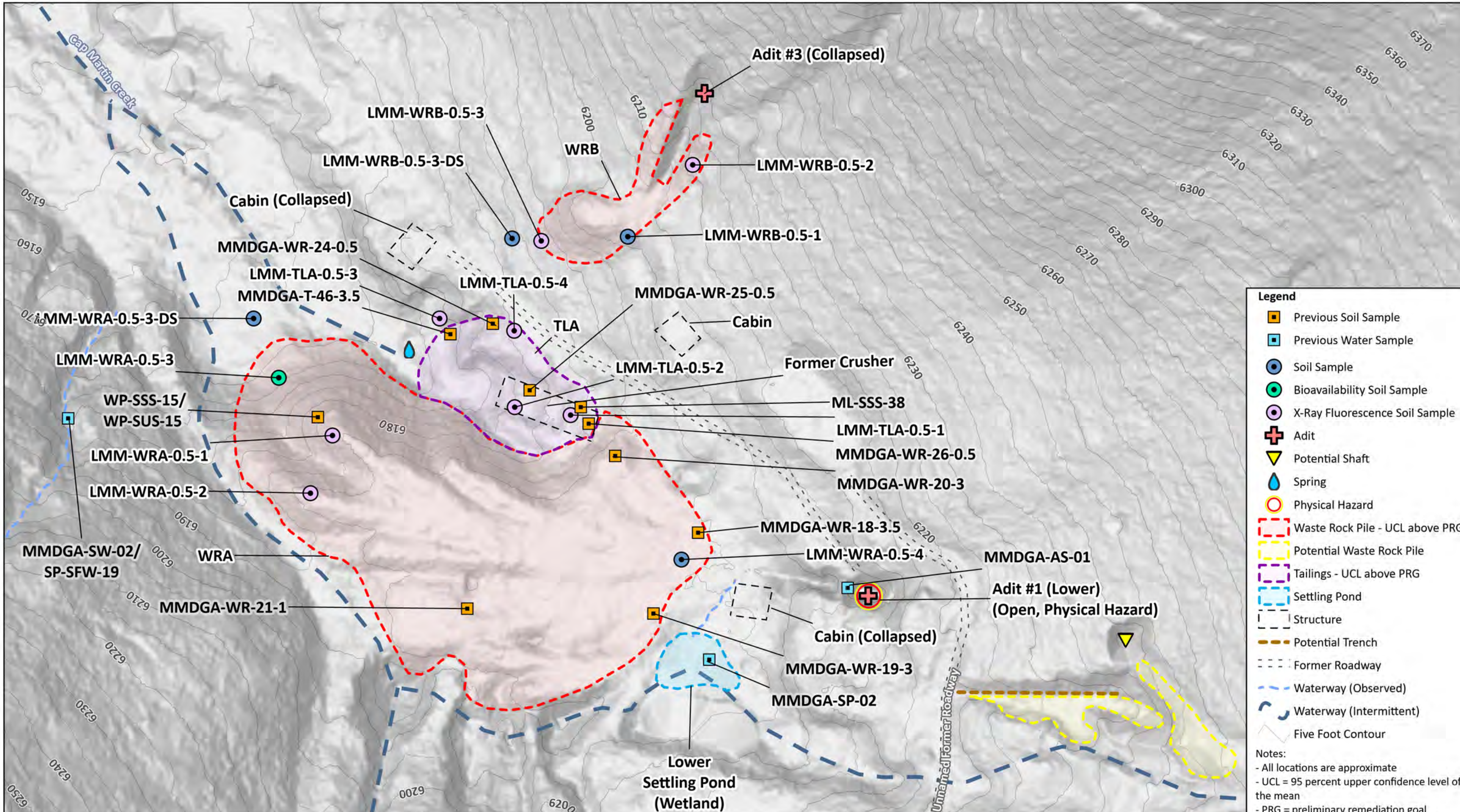
CLIENT: USDA Forest Service

PROJECT: Upper Granite Creek Watershed Mines Granite, Oregon

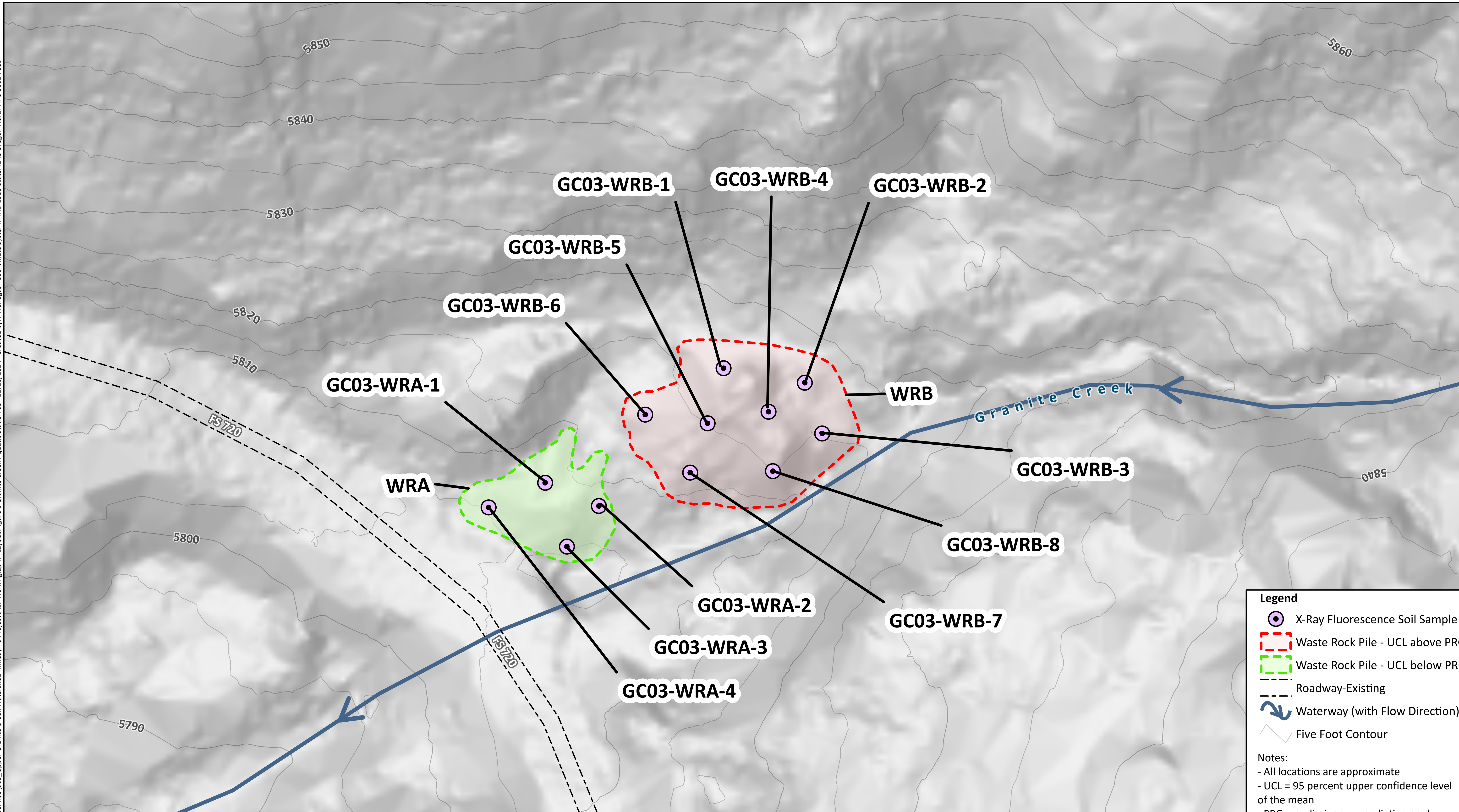
PROJECT NUMBER: O031.005

Upper Monumental Mine

FIGURE 4



SAFETY FIRST	CLIENT: USDA Forest Service	**Lower Monumental Mine**
terraphase engineering	PROJECT: Upper Granite Creek Watershed Mines, Granite, Oregon	
	PROJECT NUMBER: O031.005	**FIGURE 5**



0 10 20 40 Feet

1 inch = 20 feet

N

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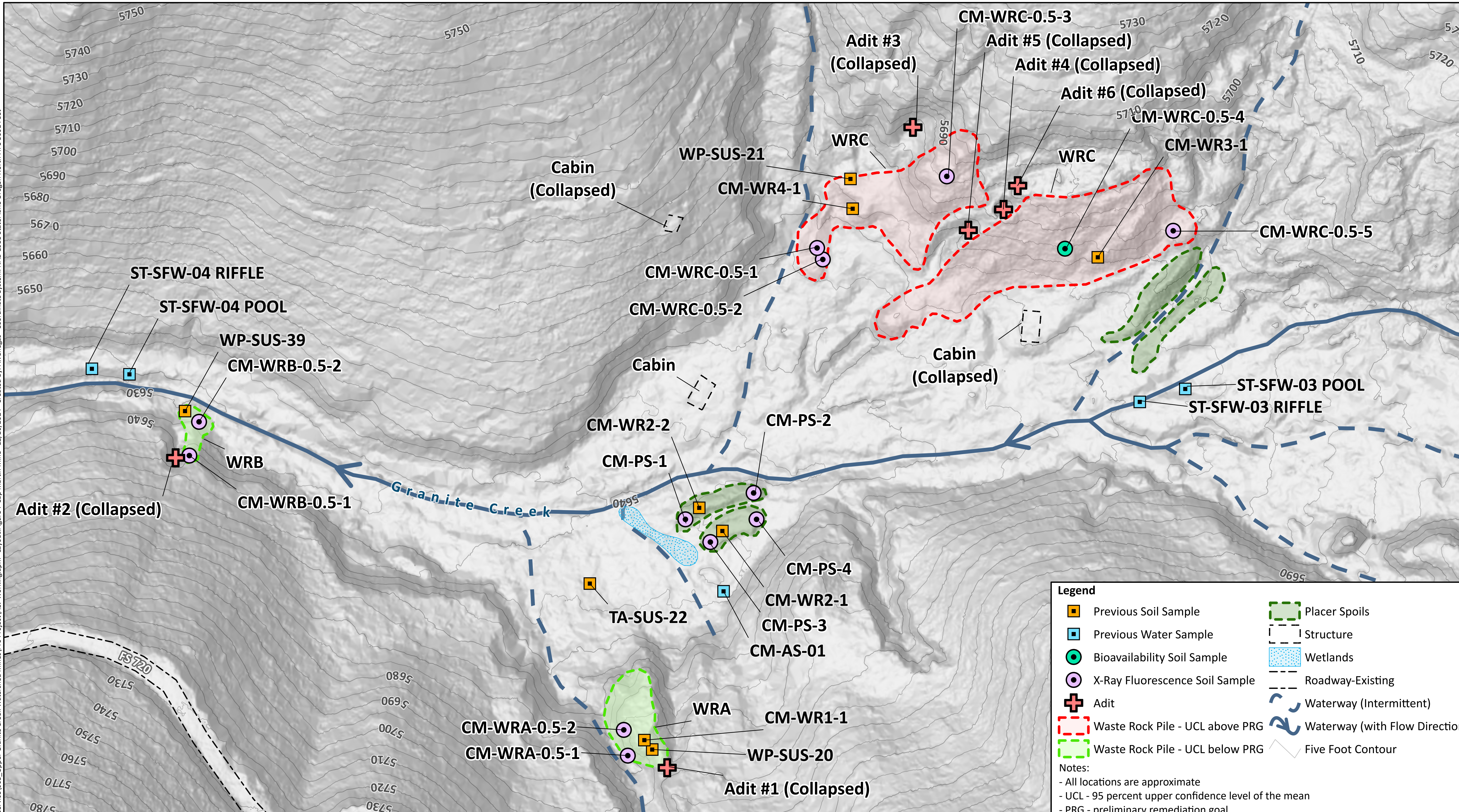
PROJECT:	Upper Granite Creek Watershed Mines Granite, Oregon
PROJECT NUMBER:	O031.005

Granite Creek Aquatic Station 03

FIGURE 6

File: N:\GIS\Prj\O031_USDA Forest Service\005_Upper Granite Creek Watershed Mines\Pro Project\ALV Working.aprx Layout:Figure 6 Granite Creek Aquatic Station 03 12/10/2024 Created by: A.Venegas Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet



0 40 80 160 Feet

1 inch = 80 feet

N

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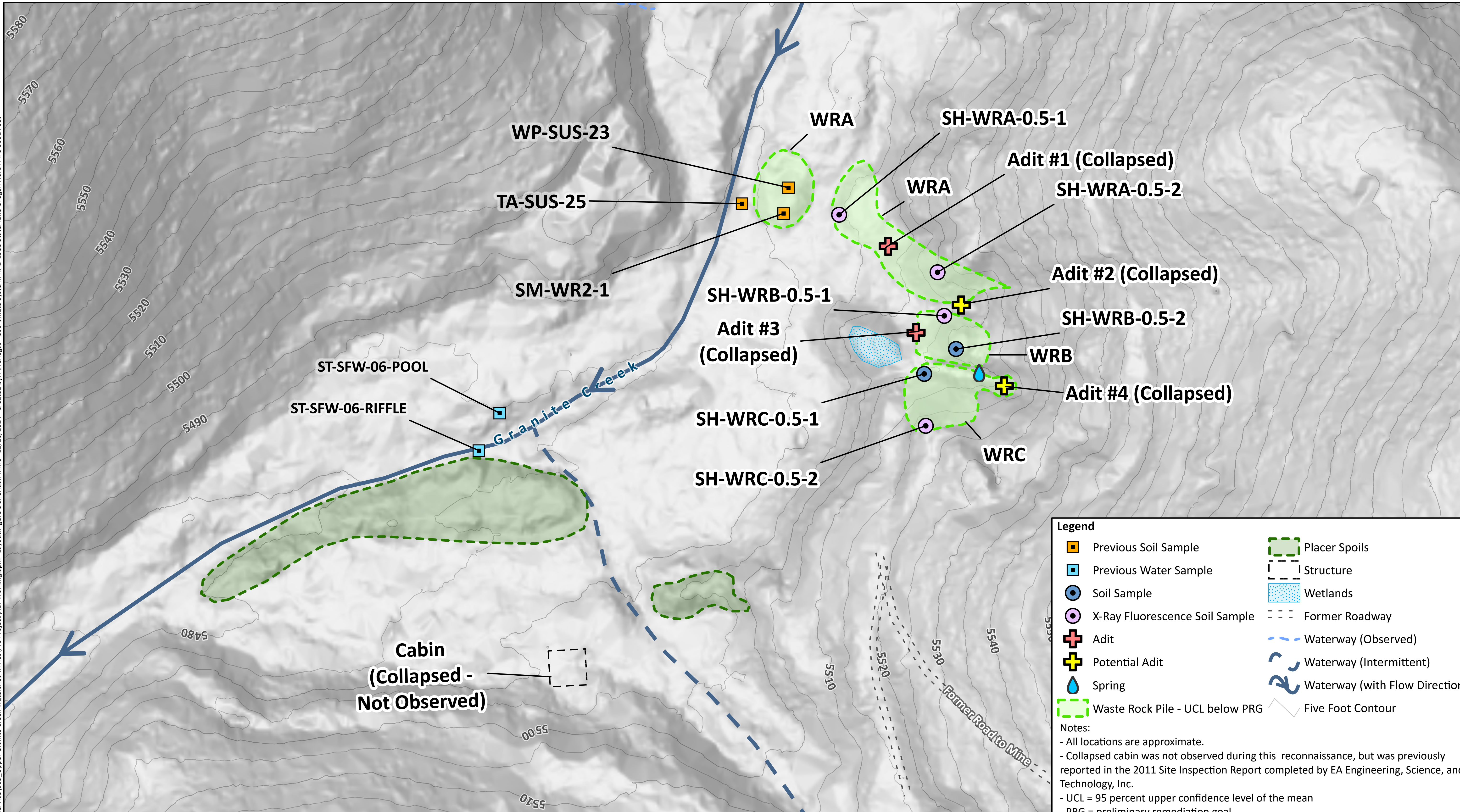
CLIENT:	USDA Forest Service
PROJECT:	Upper Granite Creek Watershed Mines Granite, Oregon
PROJECT NUMBER:	O031.005

Cap Martin Mine

FIGURE 7

File: N:\GIS\Prj\O031_USDA Forest Service\005_Upper Granite Creek Watershed Mines\Pro Project\ALV Working.aprx Layout:Figure 7 Cap Martin Mine 12/10/2024 Created by: A.Venegas Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet



0 20 40 80 Feet

1 inch = 40 feet

N

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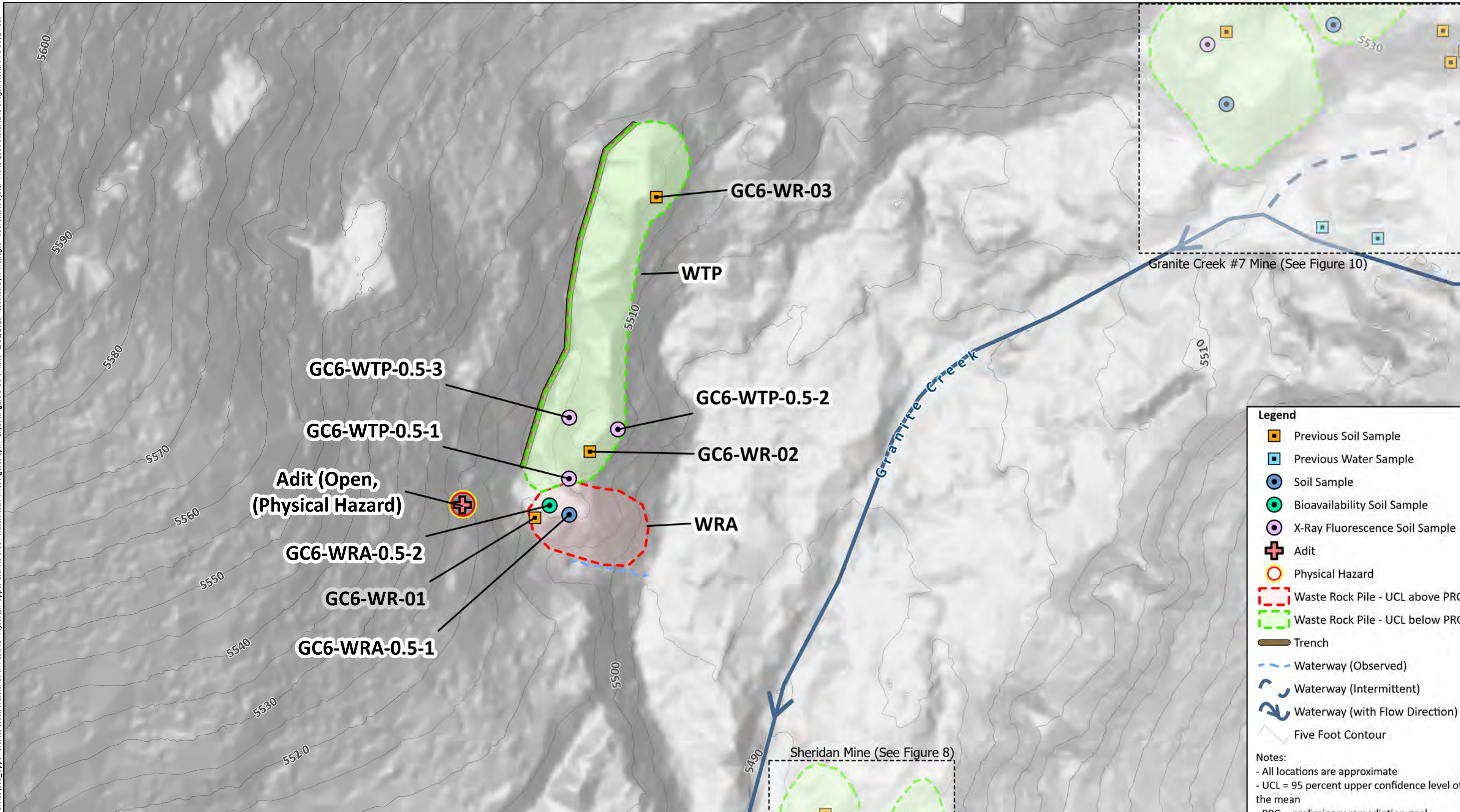
CLIENT:	USDA Forest Service
PROJECT:	Upper Granite Creek Watershed Mines Granite, Oregon
PROJECT NUMBER:	O031.005

Sheridan Mine

FIGURE 8

File: N:\GIS\Prj\O031_USDA Forest Service\005_Upper Granite Creek Watershed Mines\Pro Project\ALV Working.aprx Layout:Figure 8 Sheridan Mine 12/10/2024 Created by: A.Venegas Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet



0 15 30 60 Feet

1 inch = 30 feet

N

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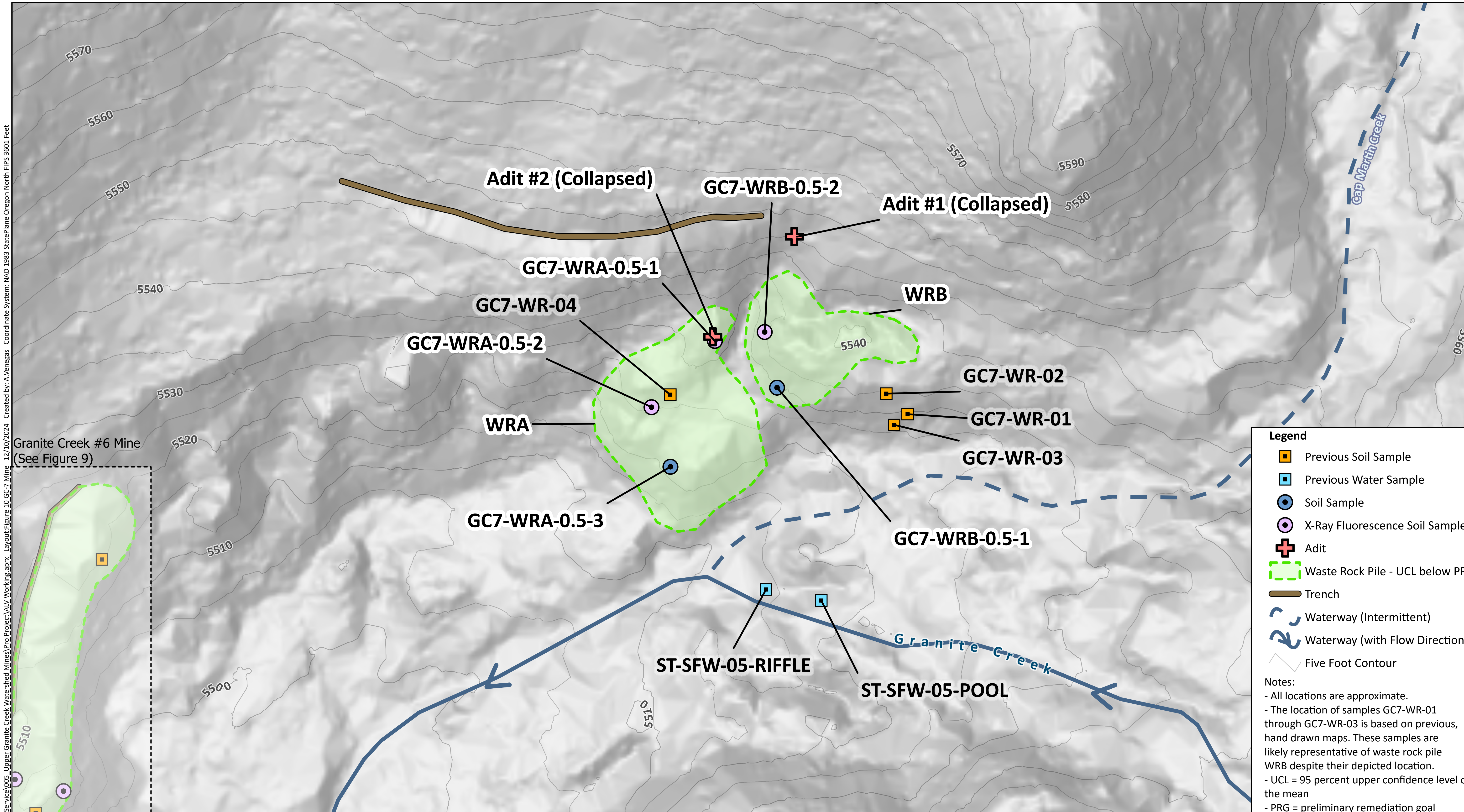
CLIENT:	USDA Forest Service
PROJECT:	Upper Granite Creek Watershed Mines, Granite, Oregon
PROJECT NUMBER:	O031.005

Granite Creek #6 Mine

FIGURE 9



File: N:\GIS\Prj\O031_USDA Forest Service\005_Upper Granite Creek Watershed Mines\Pro Project\ALV Working.aprx Layout: Figure 10 GC7 Mine 12/10/2024 Created by: A.Venegas Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet

0 15 30 60 Feet

1 inch = 30 feet

N

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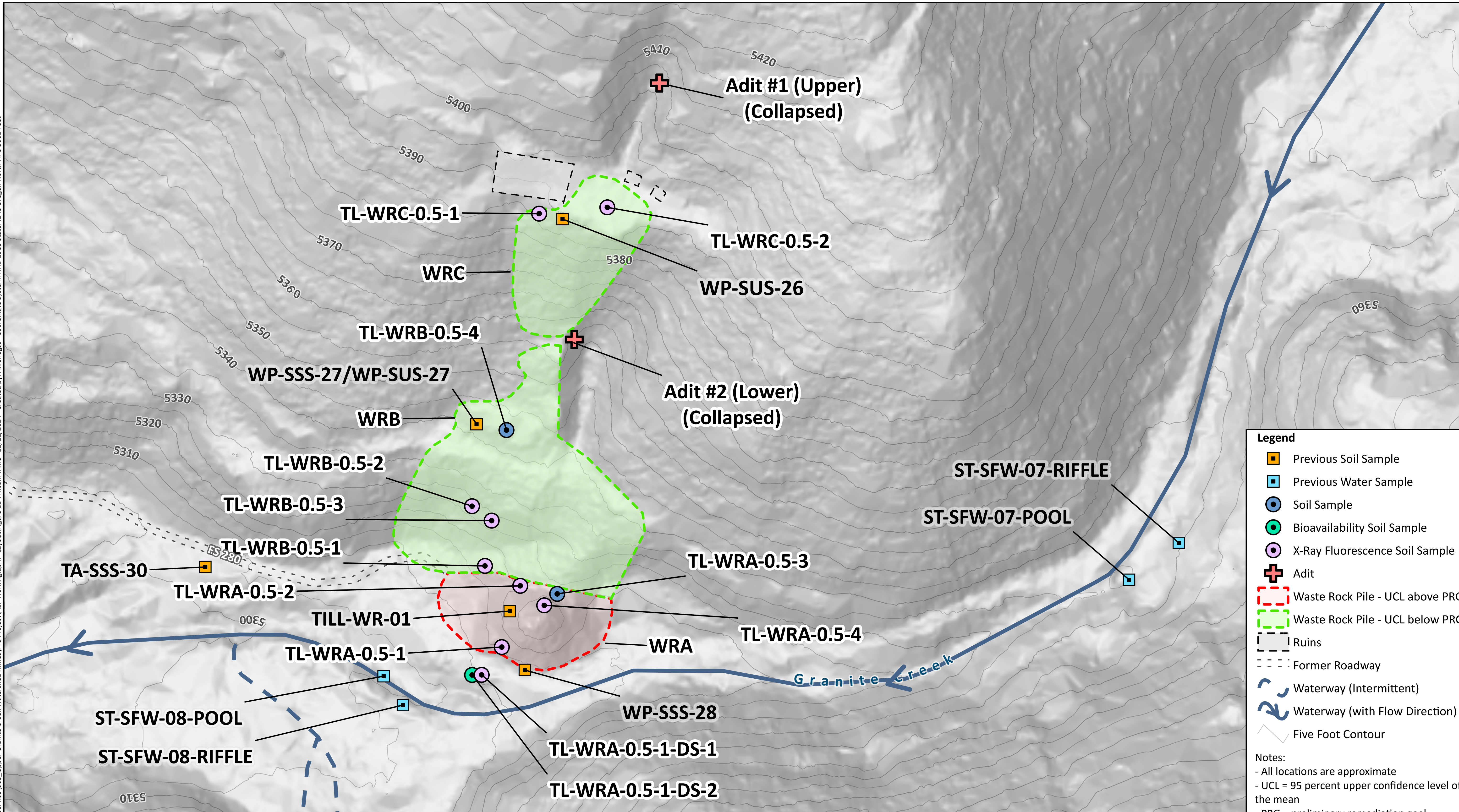
CLIENT: USDA Forest Service

PROJECT: Upper Granite Creek Watershed Mines, Granite, Oregon

PROJECT NUMBER: O031.005

Granite Creek #7 Mine

FIGURE 10



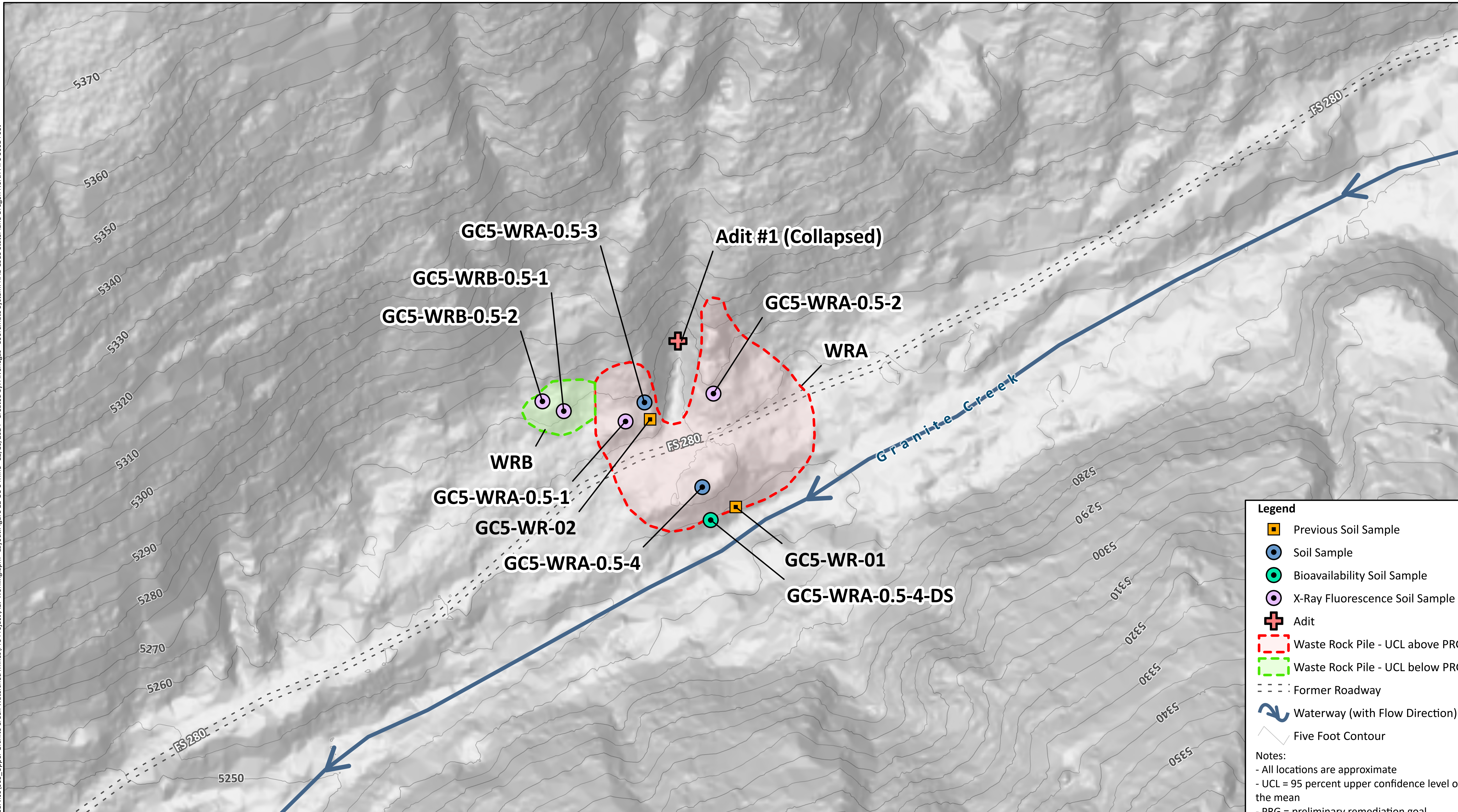
0 20 40 80 Feet

1 inch = 40 feet

N

SAFETY FIRST	CLIENT: USDA Forest Service	Tillicum Mine
terraphase engineering	PROJECT: Upper Granite Creek Watershed Mines, Granite, Oregon PROJECT NUMBER: O031.005	FIGURE 11

File: N:\GIS\Prj\O031_USDA Forest Service\005_Upper Granite Creek Watershed Mines\Pro Project\ALV Working.aprx Layout:Figure 11 Tillicum Mine 12/11/2024 Created by: A.Venegas Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet



0 20 40 80 Feet

1 inch = 40 feet

N

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CLIENT: USDA Forest Service

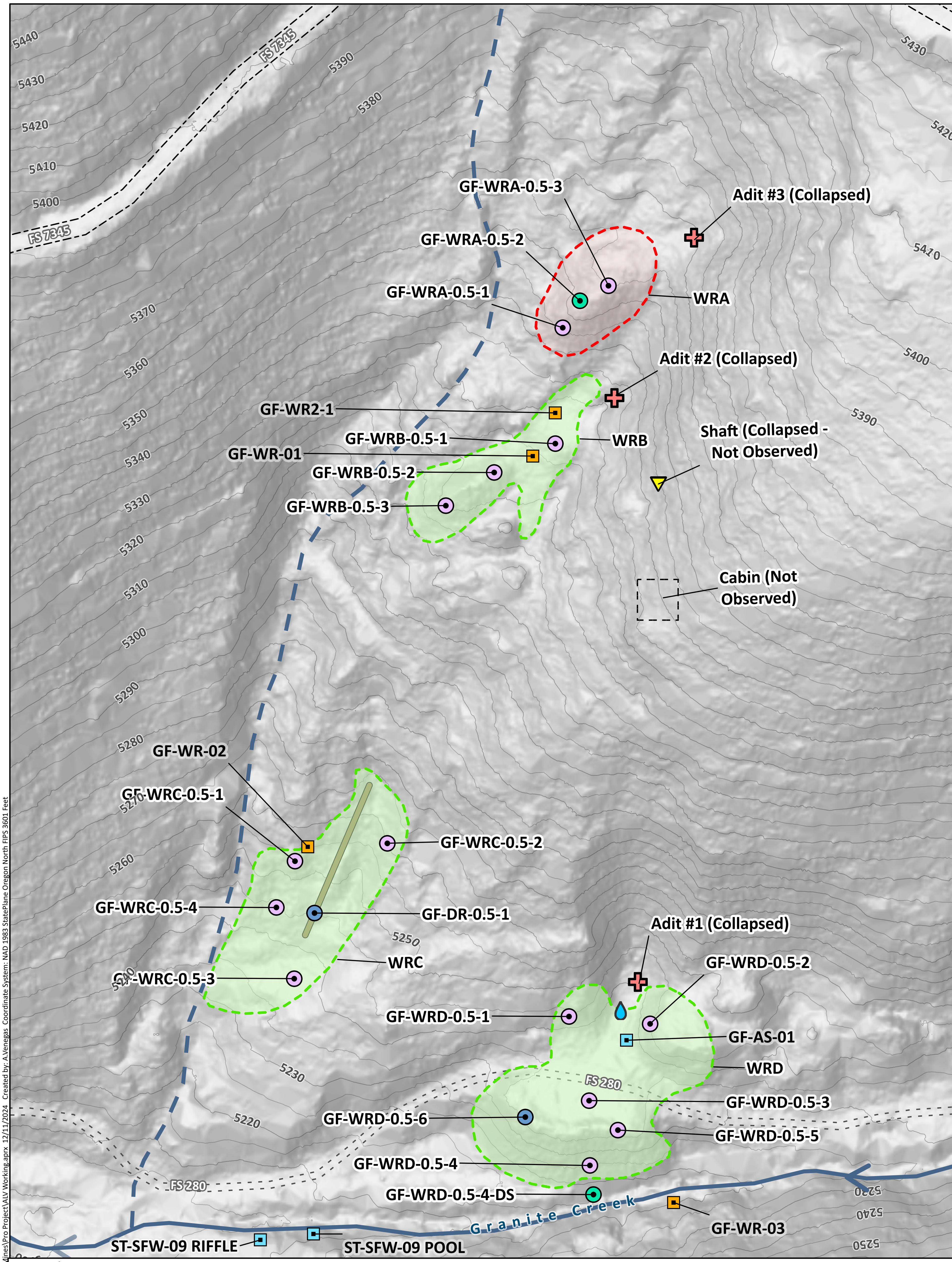
PROJECT: Upper Granite Creek Watershed Mines Granite, Oregon

PROJECT NUMBER: O031.005

Granite Creek #5 Mine

FIGURE 12

File: N:\GIS\Prj\O031_USDA Forest Service\005_Upper Granite Creek Watershed Mines\Pro Project\ALV Working.aprx Layout:Figure 12 GC-5 Mine 12/10/2024 Created by: A.Venegas Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet



Legend

- Previous Soil Sample
- Previous Water Sample
- Soil Sample
- Bioavailability Soil Sample
- X-Ray Fluorescence Soil Sample
- Adit
- Potential Shaft
- Spring
- Waste Rock Pile - UCL above PRG
- Waste Rock Pile - UCL below PRG
- Structure
- Trench
- Former Roadway
- Roadway-Existing
- Waterway (with Flow Direction)
- Waterway (Intermittent)
- Five Foot Contour

Notes:
- All locations are approximate.
- Cabin and collapsed adit were not observed during this reconnaissance, but were previously reported in the 2011 Site Inspection Report completed by EA Engineering, Science, and Technology, Inc.
- UCL = 95 percent upper confidence level of the mean
- PRG = preliminary remediation goal

N

0 20 40 80 Feet

1 inch = 50 feet

SAFETY FIRST

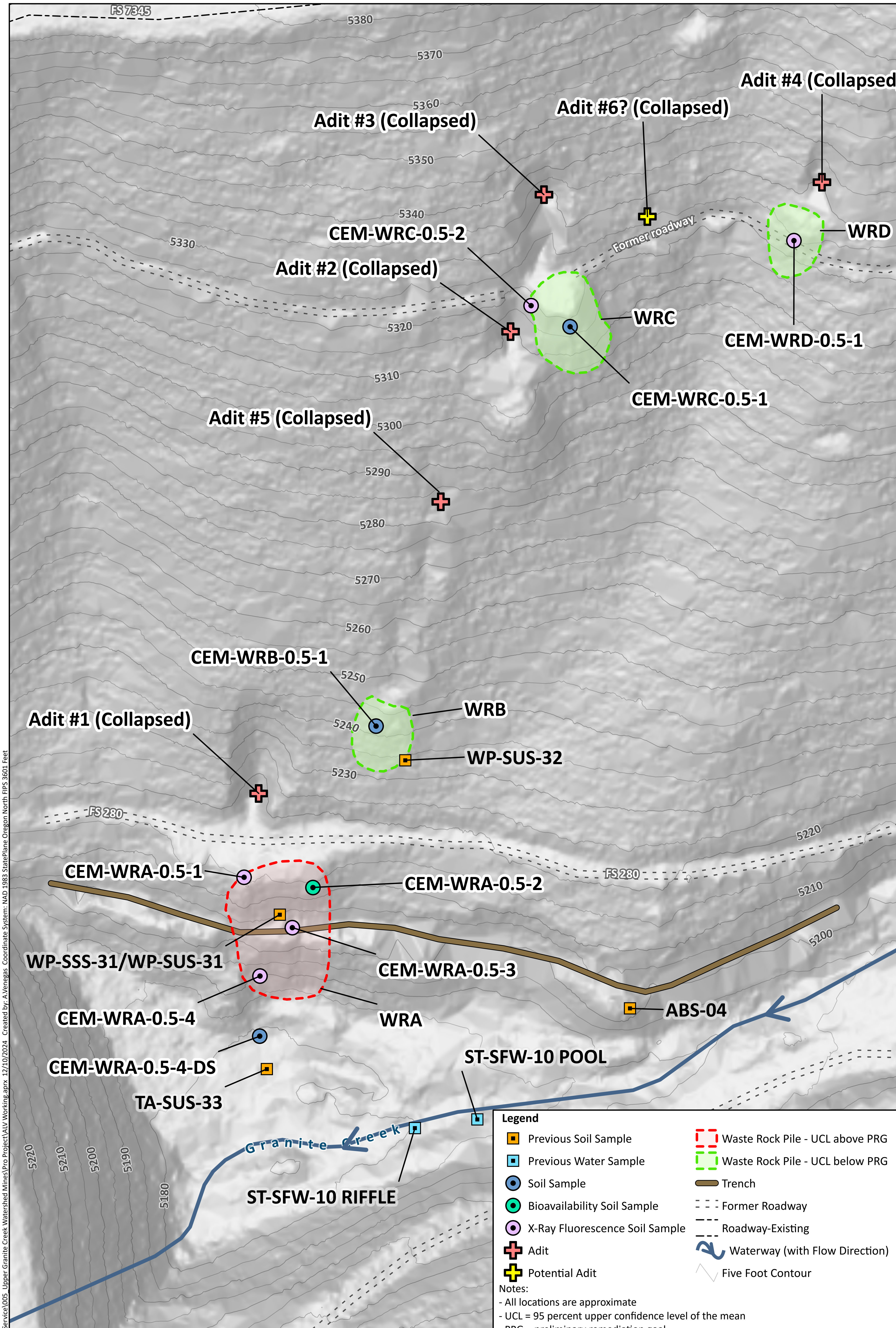
terraphase engineering

CLIENT:	USDA Forest Service
PROJECT:	Upper Granite Creek Watershed Mines Granite, Oregon
PROJECT NUMBER:	O031.005

Golden Fraction Mines

FIGURE 13

File: N:\GIS\Prj\O031_USDA Forest Service\005_Upper Granite Creek Watershed Mines\Pro Project\ALV Working.aprx 12/11/2024 Created by: A.Venegas Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet



File: N:\GIS\Prj\O031_USDA Forest Service\005_Upper Granite Creek Watershed Mines\Pro Project\ALV Working.aprx 12/10/2024 Created by: A.Venegas Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet

N

0 15 30 60 Feet

1 inch = 40 feet

SAFETY FIRST

terraphase engineering

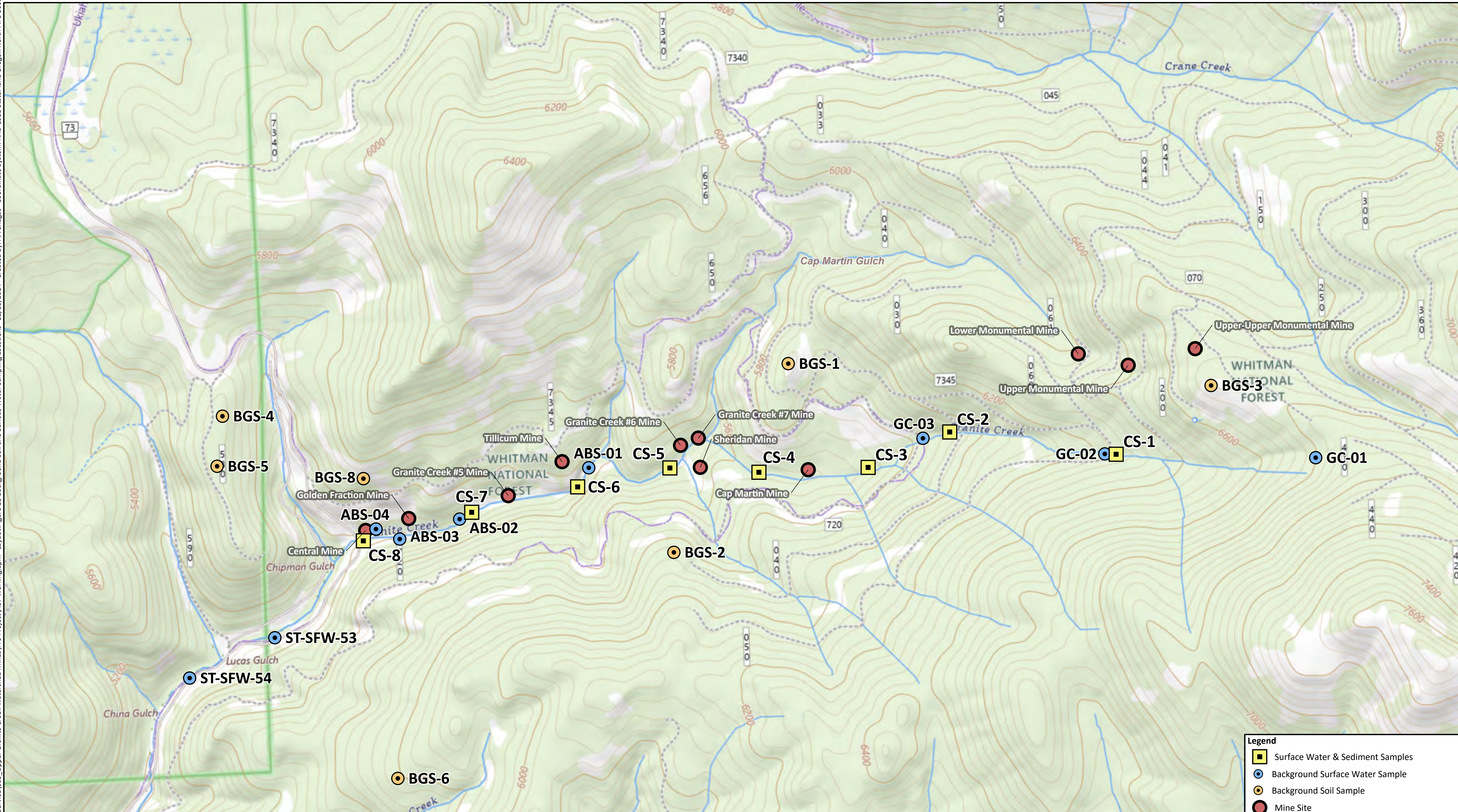
CLIENT: USDA Forest Service

PROJECT: Upper Granite Creek Watershed Mines Granite, Oregon

PROJECT NUMBER: O031.005

Central Mine

FIGURE 14



Basemap Source: USGS Topo

0 600 1,200 2,400 Feet

1 inch = 1,200 feet

N

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terraphase engineering

CLIENT: USDA Forest Service

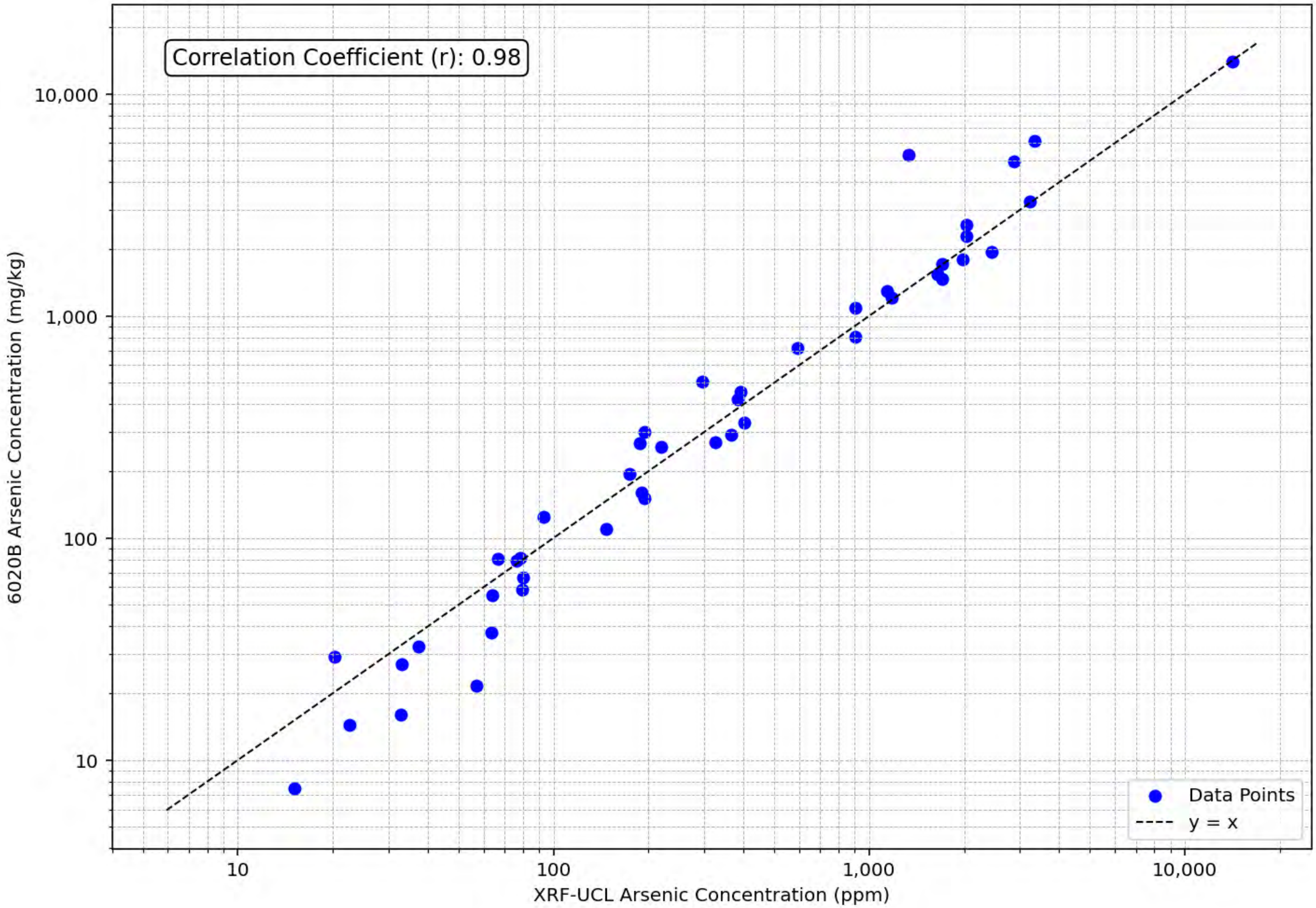
PROJECT: Upper Granite Creek Watershed Mines Granite, Oregon

PROJECT NUMBER: O031.005

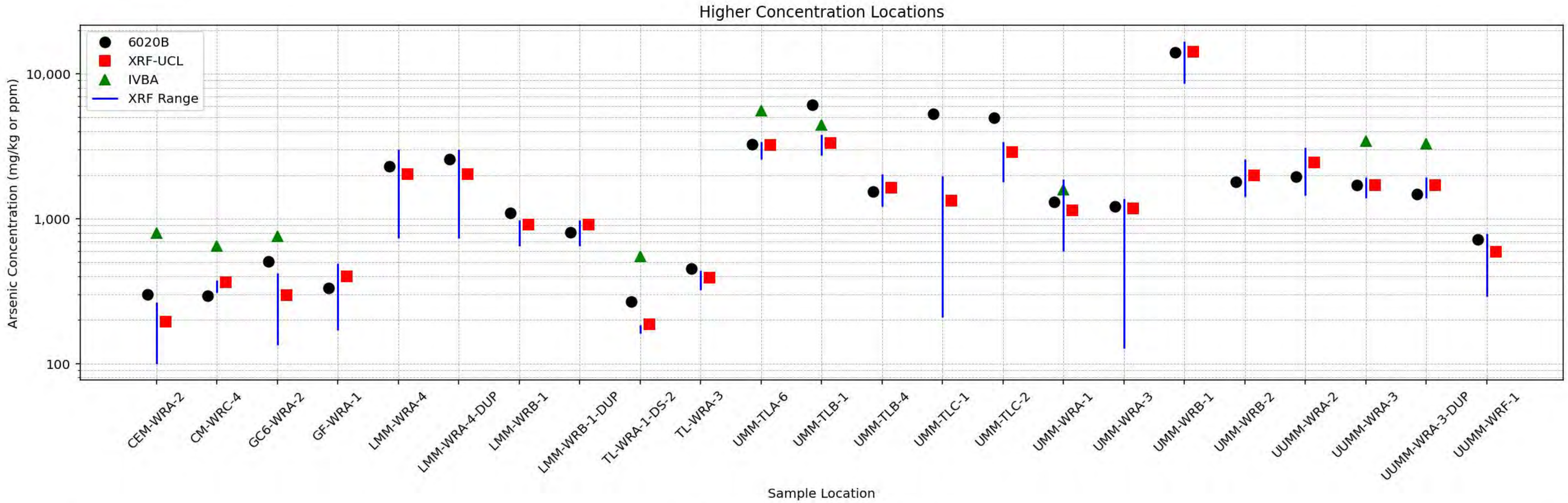
Background Soil and Surface Water Sampling Locations

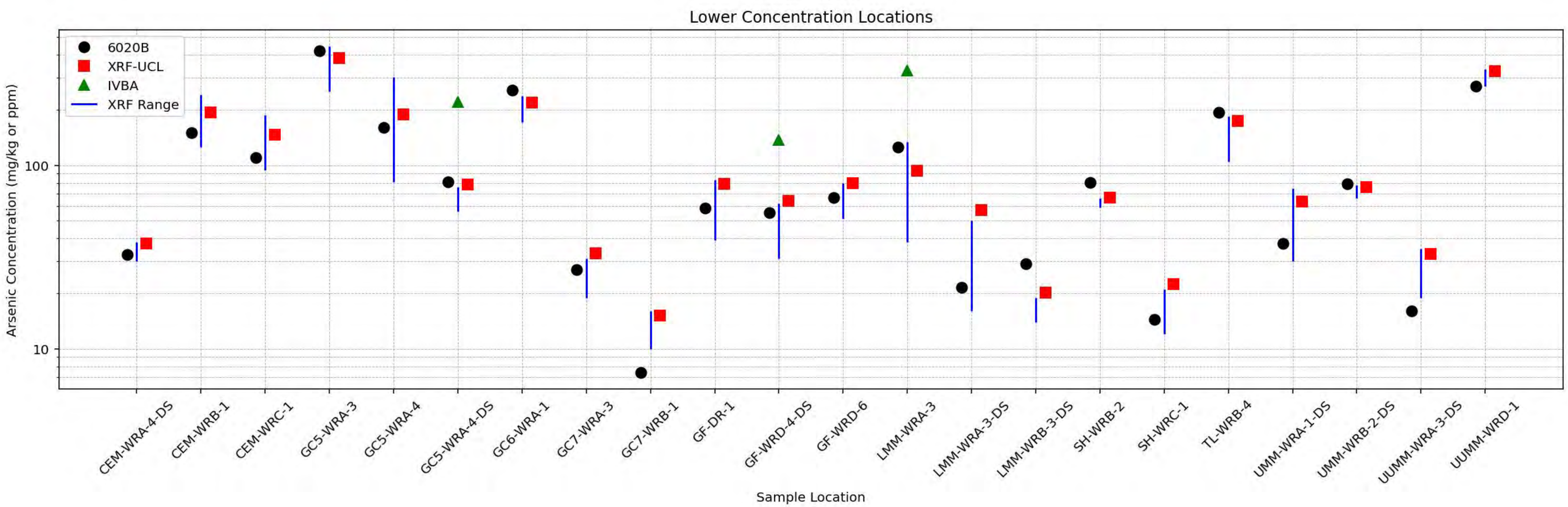
FIGURE 15

File: N:\GIS\Prj\O031_USDA Forest Service\005_Upper Granite Creek Watershed Mines\Pro Project\ALV Working.aprx Layout: Figure 15 Background Soil and Surface Water Sampling Locations 12/10/2024 Created by: A.Venegas Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet



Note: XRF – UCL = x-ray fluorescence derived 95 percent upper confidence limit mg/kg = milligrams per kilogram ppm = parts per million	SAFETY FIRST terraphase engineering	CLIENT: USDA Forest Service PROJECT: Upper Granite Creek Watershed Mines, Granite, Oregon PROJECT NUMBER: O031.005	**XRF - Analytical Data Correlation** **FIGURE 16**





Note:
XRF-UCL = x-ray fluorescence derived 95 percent upper concentration limits
IVBA = in-vitro bioaccessibility arsenic concentrations, after sieving before extraction
6020B = arsenic concentrations by EPA Method 6020B
mg/kg = milligrams per kilogram
ppm = parts per million

SAFETY FIRST

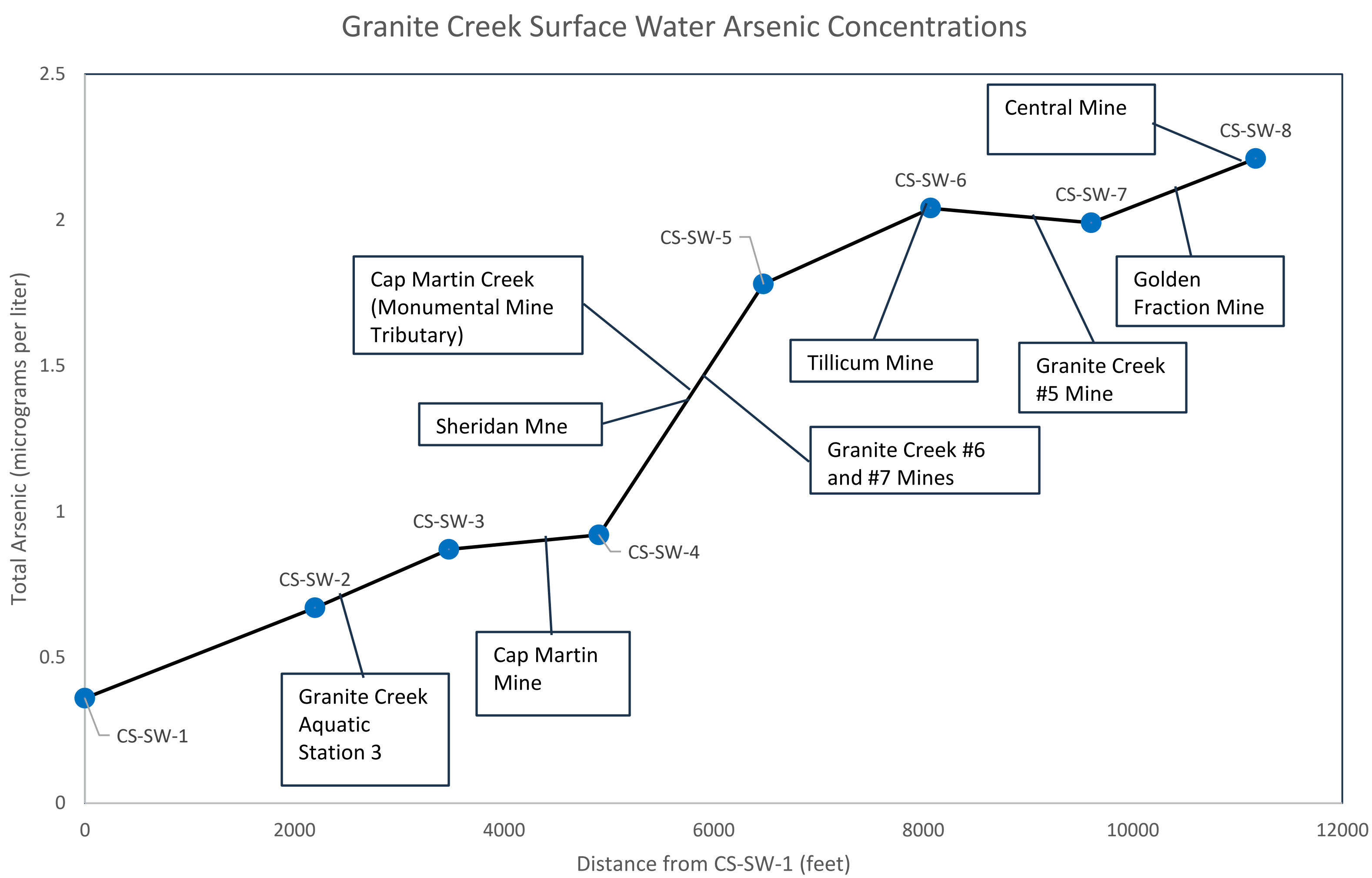
terraphase engineering

CLIENT:	USDA Forest Service
PROJECT:	UGC Watershed Mines Granite, Oregon
PROJECT NUMBER:	0031.005

XRF - Laboratory Data Comparison Chart

FIGURE 17

File: N:\GIS\Utilities\ArcMap Templates\Template_11_17_landscape.mxd 11/18/2022 Created by: Bryan Coordinate System: NAD 1983 StatePlane New York Long Island FIPS 3104 Feet



Notes:	SAFETY FIRST	CLIENT: USDA Forest Service	Surface Water Arsenic Concentration with Distance
	terraphase engineering	PROJECT: Upper Granite Creek Watershed Mines, Granite, Oregon	
		PROJECT NUMBER: O031.005	FIGURE 18

Appendix A

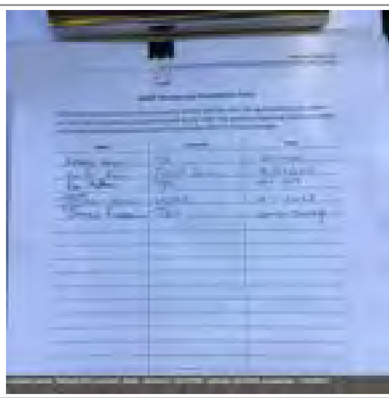
Field Notes

By: Adrienne Venegas

Date	10/01/2024	Contractor	
Staff On-Site	Adrienne Venegas, Don Malkemus, James Farrow	Crew	
Staff From Time	09:00	From Time	
Staff To Time	16:30	To Time	
Weather	Sunny	Tailgate Meeting?	YES
Equipment		Remarks	

Work Summary

Time	Notes
09:00	Meet with Mario and Keifer with USFS near Central Mine. Introductions and health and safety meeting



Picture taken at: 09:23

Caption: HASP review and acceptance form

Latitude: 44.85701750773097

Longitude: -118.3942462940675

Picture taken at: 09:24

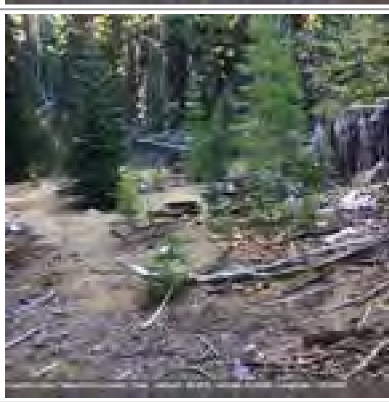
Caption: DFR

Latitude: 44.85624445584468

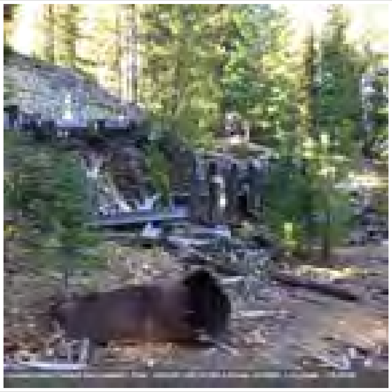
Longitude: -118.3936392660795

09:25	Driving to Upper Monumental Mine

Time	Notes
	 Picture taken at: 09:57 Caption: Stamp Mill Latitude: 44.85967547233333 Longitude: -118.3535353385
	 Picture taken at: 09:57 Caption: Chlorination flue Latitude: 44.859680902 Longitude: -118.3535841383333
	 Picture taken at: 09:57 Caption: Flotation table Latitude: 44.85967803 Longitude: -118.3536781416666
	 Picture taken at: 09:58 Caption: Chlorination flue (foreground) and flotation table (background) Latitude: 44.8596509485 Longitude: -118.3537663348333

Time	Notes	
		Picture taken at: 10:02 Caption: Chlorination flue Latitude: 44.85955154583333 Longitude: -118.3541252503333
		Picture taken at: 10:03 Caption: Upper retaining wall Latitude: 44.85972296566667 Longitude: -118.3537110743333
		Picture taken at: 10:09 Caption: Mill remains Latitude: 44.8599069955 Longitude: -118.3538225465
		Picture taken at: 10:09 Caption: Mill remains and tailings Latitude: 44.85990817433333 Longitude: -118.3538226001667

Time	Notes



Picture taken at: 10:10

Caption: Mill remains and upper and lower retaining walls

Latitude: 44.85990836866666

Longitude: -118.3538222428333

Picture taken at: 10:30

Caption: Upper shaft

Latitude: 44.86059106966667

Longitude: -118.3504906728334

Picture taken at: 10:43

Caption: Shaft above upper monumental shaft (not previously mapped)

Latitude: 44.86081504183333

Longitude: -118.3496741993333

Picture taken at: 10:48

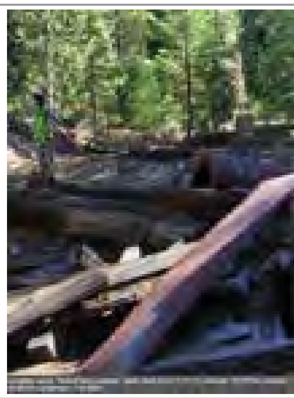
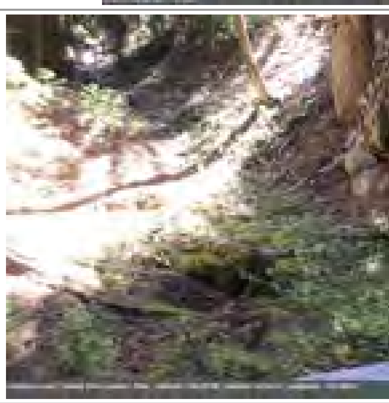
Caption: Shaft #3 above upper monumental shaft (not previously mapped). Very deep hole at bottom right

Latitude: 44.86090162483333

Longitude: -118.3492360385

11:36 Lower monumental mine.

Time	Notes
	 Picture taken at: 11:37 Caption: Adit from above Latitude: 44.86108379900001 Longitude: -118.355107257
	 Picture taken at: 11:41 Caption: Lower monumental adit entrance Latitude: 44.86105575 Longitude: -118.3554127151667
	 Picture taken at: 11:41 Caption: Drainage from Lower monumental adit Latitude: 44.86105649449999 Longitude: -118.3554090786667
	 Picture taken at: 11:44 Caption: Cabin Latitude: 44.86130057416667 Longitude: -118.3556658905

Time	Notes
	 Picture taken at: 11:47 Caption: Collapsed adit Latitude: 44.86175704066667 Longitude: -118.3555481198333
	 Picture taken at: 11:48 Caption: Collapsed adit Latitude: 44.86176202983334 Longitude: -118.3555403036667
	 Picture taken at: 11:51 Caption: Former rock crusher. Area of high arsenic concentration Latitude: 44.86133833333334 Longitude: -118.3560416666667
	 Picture taken at: 11:53 Caption: Wetland/spring (“unnamed tributaries”) below former crusher area Latitude: 44.86140766083332 Longitude: -118.3561838248333

Time	Notes

Picture taken at: 11:54

Caption: Wetland/spring (“unnamed tributaries”) below former crusher area

Latitude: 44.86139036416666

Longitude: -118.3561593996667

Picture taken at: 11:56

Caption: Collapsed cabin (not mapped)

Latitude: 44.86158838266667

Longitude: -118.3560458813333

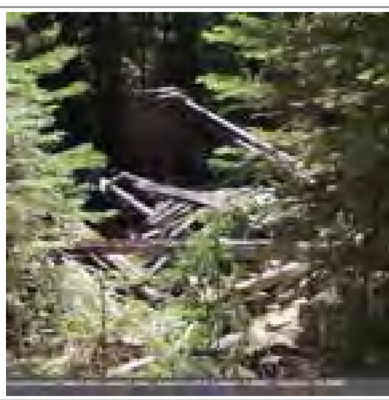
Picture taken at: 11:57

Caption: Collapsed cabin #2 (not mapped)

Latitude: 44.86176913149999

Longitude: -118.3561870145

12:30 Headed to Cap Martin

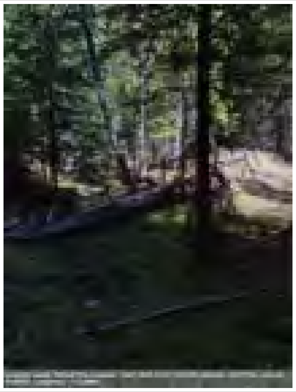
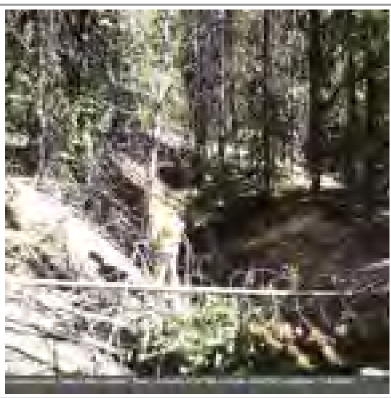


Picture taken at: 12:47

Caption: Collapsed cabin

Latitude: 44.85807001800001

Longitude: -118.3698963438333

Time	Notes	
		Picture taken at: 12:52 Caption: Settling pond? Second drainage Latitude: 44.85705450550001 Longitude: -118.3687287458333
		Picture taken at: 12:53 Caption: Drainage and waste rock pile Latitude: 44.85701166666666 Longitude: -118.36885
		Picture taken at: 12:58 Caption: Adit #3 Latitude: 44.85732991616666 Longitude: -118.3683959126667
		Picture taken at: 12:59 Caption: Adit near #4 Latitude: 44.857037865 Longitude: -118.3683618281667

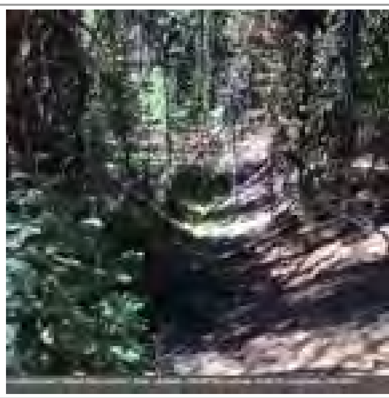
Time	Notes

Picture taken at: 13:00

Caption: Adit near #4

Latitude: 44.85705333333333

Longitude: -118.368355

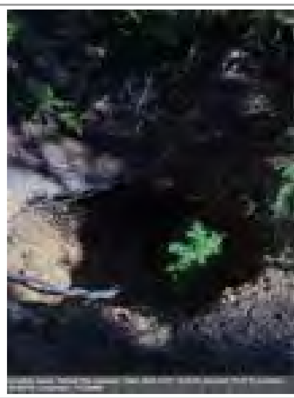


Picture taken at: 13:02

Caption: Drainage from adits

Latitude: 44.85710241966667

Longitude: -118.3681869576667

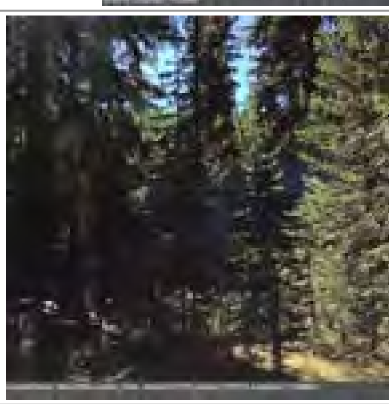


Picture taken at: 13:05

Caption: Adit #4

Latitude: 44.85717833333333

Longitude: -118.3680633333333



Picture taken at: 13:10

Caption: Cabin

Latitude: 44.85717852233334

Longitude: -118.368063151

13:24	Heading to GC-6

Time	Notes

Picture taken at: 13:45

Caption: GC-6 adit

Latitude: 44.85765392850001

Longitude: -118.3756544251667

Picture taken at: 13:47

Caption: Wet trench (left-right) with waste pile (not from adit) beyond at GC-6

Latitude: 44.85768046716667

Longitude: -118.3756259823333

13:59 GC-7

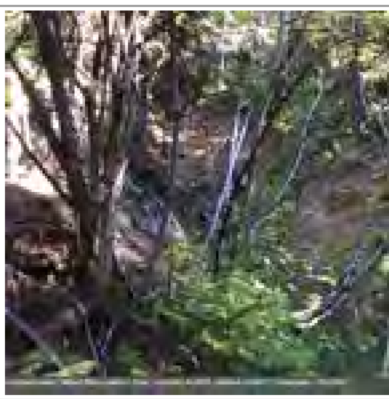
Picture taken at: 14:00

Caption: GC-7 adit and "unnamed tributary"

Latitude: 44.85812620499999

Longitude: -118.3746201356667

14:17 Sheridan



Picture taken at: 14:17

Caption: Sheridan - 1 of several parallel adits? Or "steep slope with gouges?"

Latitude: 44.85716953533333

Longitude: -118.3750253946667

Time	Notes

Picture taken at: 14:22

Caption: Sheridan - 2nd of several parallel adits? Or "steep slope with gouges?"

Latitude: 44.85720707166666

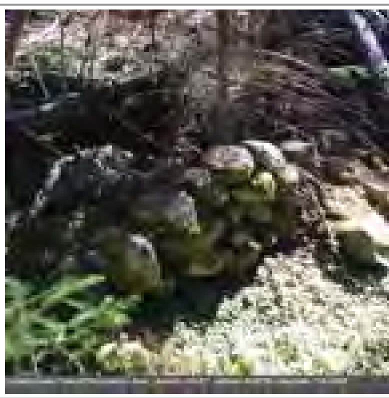
Longitude: -118.3748731503333

Picture taken at: 14:24

Caption: Several rusted drums

Latitude: 44.8571973805

Longitude: -118.3748722141667



Picture taken at: 14:31

Caption: Retaining wall at Sheridan

Latitude: 44.85700116616668

Longitude: -118.3753940575

14:57 Heading to main road to hike NF Rd 680

15:09 Central mine

Picture taken at: 15:09

Caption: Central mine #1

Latitude: 44.85501767533334

Longitude: -118.3914418738333

Time	Notes
15:18	golden fraction

Picture taken at: 15:18

Caption: Collapsed adit (lower)

Latitude: 44.85510870866667

Longitude: -118.3889174681667

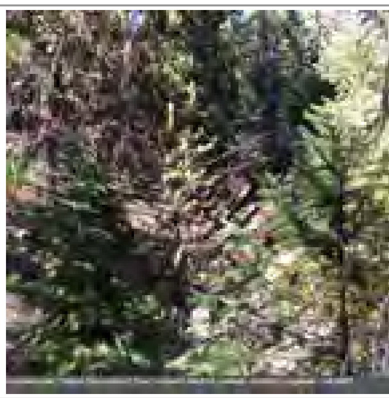
Picture taken at: 15:29

Caption: Retaining wall between lower golden fraction and GC-5

Latitude: 44.85505057416667

Longitude: -118.3879588078333

Time	Notes
15:32	GC-5



Picture taken at: 15:33

Caption: GC-5 adit

Latitude: 44.85560349699999

Longitude: -118.3863341225

Time	Notes
15:50	Tillicum mine

Time	Notes
	 Picture taken at: 15:50 Caption: Tillicum adit (lower) Latitude: 44.856359515 Longitude: -118.3818410655
16:20	Heading to quarry (potential repository site).
	 Picture taken at: 16:34 Caption: Quarry Latitude: 44.82991502433662 Longitude: -118.422087232068
	 Picture taken at: 16:34 Caption: Quarry Latitude: 44.82992898691602 Longitude: -118.4220694659046
16:30	TEI headed back to Airbnb

terraphase engineering

Daily Field Log
Site: UGCW Mines
NF-7345,Granite,Oregon

Project Number: O031.005

By: Don Malkemus

Date	10/01/2024	Contractor	
Staff On-Site	Don Malkemus, Adrienne Venegas, James Farrow	Crew	
Staff From Time	07:55	From Time	
Staff To Time		To Time	
Weather	Clear	Tailgate Meeting?	YES
Equipment	Vanya c series XRF	Remarks	

Work Summary

Time	Notes
07:56	Calibrate XRF. Arsenic reads 22. 17 in a ziplock bag. 18 in ziplock at 30 seconds.
09:01	Arrive at the site, meet Mario Isaias-Vera and Keifer Nace. At intersection of FS73 and FS7345. Go through introductions.
09:03	Health and safety tailgate
09:18	There is a quarry on FS7350.
09:56	Arrive at upper monumental mine. 3.3 on 7345 from 73.
09:57	Document upper monumental site features. Find additional previously unmapped shafts and waste rock piles above the upper shaft. Hummocks terrain
11:37	Visit lower monumental mine
12:47	Visit cap Martin mine
13:43	Visit GC-6. Not where describe or mapped
14:11	Visit GC-7, on the Sheridan map
14:11	Visit Sheridan
14:15	Survey marker
15:10	Visit central mine
15:12	Claim
15:32	Visit granite creek 5
15:49	Is it Tillicum mine
16:20	Leave mine sites, head to quarry
16:31	Arrive at quarry
18:40	Offsite, say goodbye to Mario and Keifer

Daily Field Log
Site: UGCW Mines
NF-7345,Granite,Oregon

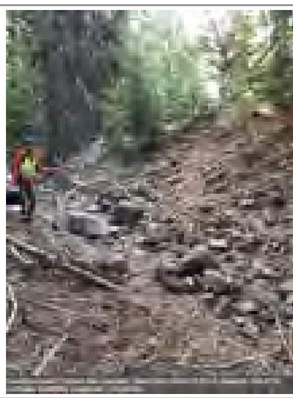
Project Number: O031.005

By: Adrienne Venegas

Date	10/02/2024	Contractor	
Staff On-Site	Adrienne Venegas, James Farrow	Crew	
Staff From Time	08:40	From Time	
Staff To Time	17:54	To Time	
Weather	Partly Cloudy	Tailgate Meeting?	
Equipment		Remarks	

Work Summary

Time	Notes
08:40	Arrive at Monumental Mine. Walk to Upper Upper Monumental Mine
09:30	Sampling upper monumental mine waste rock pile and mapping features



Picture taken at: 10:31

Caption: MM-WRA-0.5-2 and -2-DS

Latitude: 44.86065333333333

Longitude: -118.3523166666667

Picture taken at: 10:38

Caption: MM-WRA-0.5-3

Latitude: 44.86041922916667

Longitude: -118.3519728946667

Picture taken at: 10:54

Caption: MM-WRA-0.5-4

Latitude: 44.86008186533333

Longitude: -118.3524540535

Time	Notes

Picture taken at: 11:27

Caption: MM-WRA-0.5-5

Latitude: 44.86031073583334

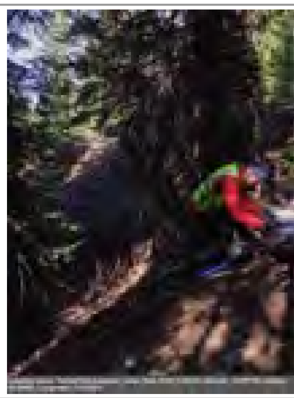
Longitude: -118.3518727916667

Picture taken at: 11:31

Caption: MM-WRA-0.5-6

Latitude: 44.86034947433333

Longitude: -118.3522562825

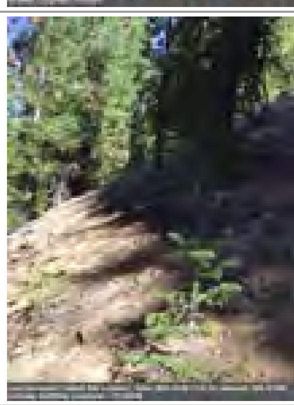


Picture taken at: 11:40

Caption: MM-WRA-0.5-7

Latitude: 44.86026666666667

Longitude: -118.35212



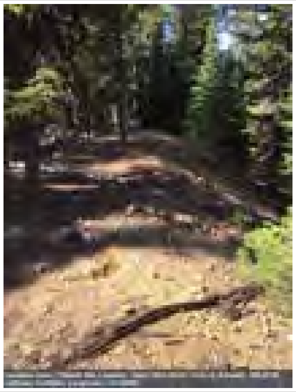
Picture taken at: 11:51

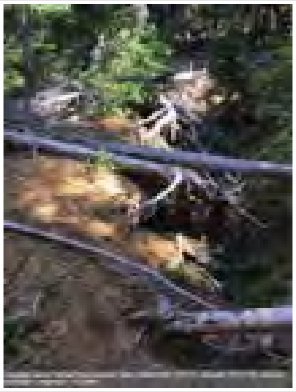
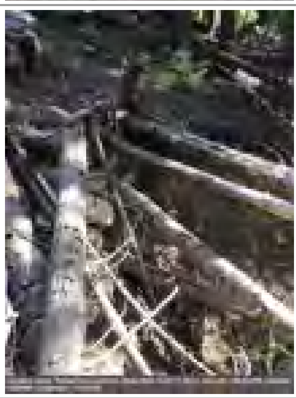
Caption: MM-WRA-0.5-8

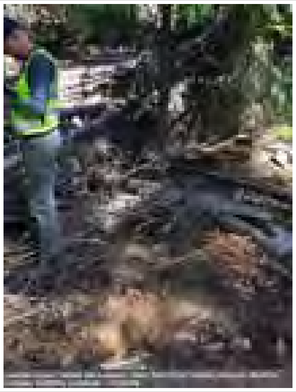
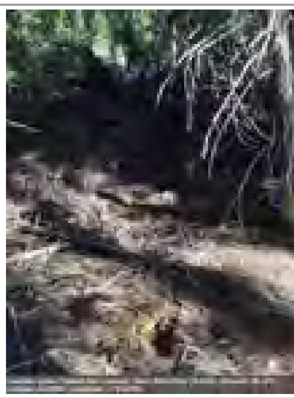
Latitude: 44.86020333333333

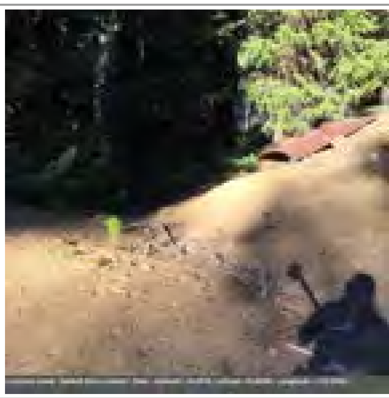
Longitude: -118.3524783333333

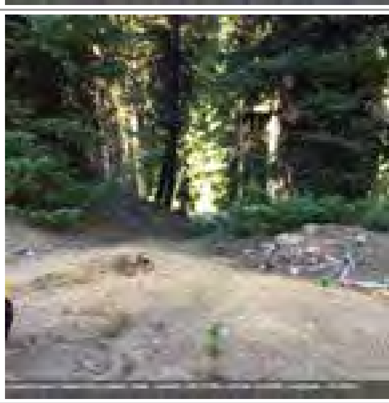
12:11	Sampling upper upper monumental mine (not previously mapped) waste rock pile and mapping features

Time	Notes
	 Picture taken at: 13:18 Caption: UUMM-WRA-0.5-2 (foreground) and 1 (background) Latitude: 44.86083666666666 Longitude: -118.3493633333333
	 Picture taken at: 13:29 Caption: UUMM-WRC-0.5-1 (left of trench) Latitude: 44.86105987483333 Longitude: -118.3495929021667
	 Picture taken at: 13:45 Caption: UUMM-WRD-0.5-1 Latitude: 44.860445 Longitude: -118.3495116666667
	 Picture taken at: 13:50 Caption: UUMM-WRE-0.5-1 Latitude: 44.86035833333333 Longitude: -118.3492583333333

Time	Notes
	 Picture taken at: 14:03 Caption: UUMM-WRF-0.5-1 (pile to left of trench) Latitude: 44.86029666666667 Longitude: -118.3497083333333
	 Picture taken at: 14:03 Caption: UUMM-WRF (pile to downslope of trench) Latitude: 44.86029666666667 Longitude: -118.349655
14:29	Sampling upper monumental mine waste rock pile and mapping features
	 Picture taken at: 14:30 Caption: Upper shaft (downslope side) Latitude: 44.86064166666667 Longitude: -118.3504466666667
	 Picture taken at: 14:30 Caption: Upper shaft (upslope side) Latitude: 44.86064166666667 Longitude: -118.350455

Time	Notes
	 Picture taken at: 14:34 Caption: UMM-WRB-0.5-1 (shaft in background) Latitude: 44.86058333333333 Longitude: -118.3505866666667
	 Picture taken at: 14:46 Caption: UMM-WRB-0.5-2 (farther) and UMM-WRB-0.5-2-DS (closer) Latitude: 44.86061166666666 Longitude: -118.3506916666667
	 Picture taken at: 14:50 Caption: UMM-WRB-0.5-3 (shaft in background) Latitude: 44.86063 Longitude: -118.3505633333333
	 Picture taken at: 14:54 Caption: UMM-WRB-0.5-4 (downhill edge of shaft) Latitude: 44.86057810883334 Longitude: -118.3505025001667
15:48	Upper mine near stamp mill (tailing piles, chlorination flue, flotation table, etc)

Time	Notes	
		Picture taken at: 15:49 Caption: Upper and lower retaining walls Latitude: 44.85992706766667 Longitude: -118.3536460298333
		Picture taken at: 15:50 Caption: Erosional chute 1/3 Latitude: 44.859912324 Longitude: -118.3536262888333
		Picture taken at: 15:56 Caption: Erosional chute 2/3 Latitude: 44.85984768033333 Longitude: -118.3539777846667
		Picture taken at: 15:58 Caption: UMM-TLA-0.5-1 Latitude: 44.85986879083332 Longitude: -118.354067886

Time	Notes
	 Picture taken at: 16:00 Caption: UMM-TLA-0.5-2 Latitude: 44.85993446516666 Longitude: -118.3539610836667
	 Picture taken at: 16:02 Caption: Old road (continues away from mill) Latitude: 44.85984380066667 Longitude: -118.3543046616666
	 Picture taken at: 16:04 Caption: Erosional chute 3/3? Latitude: 44.85982435716666 Longitude: -118.3541982723333
	 Picture taken at: 16:07 Caption: UMM-TLA-0.5-3 Latitude: 44.85991798333333 Longitude: -118.3535461333333

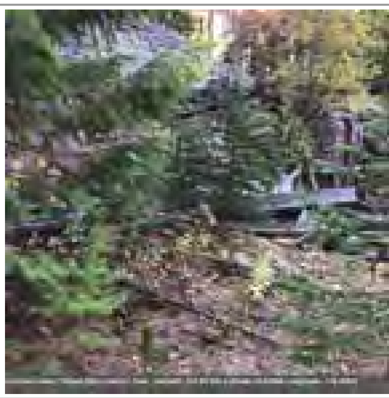
Time	Notes

Picture taken at: 16:09

Caption: UMM-TLA-0.5-4

Latitude: 44.85995027166667

Longitude: -118.3534044343333



Picture taken at: 16:11

Caption: UMM-TLA-0.5-5

Latitude: 44.85987502933334

Longitude: -118.353381637

Picture taken at: 16:15

Caption: UMM-TLA-0.5-6

Latitude: 44.85978235633333

Longitude: -118.3537078031667

Picture taken at: 16:21

Caption: Chlorination flue

Latitude: 44.85968069816666

Longitude: -118.3536930685

Time	Notes

Picture taken at: 16:25

Caption: Upper retaining wall

Latitude: 44.85972560583333

Longitude: -118.3537275328333

Picture taken at: 16:40

Caption: Wetlands on upper settling pond (toward tributary)

Latitude: 44.86033666983333

Longitude: -118.3538482471667

Picture taken at: 16:40

Caption: Wetlands on upper settling pond

Latitude: 44.86033132583334

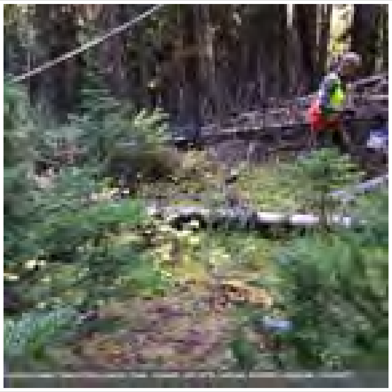
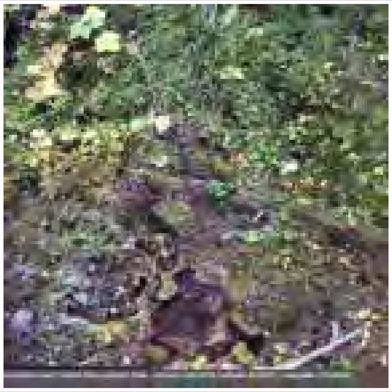
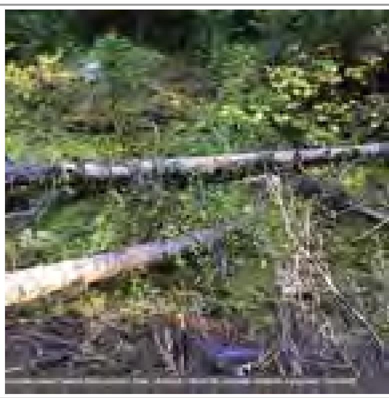
Longitude: -118.353817384

Picture taken at: 16:58

Caption: UMM-TLB-0.5-4 (near upper settling pond)

Latitude: 44.86037

Longitude: -118.3539116666667

Time	Notes	
		Picture taken at: 17:08 Caption: Wetlands on middle settling pond Latitude: 44.860685072 Longitude: -118.3542392566667
		Picture taken at: 17:10 Caption: UMM-TLC-0.5-1 Latitude: 44.86071280166666 Longitude: -118.3542512848333
		Picture taken at: 17:12 Caption: UMM-TLC-0.5-2 Latitude: 44.86075874966667 Longitude: -118.3542848983333
		Picture taken at: 17:21 Caption: UMM-TLB-0.5-3 (foreground) and 1 & 2 (background) Latitude: 44.86023615333333 Longitude: -118.353842624

Time	Notes
	 Picture taken at: 17:23 Caption: UMM-TLB-0.5-1 Latitude: 44.86025210999999 Longitude: -118.3536833281667
	 Picture taken at: 17:24 Caption: UMM-TLB-0.5-2 Latitude: 44.86026880983333 Longitude: -118.3537255115
17:54	TEI off site

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Daily Field Log

Site: UGCW Mines

NF-7345,Granite,Oregon

Project Number: O031.005

By: Don Malkemus

Date	10/02/2024	Contractor	
Staff On-Site		Crew	
Staff From Time		From Time	
Staff To Time		To Time	
Weather		Tailgate Meeting?	
Equipment		Remarks	

Work Summary

Time	Notes
07:43	Calibrate PID. Cal check passed. Arsenic in bag 20 +6, arsenic without bag 23+5, blank in bag LE 91.22%, Si 6.27%
08:56	Arrive at upper monumental mine, prepare equipment
09:30	Begin soil sampling and collecting XRF readings on WRA
09:44	Initial XRF in waste rock 809 ppm As. 3 feet downslope in brown soil 64 ppm.
10:23	Collect sample MM-WRA-0.5-1 from initial downslope boundary. Collect sample MM-WRA-DS-0.5 from native soil downslope of the waste rock pile.
12:11	Mob to upper shaft area
12:45	Arrive at upper upper area
13:18	Begin mapping, collecting soil samples and XRF readings. Appears that the many small waste rock piles would fit within the many holes and shaft openings.
13:35	Recalibrate XRF. Cal check passed. As in bag 16 +5, out of bag 13+4, blank LE 99.990%, rest is Fe, Zn
13:49	Continue mapping, XRFing
14:30	Map and XRF at the upper shaft. Appears that the waste rock would fit in the shaft opening.
15:47	Arrive at upper monumental mill site
15:56	XRF at flotation table is out of range, As at 18310 and lead at 25020 ppm
16:20	XRF bricks, As ranges from 69 to 275
16:43	Visit upper and middle settling ponds
17:27	Leave site

Daily Field Log
Site: UGCW Mines
NF-7345,Granite,Oregon

Project Number: O031.005

By: Adrienne Venegas

Date	10/03/2024	Contractor	
Staff On-Site	Adrienne Venegas, Don Malkemus, James farrow	Crew	
Staff From Time	08:10	From Time	
Staff To Time		To Time	
Weather	Sunny	Tailgate Meeting?	
Equipment		Remarks	

Work Summary

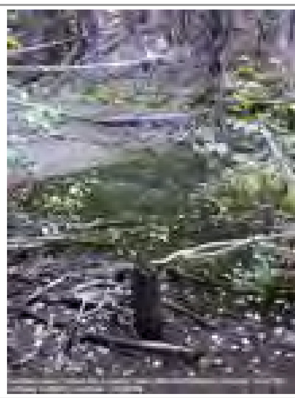
Time	Notes
08:10	TEI en route to Lower Monumental mine
08:48	Walking to Lower Monumental mine

Picture taken at: 09:00

Caption: Investigating Drainage (not mapped) between middle and lower settling ponds and tailings

Latitude: 44.86086172083333

Longitude: -118.3550789836667



Picture taken at: 09:26

Caption: Lower settling pond near adit

Latitude: 44.86096666666667

Longitude: -118.3555833333333

Time	Notes

Picture taken at: 09:29

Caption: Lower settling pond near adit

Latitude: 44.86088833333334

Longitude: -118.3554833333333

Picture taken at: 09:34

Caption: Former crusher

Latitude: 44.86132

Longitude: -118.356055

Picture taken at: 09:38

Caption: Collapsed cabin

Latitude: 44.86158

Longitude: -118.35602

Picture taken at: 09:48

Caption: LMM-WRA-0.5-4

Latitude: 44.86108605699999

Longitude: -118.3556077828333

Time	Notes
	 Picture taken at: 09:50 Caption: LMM-WRA-0.5-1 Latitude: 44.8612579155 Longitude: -118.3562858703333
	 Picture taken at: 09:52 Caption: LMM-WRA-0.5-2 Latitude: 44.861181917 Longitude: -118.356342687
	 Picture taken at: 09:54 Caption: LMM-WRA-0.5-3 Latitude: 44.86134915333334 Longitude: -118.3564625656667
	 Picture taken at: 09:55 Caption: LMM-WRA-0.5-3-DS Latitude: 44.86148238766667 Longitude: -118.356479084

Time	Notes

Picture taken at: 10:30

Caption: LMM-TLA-0.5-3

Latitude: 44.86146398514013

Longitude: -118.3562245963152

Picture taken at: 10:40

Caption: LMM-TLA-0.5-1

Latitude: 44.86128392166667

Longitude: -118.3557902623333

Picture taken at: 10:42

Caption: LMM-TLA-0.5-2

Latitude: 44.86129605033334

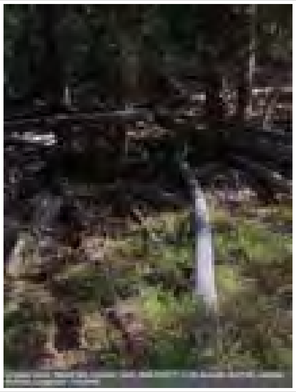
Longitude: -118.355905148

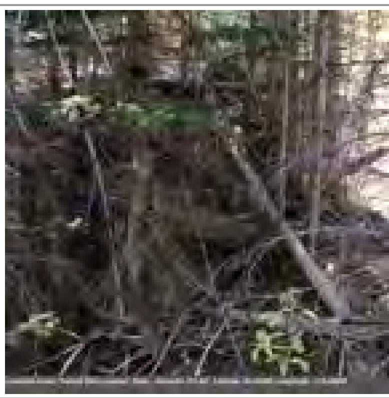
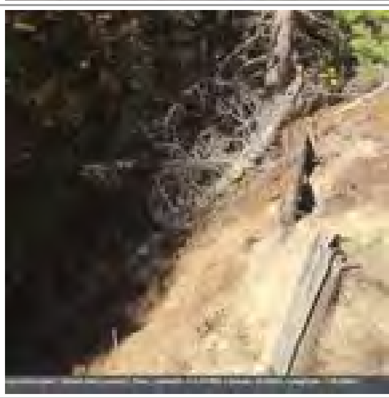
Picture taken at: 10:43

Caption: LMM-TLA-0.5-4

Latitude: 44.861448196

Longitude: -118.3559001231667

Time	Notes	
		Picture taken at: 10:49 Caption: LMM-WRB-0.5-1 Latitude: 44.86158853133333 Longitude: -118.3557070478333
		Picture taken at: 10:50 Caption: LMM-WRB-0.5-2 Latitude: 44.861652572 Longitude: -118.3556089325
		Picture taken at: 10:53 Caption: Adit #3 Latitude: 44.86182833333334 Longitude: -118.355505
		Picture taken at: 11:11 Caption: LMM-WRB-0.5-3-DS Latitude: 44.861545 Longitude: -118.3559416666667

Time	Notes
	 Picture taken at: 11:13 Caption: LMM-WRB-0.5-3 Latitude: 44.86156785749999 Longitude: -118.3559074638333
13:20	Cap Martin
	 Picture taken at: 13:11 Caption: Adit #1 at cap Martin Latitude: 44.8558286925 Longitude: -118.3692865623333
	 Picture taken at: 13:17 Caption: CMM-WRA-0.5-2 at cap Martin Latitude: 44.855906042 Longitude: -118.3694323281667
	 Picture taken at: 13:21 Caption: CMM-WRA-0.5-1 Latitude: 44.85586666666666 Longitude: -118.369355

Time	Notes
	 Picture taken at: 13:41 Caption: CMM-WRB-0.5-1 Latitude: 44.85663333333333 Longitude: -118.37088
	 Picture taken at: 13:42 Caption: Adit #2 - very overgrown Latitude: 44.85661907866667 Longitude: -118.3708862646667
	 Picture taken at: 13:44 Caption: CMM-WRB-0.5-2 Latitude: 44.85665204683334 Longitude: -118.370809521
14:49	Switching to DAM log

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Daily Field Log

Site: UGCW Mines

NF-7345,Granite,Oregon

Project Number: O031.005

By: Adrienne Venegas

Date	10/04/2024	Contractor	
Staff On-Site	Adrienne Venegas, Don Malkemus, James farrow	Crew	
Staff From Time	08:50	From Time	
Staff To Time	16:45	To Time	
Weather	Sunny	Tailgate Meeting?	
Equipment		Remarks	

Work Summary

Time	Notes
08:50	Park at Sheridan Mine. Gather equipment
09:25	Collecting CS-SW-5 (water) and CS-SD-5 (soil)
09:32	Mapping features and collecting XRF samples at Sheridan

Picture taken at: 09:49

Caption: Adit 1

Latitude: 44.85730202296959

Longitude: -118.3750389692218

Picture taken at: 10:05

Caption: SH-WRA-0.5-1

Latitude: 44.8573153355

Longitude: -118.3751281836667

Time	Notes

Picture taken at: 10:09

Caption: SH-WRA-0.5-2 with adit 1 to left

Latitude: 44.85724722433334

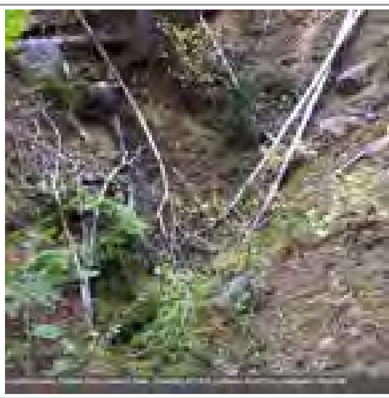
Longitude: -118.3749621631667

Picture taken at: 10:11

Caption: Adit 2 (potential)

Latitude: 44.85721433783333

Longitude: -118.3750245023333



Picture taken at: 10:15

Caption: Potential Spring from potential adit 3 (not previously mapped)

Latitude: 44.85713259083333

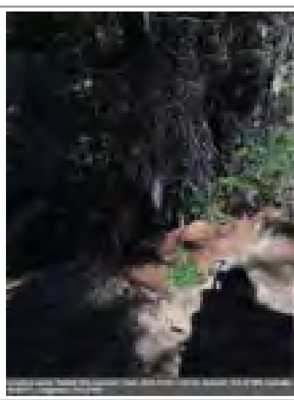
Longitude: -118.374928396

Picture taken at: 10:21

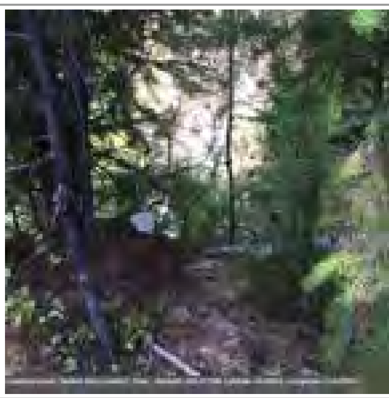
Caption: SH-WRB-0.5-2 (adit 2 beyond)

Latitude: 44.85714666666667

Longitude: -118.374925

Time	Notes
	 Picture taken at: 10:22 Caption: SH-WRC-0.5-1 (adit 3 to left) Latitude: 44.85714017233332 Longitude: -118.374993237
	 Picture taken at: 10:27 Caption: SH-WRC-0.5-2 Latitude: 44.857058646 Longitude: -118.3749980076667
	 Picture taken at: 10:31 Caption: SH-WRB-0.5-1 Latitude: 44.85719582983334 Longitude: -118.374995155
10:45	Mapping features and collecting XRF samples at GC-6
	 Picture taken at: 11:03 Caption: GC6-WTP-0.5-3 Latitude: 44.85770833333333 Longitude: -118.3754883333333

Time	Notes
	 Picture taken at: 11:04 Caption: GC6-WTP-0.5-2 Latitude: 44.85771630583334 Longitude: -118.3754872918333
	 Picture taken at: 11:06 Caption: GC6-WTP-0.5-1 Latitude: 44.85764864383334 Longitude: -118.3755053425
	 Picture taken at: 11:08 Caption: GC6-WRA-0.5-2 Latitude: 44.85765885849999 Longitude: -118.3755772786667
11:37	Mapping features and collecting XRF samples at GC-7
	 Picture taken at: 11:52 Caption: GC7-WRA-0.5-1 (adit beyond) Latitude: 44.85809233066666 Longitude: -118.374635725

Time	Notes
	 Picture taken at: 11:54 Caption: GC7-WRA-0.5-2 Latitude: 44.85804985566666 Longitude: -118.3746857153333
	 Picture taken at: 11:57 Caption: GC7-WRA-0.5-3 Latitude: 44.85799591933334 Longitude: -118.3746669551667
	 Picture taken at: 12:01 Caption: GC7-WRB-0.5-2 (adit beyond) Latitude: 44.85810029916667 Longitude: -118.374518634
	 Picture taken at: 12:13 Caption: GC7-WRB-0.5-1 Latitude: 44.85803943016668 Longitude: -118.3745557091667
12:14	Headed back to car
13:36	Collecting CS-SW-7 (water) and CS-SD-7 (soil) and CS-SD-7-DUP

Time	Notes

Picture taken at: 14:12

Caption: TL-WRB-0.5-1 at Tillicum

Latitude: 44.85622302816667

Longitude: -118.3819868695

14:16 Mapping features and collecting XRF samples at Tillicum

Picture taken at: 14:16

Caption: TL-WRA-0.5-4

Latitude: 44.85618308416667

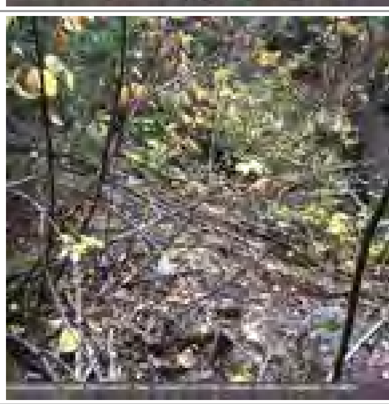
Longitude: -118.3819032196667

Picture taken at: 14:20

Caption: TL-WRA-0.5-1

Latitude: 44.85609540933334

Longitude: -118.3819744368333



Picture taken at: 14:21

Caption: TL-WRA-0.5-1-DS

Latitude: 44.85611688566667

Longitude: -118.3820030815

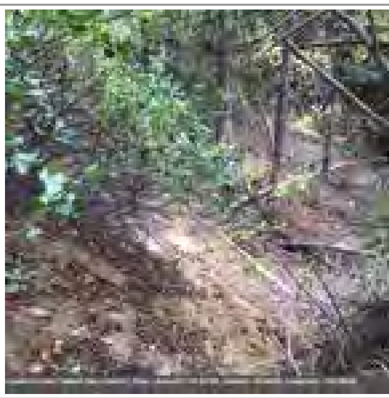
Time	Notes

Picture taken at: 14:31

Caption: TL-WRB-0.5-2

Latitude: 44.85629667083333

Longitude: -118.3819895898333



Picture taken at: 14:32

Caption: TL-WRB-0.5-3

Latitude: 44.85628020849999

Longitude: -118.3819784573333

Picture taken at: 14:34

Caption: TL-WRB-0.5-1

Latitude: 44.85638736883334

Longitude: -118.381977674

Picture taken at: 14:44

Caption: TL-WRC-0.5-2

Latitude: 44.8566282265

Longitude: -118.3817455765

Time	Notes

Picture taken at: 14:45

Caption: TL-WRC-0.5-1

Latitude: 44.85664855766667

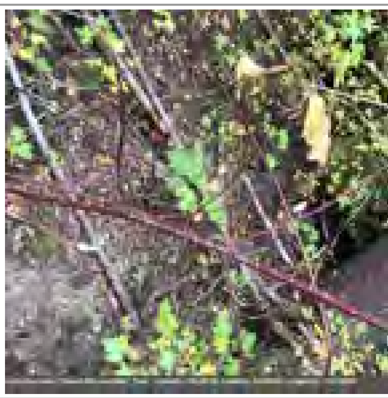
Longitude: -118.381879152

Picture taken at: 14:47

Caption: Upper adit

Latitude: 44.85665246799999

Longitude: -118.3817636833333



Picture taken at: 15:24

Caption: TL-WRA-0.5-1-DS2 - very close to River

Latitude: 44.85611618883333

Longitude: -118.3819982275

15:10 Collecting CS-SW-6 (water) and CS-SD-6 (soil)

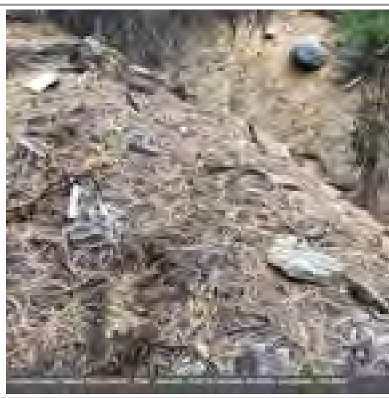
Picture taken at: 15:10

Caption: Collecting CS-SW-6 (water) and CS-SD-6 (soil)

Latitude: 44.8561914445

Longitude: -118.3809408881667

15:54 GC-5

Time	Notes
	 Picture taken at: 15:54 Caption: GC5-WRA-0.5-2 Latitude: 44.85565754716666 Longitude: -118.3862101191667
	 Picture taken at: 15:55 Caption: GC5-WRA-0.5-1 Latitude: 44.85560845766666 Longitude: -118.386404823
	 Picture taken at: 15:56 Caption: GC5-WRA-0.5-3 Latitude: 44.85562926750001 Longitude: -118.3863704898333
	 Picture taken at: 15:57 Caption: GC5-WRB-0.5-1 Latitude: 44.85561375833333 Longitude: -118.3865324223333

Time	Notes
	 Picture taken at: 15:58 Caption: GC5-WRB-0.5-2 Latitude: 44.8556561155 Longitude: -118.386513499
	 Picture taken at: 16:00 Caption: GC5-WRA-0.5-4 Latitude: 44.8555311335 Longitude: -118.3862488983333
	 Picture taken at: 16:01 Caption: GC5-WRA-0.5-4-DS (along River) Latitude: 44.85550516116668 Longitude: -118.3862477945
16:45	TEI off site

Daily Field Log
Site: UGCW Mines
NF-7345,Granite,Oregon

Project Number: O031.005

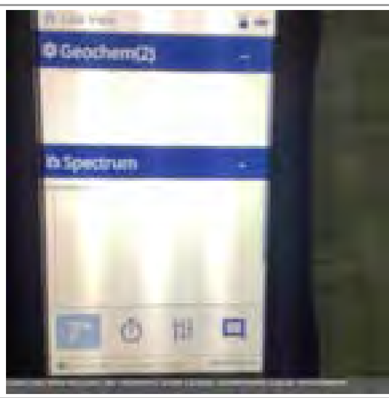
By: Don Malkemus

Date	10/04/2024	Contractor	
Staff On-Site	Don Malkemus, Adrienne Venegas, James Farrow	Crew	
Staff From Time	07:38	From Time	
Staff To Time		To Time	
Weather	Cool|Clear	Tailgate Meeting?	YES
Equipment	Vanya C Series	Remarks	

Work Summary

Sheridan, GC 6, GC 7

Time	Notes
07:38	Calibrate XRF. Cal check passed. Standard in bag As: 21+6, Standard outside bag As: 24+9, blank in bag: LE + Si 99.99%



Picture taken at: 07:41

Caption: Cal check pass

Latitude: 44.83628551642082

Longitude: -118.467842598333

Time	Notes
09:24	Arrive at Sheridan, collect CS-SW-5 and CS-SD-5

Picture taken at: 09:28

Caption: Surface water sampling

Latitude: 44.85694383449999

Longitude: -118.376280228

Time	Notes
09:41	Begin mapping, sampling at Sheridan. Unable to find collapsed cabin
10:38	Finish mapping Sheridan, mob to GC #6

Time	Notes

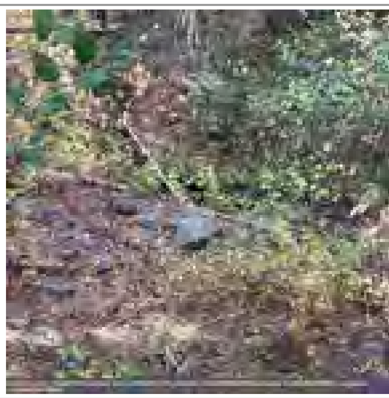
Picture taken at: 10:40

Caption: Old car on abandoned road

Latitude: 44.85751116408795

Longitude: -118.3753651356147

10:46	Begin mapping GC-6
11:40	Begin mapping GC-7
12:33	Finish mapping GC-7, mob to car.
13:09	Mob to Tillicum.
13:34	Collect CS-SW-7, SC-SD-7, and CS-SD-7-DUP. Move location slightly down gradient of GC-5



Picture taken at: 13:41

Caption: CS-7 sampling location

Latitude: 44.85536237658032

Longitude: -118.3866192263865

14:02	Calibrate XRF. Bagged standard As: 20+5, unbagged standard As: 18+5, blank in bag: no As, LE + Si 99.99%

Picture taken at: 14:04

Caption: Cal check pass

Latitude: 44.85623720983082

Longitude: -118.3821642251675

14:10	Begin mapping and sampling at Tillicum
15:39	Begin mapping and sampling at GC-5

Time	Notes
	 Picture taken at: 15:49 Caption: Collecting bioavailability sample at GC-05 Latitude: 44.85564769512642 Longitude: -118.3862886946638
16:27	Finish sampling, mapping GC-5.
16:47	Offsite

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Daily Field Log
Site: UGCW Mines
NF-7345,Granite,Oregon

Project Number: O031.005

By: Adrienne Venegas

Date	10/05/2024	Contractor	
Staff On-Site	Adrienne Venegas, Don Malkemus, James Farrow	Crew	
Staff From Time	08:30	From Time	
Staff To Time	14:15	To Time	
Weather	Sunny	Tailgate Meeting?	
Equipment		Remarks	

Work Summary

Time	Notes
08:30	Decon towels
09:16	Gather equipment and walk to golden fraction

Picture taken at: 09:29

Caption: Spring at lower GF

Latitude: 44.85520674366666

Longitude: -118.3888165911667

Picture taken at: 09:44

Caption: GF-WRA-0.5-1

Latitude: 44.85616642316666

Longitude: -118.3889246321667

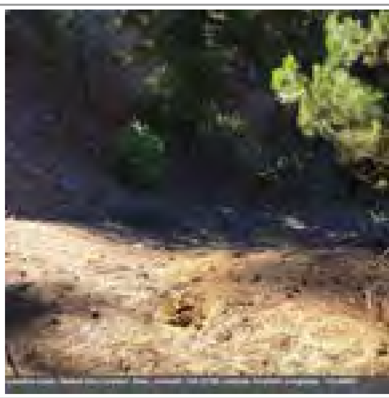
Time	Notes

Picture taken at: 09:45

Caption: GF-WRA-0.5-2

Latitude: 44.85620611816667

Longitude: -118.3888719275



Picture taken at: 09:46

Caption: GF-WRA-0.5-3

Latitude: 44.85624380833332

Longitude: -118.3888295021667

Picture taken at: 09:58

Caption: GF-WRB-0.5-3

Latitude: 44.85590156533333

Longitude: -118.3891905096667

Picture taken at: 09:59

Caption: GF-WRB-0.5-2

Latitude: 44.85597949566667

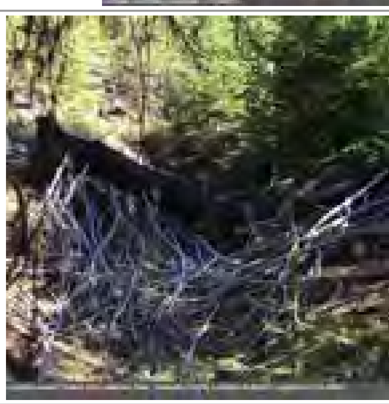
Longitude: -118.3890238976667

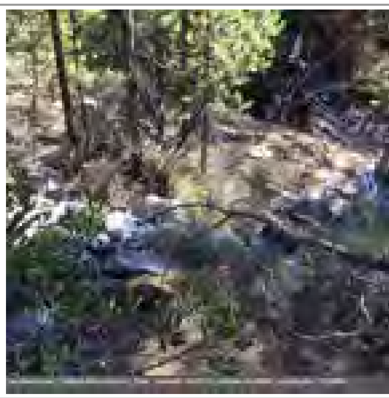
Daily Field Log

Site: UGCW Mines

NF-7345,Granite,Oregon

Project Number: O031.005

Time	Notes
	 Picture taken at: 10:00 Caption: GF-WRB-0.5-1 Latitude: 44.85599451 Longitude: -118.3889499636667
	 Picture taken at: 10:02 Caption: Potential adit (previously mapped) Latitude: 44.85586653533334 Longitude: -118.388989579
	 Picture taken at: 10:05 Caption: Area marked as cabin - no evidence of cabin Latitude: 44.85566333333333 Longitude: -118.3887783333333
	 Picture taken at: 10:32 Caption: Dredge trench Latitude: 44.85531067533334 Longitude: -118.3894149395

Time	Notes	
		Picture taken at: 10:34 Caption: GF-WRC-0.5-3 Latitude: 44.85522059733333 Longitude: -118.3895098273333
		Picture taken at: 10:36 Caption: GF-WRC-0.5-4 Latitude: 44.855318473 Longitude: -118.3895803691667
		Picture taken at: 10:37 Caption: GF-WRC-0.5-1 Latitude: 44.85541364683333 Longitude: -118.3895121963333
		Picture taken at: 10:42 Caption: GF-WRC-0.5-2 Latitude: 44.85540267983333 Longitude: -118.3892824981667

Time	Notes
	 Picture taken at: 10:45 Caption: GF-DR-0.5 Latitude: 44.855296252 Longitude: -118.3894022528333
12:18	At Central mine, line feature is "excavation"
	 Picture taken at: 12:18 Caption: Latitude: 44.8554148365 Longitude: -118.3910947703333
12:26	Find adit 2
	 Picture taken at: 12:26 Caption: Latitude: 44.85567245033334 Longitude: -118.3907950745
12:26	Find adit 3, above adit 2

Time	Notes

Picture taken at: 12:27

Caption:

Latitude: 44.855650223

Longitude: -118.3907830961667

Time	Notes
12:28	Find adit 4, east of Adit 3

Picture taken at: 12:29

Caption:

Latitude: 44.85578229566666

Longitude: -118.3904338358333

Time	Notes
12:28	A trench connects adit 3 and adit 4, mapped as a line parallel with contours on Field maps

Picture taken at: 12:29

Caption:

Latitude: 44.8557745765

Longitude: -118.3904351065

Time	Notes
13:53	Heading back to vehicle
14:15	TEI off site

Appendix B

ProUCL Outputs

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 11/18/2024 10:17:49 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

CEM-WRA

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	44.72	Mean	162.2
Maximum	299	Median	150
SD	105.3	Std. Error of Mean	39.78
Coefficient of Variation	0.649	Skewness	0.39

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.892	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.73	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.185	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.35	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	239.5	95% Adjusted-CLT UCL (Chen-1995)	233.9
		95% Modified-t UCL (Johnson-1978)	240.5

Gamma GOF Test

A-D Test Statistic	0.302	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.714	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.179	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.314	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	2.462	k star (bias corrected MLE)	1.502
Theta hat (MLE)	65.9	Theta star (bias corrected MLE)	108
nu hat (MLE)	34.47	nu star (bias corrected)	21.03
MLE Mean (bias corrected)	162.2	MLE Sd (bias corrected)	132.4
		Approximate Chi Square Value (0.05)	11.61
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	9.572

Assuming Gamma Distribution

95% Approximate Gamma UCL	293.8	95% Adjusted Gamma UCL	356.4

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.926	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.838	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.148	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.28	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	3.8	Mean of logged Data	4.872
Maximum of Logged Data	5.7	SD of logged Data	0.747

Assuming Lognormal Distribution

95% H-UCL	433.5	90% Chebyshev (MVUE) UCL	305.3
95% Chebyshev (MVUE) UCL	368.9	97.5% Chebyshev (MVUE) UCL	457.3
99% Chebyshev (MVUE) UCL	630.8		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	227.7	95% BCA Bootstrap UCL	232.4
95% Standard Bootstrap UCL	225.5	95% Bootstrap-t UCL	260.7
95% Hall's Bootstrap UCL	240.8	95% Percentile Bootstrap UCL	230.5

	A–E	F	G–K	L
83	90% Chebyshev(Mean, Sd) UCL	281.6	95% Chebyshev(Mean, Sd) UCL	335.6
84	97.5% Chebyshev(Mean, Sd) UCL	410.7	99% Chebyshev(Mean, Sd) UCL	558
85				
86	**Suggested UCL to Use**			
87	95% Student's-t UCL	239.5		
88				
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.			
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			
92				
93				
94	CEM-WRB			
95				
96	**General Statistics**			
97	Total Number of Observations	13	Number of Distinct Observations	12
98			Number of Missing Observations	0
99	Minimum	106	Mean	165.3
100	Maximum	242	Median	151
101	SD	41.37	Std. Error of Mean	11.47
102	Coefficient of Variation	0.25	Skewness	0.452
103				
104	**Normal GOF Test**			
105	Shapiro Wilk Test Statistic	0.953	**Shapiro Wilk GOF Test**	
106	1% Shapiro Wilk Critical Value	0.814	Data appear Normal at 1% Significance Level	
107	Lilliefors Test Statistic	0.174	**Lilliefors GOF Test**	
108	1% Lilliefors Critical Value	0.271	Data appear Normal at 1% Significance Level	
109	**Data appear Normal at 1% Significance Level**			
110				
111	**Assuming Normal Distribution**			
112	**95% Normal UCL**		**95% UCLs (Adjusted for Skewness)**	
113	95% Student's-t UCL	185.8	95% Adjusted-CLT UCL (Chen-1995)	185.7
114			95% Modified-t UCL (Johnson-1978)	186
115				
116	**Gamma GOF Test**			
117	A-D Test Statistic	0.258	**Anderson-Darling Gamma GOF Test**	
118	5% A-D Critical Value	0.733	Detected data appear Gamma Distributed at 5% Significance Level	
119	K-S Test Statistic	0.154	**Kolmogorov-Smirnov Gamma GOF Test**	
120	5% K-S Critical Value	0.236	Detected data appear Gamma Distributed at 5% Significance Level	
121	**Detected data appear Gamma Distributed at 5% Significance Level**			
122				
123	**Gamma Statistics**			
124	k hat (MLE)	17.64	k star (bias corrected MLE)	13.62
125	Theta hat (MLE)	9.372	Theta star (bias corrected MLE)	12.14
126	nu hat (MLE)	458.6	nu star (bias corrected)	354.1
127	MLE Mean (bias corrected)	165.3	MLE Sd (bias corrected)	44.79
128			Approximate Chi Square Value (0.05)	311.5
129	Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	305.8
130				
131	**Assuming Gamma Distribution**			
132	95% Approximate Gamma UCL	187.9	95% Adjusted Gamma UCL	191.4
133				
134	**Lognormal GOF Test**			
135	Shapiro Wilk Test Statistic	0.969	**Shapiro Wilk Lognormal GOF Test**	
136	10% Shapiro Wilk Critical Value	0.889	Data appear Lognormal at 10% Significance Level	
137	Lilliefors Test Statistic	0.137	**Lilliefors Lognormal GOF Test**	
138	10% Lilliefors Critical Value	0.215	Data appear Lognormal at 10% Significance Level	
139	**Data appear Lognormal at 10% Significance Level**			
140				
141	**Lognormal Statistics**			
142	Minimum of Logged Data	4.663	Mean of logged Data	5.079
143	Maximum of Logged Data	5.489	SD of logged Data	0.249
144				
145	**Assuming Lognormal Distribution**			
146	95% H-UCL	189.5	90% Chebyshev (MVUE) UCL	199.8
147	95% Chebyshev (MVUE) UCL	215.4	97.5% Chebyshev (MVUE) UCL	237
148	99% Chebyshev (MVUE) UCL	279.6		
149				
150	**Nonparametric Distribution Free UCL Statistics**			
151	**Data appear to follow a Discernible Distribution**			
152				
153	**Nonparametric Distribution Free UCLs**			
154	95% CLT UCL	184.2	95% BCA Bootstrap UCL	183.9
155	95% Standard Bootstrap UCL	183.1	95% Bootstrap-t UCL	187.6
156	95% Hall's Bootstrap UCL	185.2	95% Percentile Bootstrap UCL	183.7
157	90% Chebyshev(Mean, Sd) UCL	199.7	95% Chebyshev(Mean, Sd) UCL	215.3
158	97.5% Chebyshev(Mean, Sd) UCL	237	99% Chebyshev(Mean, Sd) UCL	279.5
159				
160	**Suggested UCL to Use**			
161	95% Student's-t UCL	185.8		
162				
163	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
164	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.			

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

CEM-WRC

General Statistics			
Total Number of Observations	16	Number of Distinct Observations	16
		Number of Missing Observations	0
Minimum	52	Mean	107
Maximum	187	Median	106.5
SD	39.88	Std. Error of Mean	9.969
Coefficient of Variation	0.373	Skewness	0.439
Normal GOF Test			
Shapiro Wilk Test Statistic	0.952	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.844	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.145	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.248	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	124.5	95% Adjusted-CLT UCL (Chen-1995)	124.6
		95% Modified-t UCL (Johnson-1978)	124.7
Gamma GOF Test			
A-D Test Statistic	0.292	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.74	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.156	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.215	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	7.52	k star (bias corrected MLE)	6.151
Theta hat (MLE)	14.24	Theta star (bias corrected MLE)	17.4
nu hat (MLE)	240.6	nu star (bias corrected)	196.8
MLE Mean (bias corrected)	107	MLE Sd (bias corrected)	43.16
		Approximate Chi Square Value (0.05)	165.4
Adjusted Level of Significance	0.0335	Adjusted Chi Square Value	162.1
Assuming Gamma Distribution			
95% Approximate Gamma UCL	127.4	95% Adjusted Gamma UCL	130
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.955	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.906	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.147	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.196	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	3.951	Mean of logged Data	4.605
Maximum of Logged Data	5.231	SD of logged Data	0.387
Assuming Lognormal Distribution			
95% H-UCL	130.9	90% Chebyshev (MVUE) UCL	139.1
95% Chebyshev (MVUE) UCL	153.4	97.5% Chebyshev (MVUE) UCL	173.4
99% Chebyshev (MVUE) UCL	212.7		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	123.4	95% BCA Bootstrap UCL	124.9
95% Standard Bootstrap UCL	123.3	95% Bootstrap-t UCL	127.7
95% Hall's Bootstrap UCL	127.2	95% Percentile Bootstrap UCL	123.5
90% Chebyshev(Mean, Sd) UCL	137	95% Chebyshev(Mean, Sd) UCL	150.5
97.5% Chebyshev(Mean, Sd) UCL	169.3	99% Chebyshev(Mean, Sd) UCL	206.2
Suggested UCL to Use			
95% Student's-t UCL	124.5		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

CEM-WRD

General Statistics			
Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0

Minimum	56	Mean	66.5
Maximum	87	Median	61.5
SD	13.92	Std. Error of Mean	6.958
Coefficient of Variation	0.209	Skewness	1.781

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.793	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.377	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	82.88	95% Adjusted-CLT UCL (Chen-1995)	84.57
		95% Modified-t UCL (Johnson-1978)	83.91

Gamma GOF Test

A-D Test Statistic	0.562	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.385	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	33.76	k star (bias corrected MLE)	8.606
Theta hat (MLE)	1.97	Theta star (bias corrected MLE)	7.727
nu hat (MLE)	270.1	nu star (bias corrected)	68.85
MLE Mean (bias corrected)	66.5	MLE Sd (bias corrected)	22.67
		Approximate Chi Square Value (0.05)	50.75
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	90.22	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.824	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.362	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data Not Lognormal at 10% Significance Level

Data appear Approximate Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	4.025	Mean of logged Data	4.182
Maximum of Logged Data	4.466	SD of logged Data	0.194

Assuming Lognormal Distribution

95% H-UCL	87.85	90% Chebyshev (MVUE) UCL	85.76
95% Chebyshev (MVUE) UCL	94.5	97.5% Chebyshev (MVUE) UCL	106.6
99% Chebyshev (MVUE) UCL	130.5		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	77.95	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
90% Chebyshev(Mean, Sd) UCL	87.37	95% Chebyshev(Mean, Sd) UCL	96.83
97.5% Chebyshev(Mean, Sd) UCL	110	99% Chebyshev(Mean, Sd) UCL	135.7

Suggested UCL to Use

95% Student's-t UCL	82.88		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 11/18/2024 10:24:45 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

CM-PS

General Statistics

Total Number of Observations	7	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	9.7	Mean	29.26
Maximum	38.61	Median	33
SD	10.01	Std. Error of Mean	3.782
Coefficient of Variation	0.342	Skewness	-1.42

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.857	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.73	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.217	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.35	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	36.61	95% Adjusted-CLT UCL (Chen-1995)	33.31
		95% Modified-t UCL (Johnson-1978)	36.27

Gamma GOF Test

A-D Test Statistic	0.734	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.709	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.255	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.313	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	6.549	k star (bias corrected MLE)	3.838
Theta hat (MLE)	4.468	Theta star (bias corrected MLE)	7.624
nu hat (MLE)	91.69	nu star (bias corrected)	53.73
MLE Mean (bias corrected)	29.26	MLE Sd (bias corrected)	14.94
		Approximate Chi Square Value (0.05)	37.89
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	33.91

Assuming Gamma Distribution

95% Approximate Gamma UCL	41.49	95% Adjusted Gamma UCL	46.35

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.741	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.838	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.292	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.28	Data Not Lognormal at 10% Significance Level	

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.272	Mean of logged Data	3.298
Maximum of Logged Data	3.654	SD of logged Data	0.481

Assuming Lognormal Distribution

95% H-UCL	48.86	90% Chebyshev (MVUE) UCL	46.19
95% Chebyshev (MVUE) UCL	53.59	97.5% Chebyshev (MVUE) UCL	63.87
99% Chebyshev (MVUE) UCL	84.06		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	35.48	95% BCA Bootstrap UCL	33.94
95% Standard Bootstrap UCL	35.04	95% Bootstrap-t UCL	34.88
95% Hall's Bootstrap UCL	33.72	95% Percentile Bootstrap UCL	34.59
90% Chebyshev(Mean, Sd) UCL	40.6	95% Chebyshev(Mean, Sd) UCL	45.74
97.5% Chebyshev(Mean, Sd) UCL	52.87	99% Chebyshev(Mean, Sd) UCL	66.89

Suggested UCL to Use

95% Student's-t UCL	36.61		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

CM-WRA

General Statistics

Total Number of Observations	12	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	5	Mean	10.64
Maximum	19.6	Median	10.55
SD	3.808	Std. Error of Mean	1.099
Coefficient of Variation	0.358	Skewness	0.924

Normal GOF Test

Shapiro Wilk Test Statistic	0.932	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.805	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.184	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.281	Data appear Normal at 1% Significance Level	

Data appear Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	12.61	95% Adjusted-CLT UCL (Chen-1995)	12.76
		95% Modified-t UCL (Johnson-1978)	12.66
Gamma GOF Test			
A-D Test Statistic	0.25	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.731	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.151	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.246	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	8.767	k star (bias corrected MLE)	6.631
Theta hat (MLE)	1.213	Theta star (bias corrected MLE)	1.604
nu hat (MLE)	210.4	nu star (bias corrected)	159.1
MLE Mean (bias corrected)	10.64	MLE Sd (bias corrected)	4.13
		Approximate Chi Square Value (0.05)	131
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	127.1
Assuming Gamma Distribution			
95% Approximate Gamma UCL	12.92	95% Adjusted Gamma UCL	13.32
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.969	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.883	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.153	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.223	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	1.609	Mean of logged Data	2.306
Maximum of Logged Data	2.976	SD of logged Data	0.36
Assuming Lognormal Distribution			
95% H-UCL	13.28	90% Chebyshev (MVUE) UCL	14.01
95% Chebyshev (MVUE) UCL	15.53	97.5% Chebyshev (MVUE) UCL	17.64
99% Chebyshev (MVUE) UCL	21.79		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	12.44	95% BCA Bootstrap UCL	12.46
95% Standard Bootstrap UCL	12.34	95% Bootstrap-t UCL	12.92
95% Hall's Bootstrap UCL	13.55	95% Percentile Bootstrap UCL	12.38
90% Chebyshev(Mean, Sd) UCL	13.93	95% Chebyshev(Mean, Sd) UCL	15.43
97.5% Chebyshev(Mean, Sd) UCL	17.5	99% Chebyshev(Mean, Sd) UCL	21.57
Suggested UCL to Use			
95% Student's-t UCL	12.61		
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

CM-WRB

General Statistics

Total Number of Observations	11	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	5	Mean	11.46
Maximum	17.5	Median	11
SD	3.29	Std. Error of Mean	0.992
Coefficient of Variation	0.287	Skewness	-0.203

Normal GOF Test

Shapiro Wilk Test Statistic	0.965	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.792	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.171	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.291	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	13.26	95% Adjusted-CLT UCL (Chen-1995)	13.03
		95% Modified-t UCL (Johnson-1978)	13.25

Gamma GOF Test

A-D Test Statistic	0.417	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.729	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.212	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.255	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	11.4	k star (bias corrected MLE)	8.35
Theta hat (MLE)	1.006	Theta star (bias corrected MLE)	1.373
nu hat (MLE)	250.8	nu star (bias corrected)	183.7
MLE Mean (bias corrected)	11.46	MLE Sd (bias corrected)	3.967
		Approximate Chi Square Value (0.05)	153.4
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	148.8

Assuming Gamma Distribution

95% Approximate Gamma UCL	13.73	95% Adjusted Gamma UCL	14.15

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.897	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.876	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.231	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.231	Data Not Lognormal at 10% Significance Level

Data appear Approximate Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.609	Mean of logged Data	2.395
Maximum of Logged Data	2.862	SD of logged Data	0.331

Assuming Lognormal Distribution

95% H-UCL	14.25	90% Chebyshev (MVUE) UCL	15.01
95% Chebyshev (MVUE) UCL	16.58	97.5% Chebyshev (MVUE) UCL	18.77
99% Chebyshev (MVUE) UCL	23.07		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	13.1	95% BCA Bootstrap UCL	13
95% Standard Bootstrap UCL	13.02	95% Bootstrap-t UCL	13.19
95% Hall's Bootstrap UCL	13.32	95% Percentile Bootstrap UCL	13.01
90% Chebyshev(Mean, Sd) UCL	14.44	95% Chebyshev(Mean, Sd) UCL	15.79
97.5% Chebyshev(Mean, Sd) UCL	17.66	99% Chebyshev(Mean, Sd) UCL	21.33

Suggested UCL to Use

95% Student's-t UCL	13.26		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

CM-WRC

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	63.42	Mean	177.5
Maximum	365.8	Median	131
SD	106.5	Std. Error of Mean	35.49
Coefficient of Variation	0.6	Skewness	0.717

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.905	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.764	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.224	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.316	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	243.5	95% Adjusted-CLT UCL (Chen-1995)	244.9
		95% Modified-t UCL (Johnson-1978)	244.9

	A–E	F	G–K	L
276	Gamma GOF Test			
277	A-D Test Statistic	0.306	**Anderson-Darling Gamma GOF Test**	
278	5% A-D Critical Value	0.726	Detected data appear Gamma Distributed at 5% Significance Level	
279	K-S Test Statistic	0.182	**Kolmogorov-Smirnov Gamma GOF Test**	
280	5% K-S Critical Value	0.281	Detected data appear Gamma Distributed at 5% Significance Level	
281	**Detected data appear Gamma Distributed at 5% Significance Level**			
282	**Note GOF tests may be unreliable for small sample sizes**			
283				
284	**Gamma Statistics**			
285	k hat (MLE)	3.183	k star (bias corrected MLE)	2.196
286	Theta hat (MLE)	55.75	Theta star (bias corrected MLE)	80.8
287	nu hat (MLE)	57.3	nu star (bias corrected)	39.53
288	MLE Mean (bias corrected)	177.5	MLE Sd (bias corrected)	119.7
289			Approximate Chi Square Value (0.05)	26.13
290	Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	23.85
291				
292	**Assuming Gamma Distribution**			
293	95% Approximate Gamma UCL	268.5	95% Adjusted Gamma UCL	294.1
294				
295	**Lognormal GOF Test**			
296	Shapiro Wilk Test Statistic	0.95	**Shapiro Wilk Lognormal GOF Test**	
297	10% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 10% Significance Level	
298	Lilliefors Test Statistic	0.144	**Lilliefors Lognormal GOF Test**	
299	10% Lilliefors Critical Value	0.252	Data appear Lognormal at 10% Significance Level	
300	**Data appear Lognormal at 10% Significance Level**			
301	**Note GOF tests may be unreliable for small sample sizes**			
302				
303	**Lognormal Statistics**			
304	Minimum of Logged Data	4.15	Mean of logged Data	5.014
305	Maximum of Logged Data	5.902	SD of logged Data	0.616
306				
307	**Assuming Lognormal Distribution**			
308	95% H-UCL	311.7	90% Chebyshev (MVUE) UCL	289.3
309	95% Chebyshev (MVUE) UCL	339.9	97.5% Chebyshev (MVUE) UCL	410.2
310	99% Chebyshev (MVUE) UCL	548.1		
311				
312	**Nonparametric Distribution Free UCL Statistics**			
313	**Data appear to follow a Discernible Distribution**			
314				
315	**Nonparametric Distribution Free UCLs**			
316	95% CLT UCL	235.8	95% BCA Bootstrap UCL	241.8
317	95% Standard Bootstrap UCL	232.9	95% Bootstrap-t UCL	259.7
318	95% Hall's Bootstrap UCL	237.9	95% Percentile Bootstrap UCL	238
319	90% Chebyshev(Mean, Sd) UCL	283.9	95% Chebyshev(Mean, Sd) UCL	332.1
320	97.5% Chebyshev(Mean, Sd) UCL	399.1	99% Chebyshev(Mean, Sd) UCL	530.5
321				
322	**Suggested UCL to Use**			
323	95% Student's-t UCL	243.5		
324				
325	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
326	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.			
327	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			
328				

UCL Statistics for Uncensored Full Data Sets			
User Selected Options			
Date/Time of Computation	ProUCL 5.2 11/18/2024 10:46:30 AM		
From File	WorkSheet.xls		
Full Precision	OFF		
Confidence Coefficient	95%		
Number of Bootstrap Operations	2000		
GC03-WRA			
General Statistics			
Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	30	Mean	35.5
Maximum	45	Median	33.5
SD	6.856	Std. Error of Mean	3.428
Coefficient of Variation	0.193	Skewness	1.241
Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,			
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,			
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).			
The Chebyshev UCL often results in gross overestimates of the mean.			
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.			
Normal GOF Test			
Shapiro Wilk Test Statistic	0.881	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.244	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	43.57	95% Adjusted-CLT UCL (Chen-1995)	43.41
		95% Modified-t UCL (Johnson-1978)	43.92
Gamma GOF Test			
A-D Test Statistic	0.371	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.656	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.277	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Gamma Statistics			
k hat (MLE)	38.07	k star (bias corrected MLE)	9.684
Theta hat (MLE)	0.932	Theta star (bias corrected MLE)	3.666
nu hat (MLE)	304.6	nu star (bias corrected)	77.47
MLE Mean (bias corrected)	35.5	MLE Sd (bias corrected)	11.41
		Approximate Chi Square Value (0.05)	58.2
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	47.26	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.9	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.246	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	3.401	Mean of logged Data	3.556
Maximum of Logged Data	3.807	SD of logged Data	0.185

Assuming Lognormal Distribution

95% H-UCL	46.14	90% Chebyshev (MVUE) UCL	45.3
95% Chebyshev (MVUE) UCL	49.74	97.5% Chebyshev (MVUE) UCL	55.91
99% Chebyshev (MVUE) UCL	68.02		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	41.14	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
90% Chebyshev(Mean, Sd) UCL	45.78	95% Chebyshev(Mean, Sd) UCL	50.44
97.5% Chebyshev(Mean, Sd) UCL	56.91	99% Chebyshev(Mean, Sd) UCL	69.61

Suggested UCL to Use

95% Student's-t UCL	43.57		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

GC03-WRB

General Statistics

Total Number of Observations	9	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	75	Mean	230.9
Maximum	485	Median	222
SD	126.6	Std. Error of Mean	42.19
Coefficient of Variation	0.548	Skewness	0.971

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,

refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,

but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).

The Chebyshev UCL often results in gross overestimates of the mean.

Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

	A–E	F	G–K	L
111	Shapiro Wilk Test Statistic	0.922	**Shapiro Wilk GOF Test**	
112	1% Shapiro Wilk Critical Value	0.764	Data appear Normal at 1% Significance Level	
113	Lilliefors Test Statistic	0.195	**Lilliefors GOF Test**	
114	1% Lilliefors Critical Value	0.316	Data appear Normal at 1% Significance Level	
115	**Data appear Normal at 1% Significance Level**			
116	**Note GOF tests may be unreliable for small sample sizes**			
117				
118	**Assuming Normal Distribution**			
119	**95% Normal UCL**		**95% UCLs (Adjusted for Skewness)**	
120	95% Student's-t UCL	309.3	95% Adjusted-CLT UCL (Chen-1995)	314.9
121			95% Modified-t UCL (Johnson-1978)	311.6
122				
123	**Gamma GOF Test**			
124	A-D Test Statistic	0.239	**Anderson-Darling Gamma GOF Test**	
125	5% A-D Critical Value	0.725	Detected data appear Gamma Distributed at 5% Significance Level	
126	K-S Test Statistic	0.175	**Kolmogorov-Smirnov Gamma GOF Test**	
127	5% K-S Critical Value	0.281	Detected data appear Gamma Distributed at 5% Significance Level	
128	**Detected data appear Gamma Distributed at 5% Significance Level**			
129	**Note GOF tests may be unreliable for small sample sizes**			
130				
131	**Gamma Statistics**			
132	k hat (MLE)	3.853	k star (bias corrected MLE)	2.643
133	Theta hat (MLE)	59.92	Theta star (bias corrected MLE)	87.37
134	nu hat (MLE)	69.35	nu star (bias corrected)	47.57
135	MLE Mean (bias corrected)	230.9	MLE Sd (bias corrected)	142
136			Approximate Chi Square Value (0.05)	32.74
137	Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	30.17
138				
139	**Assuming Gamma Distribution**			
140	95% Approximate Gamma UCL	335.5	95% Adjusted Gamma UCL	364.1
141				
142	**Lognormal GOF Test**			
143	Shapiro Wilk Test Statistic	0.97	**Shapiro Wilk Lognormal GOF Test**	
144	10% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 10% Significance Level	
145	Lilliefors Test Statistic	0.151	**Lilliefors Lognormal GOF Test**	
146	10% Lilliefors Critical Value	0.252	Data appear Lognormal at 10% Significance Level	
147	**Data appear Lognormal at 10% Significance Level**			
148	**Note GOF tests may be unreliable for small sample sizes**			
149				
150	**Lognormal Statistics**			
151	Minimum of Logged Data	4.317	Mean of logged Data	5.307
152	Maximum of Logged Data	6.184	SD of logged Data	0.563
153				
154	**Assuming Lognormal Distribution**			
155	95% H-UCL	377.1	90% Chebyshev (MVUE) UCL	364.5
156	95% Chebyshev (MVUE) UCL	424.7	97.5% Chebyshev (MVUE) UCL	508.2
157	99% Chebyshev (MVUE) UCL	672.2		
158				
159	**Nonparametric Distribution Free UCL Statistics**			
160	**Data appear to follow a Discernible Distribution**			
161				
162	**Nonparametric Distribution Free UCLs**			
163	95% CLT UCL	300.3	95% BCA Bootstrap UCL	307.9
164	95% Standard Bootstrap UCL	296.8	95% Bootstrap-t UCL	342.8
165	95% Hall's Bootstrap UCL	341	95% Percentile Bootstrap UCL	301.9

	A	B	C	D	E	F	G	H	I	J	K	L
166	90% Chebyshev(Mean, Sd) UCL					357.5	95% Chebyshev(Mean, Sd) UCL					414.8
167	97.5% Chebyshev(Mean, Sd) UCL					494.4	99% Chebyshev(Mean, Sd) UCL					650.7
168												
169	**Suggested UCL to Use**											
170	95% Student's-t UCL					309.3						
171												
172	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
173	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
174	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
175												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 11/18/2024 10:50:06 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

GC5-WRA

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	82.14	Mean	211
Maximum	421	Median	165
SD	122.8	Std. Error of Mean	43.43
Coefficient of Variation	0.582	Skewness	1.159

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.814	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.749	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.318	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.333	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	293.2	95% Adjusted-CLT UCL (Chen-1995)	301.4
		95% Modified-t UCL (Johnson-1978)	296.2

Gamma GOF Test

A-D Test Statistic	0.545	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.719	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.263	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.295	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	3.877	k star (bias corrected MLE)	2.506
Theta hat (MLE)	54.42	Theta star (bias corrected MLE)	84.17
nu hat (MLE)	62.03	nu star (bias corrected)	40.1
MLE Mean (bias corrected)	211	MLE Sd (bias corrected)	133.3
		Approximate Chi Square Value (0.05)	26.59
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	23.84

Assuming Gamma Distribution

95% Approximate Gamma UCL	318.1	95% Adjusted Gamma UCL	354.8

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.918	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.851	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.229	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.265	Data appear Lognormal at 10% Significance Level	

Data appear Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	4.408	Mean of logged Data	5.217
Maximum of Logged Data	6.043	SD of logged Data	0.545

Assuming Lognormal Distribution

95% H-UCL	352.8	90% Chebyshev (MVUE) UCL	332
95% Chebyshev (MVUE) UCL	387.5	97.5% Chebyshev (MVUE) UCL	464.4
99% Chebyshev (MVUE) UCL	615.6		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	282.4	95% BCA Bootstrap UCL	288.1
95% Standard Bootstrap UCL	277.8	95% Bootstrap-t UCL	446.6
95% Hall's Bootstrap UCL	941.1	95% Percentile Bootstrap UCL	281.3
90% Chebyshev(Mean, Sd) UCL	341.3	95% Chebyshev(Mean, Sd) UCL	400.3
97.5% Chebyshev(Mean, Sd) UCL	482.2	99% Chebyshev(Mean, Sd) UCL	643.1

Suggested UCL to Use

95% Student's-t UCL	293.2		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

GC5-WRB

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	52	Mean	117.1
Maximum	162	Median	124.5
SD	34.46	Std. Error of Mean	10.9
Coefficient of Variation	0.294	Skewness	-0.629

Normal GOF Test

Shapiro Wilk Test Statistic	0.936	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.208	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level	

Data appear Normal at 1% Significance Level

Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	137.1	95% Adjusted-CLT UCL (Chen-1995)	132.7
		95% Modified-t UCL (Johnson-1978)	136.7
Gamma GOF Test			
A-D Test Statistic	0.498	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.725	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.249	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.267	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	10.51	k star (bias corrected MLE)	7.422
Theta hat (MLE)	11.14	Theta star (bias corrected MLE)	15.78
nu hat (MLE)	210.1	nu star (bias corrected)	148.4
MLE Mean (bias corrected)	117.1	MLE Sd (bias corrected)	42.98
		Approximate Chi Square Value (0.05)	121.3
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	117
Assuming Gamma Distribution			
95% Approximate Gamma UCL	143.3	95% Adjusted Gamma UCL	148.5
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.874	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.262	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.241	Data Not Lognormal at 10% Significance Level	
Data appear Approximate Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	3.951	Mean of logged Data	4.715
Maximum of Logged Data	5.088	SD of logged Data	0.348
Assuming Lognormal Distribution			
95% H-UCL	150	90% Chebyshev (MVUE) UCL	157.1
95% Chebyshev (MVUE) UCL	174.8	97.5% Chebyshev (MVUE) UCL	199.5
99% Chebyshev (MVUE) UCL	248		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	135	95% BCA Bootstrap UCL	133.9
95% Standard Bootstrap UCL	134.3	95% Bootstrap-t UCL	135.7
95% Hall's Bootstrap UCL	133.4	95% Percentile Bootstrap UCL	133.9
90% Chebyshev(Mean, Sd) UCL	149.8	95% Chebyshev(Mean, Sd) UCL	164.6
97.5% Chebyshev(Mean, Sd) UCL	185.2	99% Chebyshev(Mean, Sd) UCL	225.5
Suggested UCL to Use			
95% Student's-t UCL	137.1		
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.			
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			

	A	B	C	D	E	F	G	H	I	J	K	L
166												
167	Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be											
168	reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.											
169												

UCL Statistics for Uncensored Full Data Sets			
User Selected Options			
Date/Time of Computation	ProUCL 5.2 11/18/2024 10:57:52 AM		
From File	WorkSheet.xls		
Full Precision	OFF		
Confidence Coefficient	95%		
Number of Bootstrap Operations	2000		
GC6-WRA			
General Statistics			
Total Number of Observations	17	Number of Distinct Observations	16
		Number of Missing Observations	0
Minimum	134	Mean	243.8
Maximum	504	Median	201
SD	101.1	Std. Error of Mean	24.53
Coefficient of Variation	0.415	Skewness	1.518
Normal GOF Test			
Shapiro Wilk Test Statistic	0.825	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.851	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.221	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.241	Data appear Normal at 1% Significance Level	
Data appear Approximate Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	286.6	95% Adjusted-CLT UCL (Chen-1995)	293.8
		95% Modified-t UCL (Johnson-1978)	288.1
Gamma GOF Test			
A-D Test Statistic	0.769	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.74	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.183	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.209	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data follow Appr. Gamma Distribution at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	7.643	k star (bias corrected MLE)	6.333
Theta hat (MLE)	31.9	Theta star (bias corrected MLE)	38.49
nu hat (MLE)	259.8	nu star (bias corrected)	215.3
MLE Mean (bias corrected)	243.8	MLE Sd (bias corrected)	96.86
		Approximate Chi Square Value (0.05)	182.4
Adjusted Level of Significance	0.0346	Adjusted Chi Square Value	179.2
Assuming Gamma Distribution			
95% Approximate Gamma UCL	287.8	95% Adjusted Gamma UCL	292.9
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.923	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.91	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.166	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.19	Data appear Lognormal at 10% Significance Level	

Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	4.898	Mean of logged Data	5.429
Maximum of Logged Data	6.223	SD of logged Data	0.361
Assuming Lognormal Distribution			
95% H-UCL	289.2	90% Chebyshev (MVUE) UCL	307.2
95% Chebyshev (MVUE) UCL	336.6	97.5% Chebyshev (MVUE) UCL	377.4
99% Chebyshev (MVUE) UCL	457.5		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	284.1	95% BCA Bootstrap UCL	295.1
95% Standard Bootstrap UCL	283.3	95% Bootstrap-t UCL	307.9
95% Hall's Bootstrap UCL	301.6	95% Percentile Bootstrap UCL	285.7
90% Chebyshev(Mean, Sd) UCL	317.3	95% Chebyshev(Mean, Sd) UCL	350.7
97.5% Chebyshev(Mean, Sd) UCL	396.9	99% Chebyshev(Mean, Sd) UCL	487.8
Suggested UCL to Use			
95% Student's-t UCL	286.6		
When a data set follows an approximate distribution passing only one of the GOF tests,			
it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL			
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.			
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			
GC6-WTP			
General Statistics			
Total Number of Observations	14	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	1.7	Mean	8.236
Maximum	16	Median	7
SD	3.761	Std. Error of Mean	1.005
Coefficient of Variation	0.457	Skewness	0.607
Normal GOF Test			
Shapiro Wilk Test Statistic	0.926	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.825	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.272	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.263	Data Not Normal at 1% Significance Level	
Data appear Approximate Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	10.02	95% Adjusted-CLT UCL (Chen-1995)	10.06
		95% Modified-t UCL (Johnson-1978)	10.04
Gamma GOF Test			

A-D Test Statistic	0.545	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.739	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.213	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.23	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	4.496	k star (bias corrected MLE)	3.58
Theta hat (MLE)	1.832	Theta star (bias corrected MLE)	2.3
nu hat (MLE)	125.9	nu star (bias corrected)	100.2
MLE Mean (bias corrected)	8.236	MLE Sd (bias corrected)	4.353
		Approximate Chi Square Value (0.05)	78.14
Adjusted Level of Significance	0.0312	Adjusted Chi Square Value	75.56
Assuming Gamma Distribution			
95% Approximate Gamma UCL	10.56	95% Adjusted Gamma UCL	10.93
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.872	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.895	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.213	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.208	Data Not Lognormal at 10% Significance Level	
Data Not Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	0.531	Mean of logged Data	1.993
Maximum of Logged Data	2.773	SD of logged Data	0.543
Assuming Lognormal Distribution			
95% H-UCL	11.62	90% Chebyshev (MVUE) UCL	12.19
95% Chebyshev (MVUE) UCL	13.9	97.5% Chebyshev (MVUE) UCL	16.28
99% Chebyshev (MVUE) UCL	20.94		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	9.889	95% BCA Bootstrap UCL	9.95
95% Standard Bootstrap UCL	9.866	95% Bootstrap-t UCL	10.24
95% Hall's Bootstrap UCL	10.36	95% Percentile Bootstrap UCL	9.907
90% Chebyshev(Mean, Sd) UCL	11.25	95% Chebyshev(Mean, Sd) UCL	12.62
97.5% Chebyshev(Mean, Sd) UCL	14.51	99% Chebyshev(Mean, Sd) UCL	18.24
Suggested UCL to Use			
95% Student's-t UCL	10.02		
When a data set follows an approximate distribution passing only one of the GOF tests,			
it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL			
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.			
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			

UCL Statistics for Uncensored Full Data Sets			
User Selected Options			
Date/Time of Computation	ProUCL 5.2 11/18/2024 11:03:21 AM		
From File	WorkSheet.xls		
Full Precision	OFF		
Confidence Coefficient	95%		
Number of Bootstrap Operations	2000		
GC7-WRA			
General Statistics			
Total Number of Observations	14	Number of Distinct Observations	12
		Number of Missing Observations	0
Minimum	10	Mean	19.06
Maximum	31	Median	16
SD	7.15	Std. Error of Mean	1.911
Coefficient of Variation	0.375	Skewness	0.547
Normal GOF Test			
Shapiro Wilk Test Statistic	0.897	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.825	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.215	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.263	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	22.44	95% Adjusted-CLT UCL (Chen-1995)	22.5
		95% Modified-t UCL (Johnson-1978)	22.49
Gamma GOF Test			
A-D Test Statistic	0.493	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.736	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.201	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.229	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	7.91	k star (bias corrected MLE)	6.262
Theta hat (MLE)	2.409	Theta star (bias corrected MLE)	3.043
nu hat (MLE)	221.5	nu star (bias corrected)	175.3
MLE Mean (bias corrected)	19.06	MLE Sd (bias corrected)	7.615
		Approximate Chi Square Value (0.05)	145.7
Adjusted Level of Significance	0.0312	Adjusted Chi Square Value	142.1
Assuming Gamma Distribution			
95% Approximate Gamma UCL	22.93	95% Adjusted Gamma UCL	23.51
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.933	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk Critical Value	0.895	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.181	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.208	Data appear Lognormal at 10% Significance Level	

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.303	Mean of logged Data	2.883
Maximum of Logged Data	3.434	SD of logged Data	0.372

Assuming Lognormal Distribution

95% H-UCL	23.44	90% Chebyshev (MVUE) UCL	24.83
95% Chebyshev (MVUE) UCL	27.45	97.5% Chebyshev (MVUE) UCL	31.08
99% Chebyshev (MVUE) UCL	38.22		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	22.2	95% BCA Bootstrap UCL	22.26
95% Standard Bootstrap UCL	22.14	95% Bootstrap-t UCL	22.95
95% Hall's Bootstrap UCL	22.16	95% Percentile Bootstrap UCL	22.2
90% Chebyshev(Mean, Sd) UCL	24.79	95% Chebyshev(Mean, Sd) UCL	27.39
97.5% Chebyshev(Mean, Sd) UCL	30.99	99% Chebyshev(Mean, Sd) UCL	38.07

Suggested UCL to Use

95% Student's-t UCL	22.44		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

GC7-WRB

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	7.43	Mean	96.92
Maximum	220	Median	78.57
SD	96.8	Std. Error of Mean	39.52
Coefficient of Variation	0.999	Skewness	0.252

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,

refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,

but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).

The Chebyshev UCL often results in gross overestimates of the mean.

Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.823	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.713	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.301	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.373	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL	**95% UCLs (Adjusted for Skewness)**

95% Student's-t UCL	176.6	95% Adjusted-CLT UCL (Chen-1995)	166.3
		95% Modified-t UCL (Johnson-1978)	177.2
Gamma GOF Test			
A-D Test Statistic	0.639	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.721	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.298	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.343	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Gamma Statistics			
k hat (MLE)	0.767	k star (bias corrected MLE)	0.495
Theta hat (MLE)	126.4	Theta star (bias corrected MLE)	196
nu hat (MLE)	9.202	nu star (bias corrected)	5.935
MLE Mean (bias corrected)	96.92	MLE Sd (bias corrected)	137.8
		Approximate Chi Square Value (0.05)	1.606
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	0.927
Assuming Gamma Distribution			
95% Approximate Gamma UCL	358	95% Adjusted Gamma UCL	620.6
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.822	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.826	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.273	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.298	Data appear Lognormal at 10% Significance Level	
Data appear Approximate Lognormal at 10% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Lognormal Statistics			
Minimum of Logged Data	2.006	Mean of logged Data	3.796
Maximum of Logged Data	5.394	SD of logged Data	1.551
Assuming Lognormal Distribution			
95% H-UCL	9925	90% Chebyshev (MVUE) UCL	301
95% Chebyshev (MVUE) UCL	388.2	97.5% Chebyshev (MVUE) UCL	509.3
99% Chebyshev (MVUE) UCL	747.2		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	161.9	95% BCA Bootstrap UCL	159.3
95% Standard Bootstrap UCL	155.9	95% Bootstrap-t UCL	175.7
95% Hall's Bootstrap UCL	132	95% Percentile Bootstrap UCL	159.9
90% Chebyshev(Mean, Sd) UCL	215.5	95% Chebyshev(Mean, Sd) UCL	269.2
97.5% Chebyshev(Mean, Sd) UCL	343.7	99% Chebyshev(Mean, Sd) UCL	490.1
Suggested UCL to Use			
95% Student's-t UCL	176.6		
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.			
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			

	A	B	C	D	E	F	G	H	I	J	K	L
166												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 11/19/2024 4:45:42 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

GF-WRA

General Statistics

Total Number of Observations	26	Number of Distinct Observations	22
		Number of Missing Observations	0
Minimum	170	Mean	305.6
Maximum	491	Median	287.5
SD	78.73	Std. Error of Mean	15.44
Coefficient of Variation	0.258	Skewness	0.634

Normal GOF Test

Shapiro Wilk Test Statistic	0.96	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.891	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.132	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.199	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	332	95% Adjusted-CLT UCL (Chen-1995)	333.1
		95% Modified-t UCL (Johnson-1978)	332.3

Gamma GOF Test

A-D Test Statistic	0.234	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.744	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.109	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.171	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	16.13	k star (bias corrected MLE)	14.29
Theta hat (MLE)	18.95	Theta star (bias corrected MLE)	21.39
nu hat (MLE)	838.6	nu star (bias corrected)	743.1
MLE Mean (bias corrected)	305.6	MLE Sd (bias corrected)	80.84
		Approximate Chi Square Value (0.05)	680.9
Adjusted Level of Significance	0.0398	Adjusted Chi Square Value	676.9

Assuming Gamma Distribution

95% Approximate Gamma UCL	333.6	95% Adjusted Gamma UCL	335.5

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.984	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.933	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.0925	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.156	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.136	Mean of logged Data	5.691
Maximum of Logged Data	6.196	SD of logged Data	0.256

Assuming Lognormal Distribution

95% H-UCL	335.3	90% Chebyshev (MVUE) UCL	352.1
95% Chebyshev (MVUE) UCL	373.2	97.5% Chebyshev (MVUE) UCL	402.4
99% Chebyshev (MVUE) UCL	459.8		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	331	95% BCA Bootstrap UCL	331.3
95% Standard Bootstrap UCL	330.3	95% Bootstrap-t UCL	334.4
95% Hall's Bootstrap UCL	333.8	95% Percentile Bootstrap UCL	330
90% Chebyshev(Mean, Sd) UCL	351.9	95% Chebyshev(Mean, Sd) UCL	372.9
97.5% Chebyshev(Mean, Sd) UCL	402	99% Chebyshev(Mean, Sd) UCL	459.2

Suggested UCL to Use

95% Student's-t UCL	332

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

GF-WRB

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	28.7	Mean	84.81
Maximum	141	Median	79.36
SD	42.32	Std. Error of Mean	16
Coefficient of Variation	0.499	Skewness	0.402

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.907	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.73	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.189	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.35	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	115.9	95% Adjusted-CLT UCL (Chen-1995)	113.7
		95% Modified-t UCL (Johnson-1978)	116.3

Gamma GOF Test

A-D Test Statistic	0.298	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.71	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.186	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.313	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	4.281	k star (bias corrected MLE)	2.541
Theta hat (MLE)	19.81	Theta star (bias corrected MLE)	33.37
nu hat (MLE)	59.93	nu star (bias corrected)	35.58
MLE Mean (bias corrected)	84.81	MLE Sd (bias corrected)	53.2
		Approximate Chi Square Value (0.05)	22.93
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	19.92

Assuming Gamma Distribution

95% Approximate Gamma UCL	131.6	95% Adjusted Gamma UCL	151.5

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.928	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.838	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.182	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.28	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	3.357	Mean of logged Data	4.319
Maximum of Logged Data	4.949	SD of logged Data	0.557

Assuming Lognormal Distribution

95% H-UCL	157.7	90% Chebyshev (MVUE) UCL	140
95% Chebyshev (MVUE) UCL	164.6	97.5% Chebyshev (MVUE) UCL	198.7
99% Chebyshev (MVUE) UCL	265.9		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	111.1	95% BCA Bootstrap UCL	112.5
95% Standard Bootstrap UCL	109.4	95% Bootstrap-t UCL	130.3
95% Hall's Bootstrap UCL	140.9	95% Percentile Bootstrap UCL	109.9
90% Chebyshev(Mean, Sd) UCL	132.8	95% Chebyshev(Mean, Sd) UCL	154.5
97.5% Chebyshev(Mean, Sd) UCL	184.7	99% Chebyshev(Mean, Sd) UCL	244

Suggested UCL to Use

95% Student's-t UCL	115.9		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

GF-WRC

General Statistics

Total Number of Observations	17	Number of Distinct Observations	17
		Number of Missing Observations	0
Minimum	41	Mean	143.1
Maximum	1340	Median	75
SD	309.1	Std. Error of Mean	74.96
Coefficient of Variation	2.16	Skewness	4.094

Normal GOF Test

Shapiro Wilk Test Statistic	0.318	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.851	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.494	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.241	Data Not Normal at 1% Significance Level	

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	274	95% Adjusted-CLT UCL (Chen-1995)	346
		95% Modified-t UCL (Johnson-1978)	286.4

Gamma GOF Test

A-D Test Statistic	3.592	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.768	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.426	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.215	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.958	k star (bias corrected MLE)	0.828
Theta hat (MLE)	149.4	Theta star (bias corrected MLE)	172.8
nu hat (MLE)	32.57	nu star (bias corrected)	28.15
MLE Mean (bias corrected)	143.1	MLE Sd (bias corrected)	157.3
		Approximate Chi Square Value (0.05)	17.05
Adjusted Level of Significance	0.0346	Adjusted Chi Square Value	16.14

Assuming Gamma Distribution

95% Approximate Gamma UCL	236.4	95% Adjusted Gamma UCL	249.6

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.623	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.91	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.309	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.19	Data Not Lognormal at 10% Significance Level	

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.714	Mean of logged Data	4.358
Maximum of Logged Data	7.2	SD of logged Data	0.791

Assuming Lognormal Distribution

95% H-UCL	170	90% Chebyshev (MVUE) UCL	168.9
95% Chebyshev (MVUE) UCL	198.1	97.5% Chebyshev (MVUE) UCL	238.7
99% Chebyshev (MVUE) UCL	318.4		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	266.4	95% BCA Bootstrap UCL	369.2
95% Standard Bootstrap UCL	260.2	95% Bootstrap-t UCL	1526
95% Hall's Bootstrap UCL	994.7	95% Percentile Bootstrap UCL	291.5
90% Chebyshev(Mean, Sd) UCL	368	95% Chebyshev(Mean, Sd) UCL	469.9
97.5% Chebyshev(Mean, Sd) UCL	611.2	99% Chebyshev(Mean, Sd) UCL	888.9

Suggested UCL to Use

95% Student's-t UCL	274		

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.
Please verify the data were collected from random locations.
If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A–E	F	G–K	L
247	GF-WRC-Rev			
248				
249	**General Statistics**			
250	Total Number of Observations	16	Number of Distinct Observations	16
251			Number of Missing Observations	0
252	Minimum	41	Mean	68.31
253	Maximum	102	Median	71
254	SD	20.42	Std. Error of Mean	5.106
255	Coefficient of Variation	0.299	Skewness	0.154
256				
257	**Normal GOF Test**			
258	Shapiro Wilk Test Statistic	0.928	**Shapiro Wilk GOF Test**	
259	1% Shapiro Wilk Critical Value	0.844	Data appear Normal at 1% Significance Level	
260	Lilliefors Test Statistic	0.133	**Lilliefors GOF Test**	
261	1% Lilliefors Critical Value	0.248	Data appear Normal at 1% Significance Level	
262	**Data appear Normal at 1% Significance Level**			
263				
264	**Assuming Normal Distribution**			
265	**95% Normal UCL**		**95% UCLs (Adjusted for Skewness)**	
266	95% Student's-t UCL	77.26	95% Adjusted-CLT UCL (Chen-1995)	76.92
267			95% Modified-t UCL (Johnson-1978)	77.3
268				
269	**Gamma GOF Test**			
270	A-D Test Statistic	0.475	**Anderson-Darling Gamma GOF Test**	
271	5% A-D Critical Value	0.739	Detected data appear Gamma Distributed at 5% Significance Level	
272	K-S Test Statistic	0.163	**Kolmogorov-Smirnov Gamma GOF Test**	
273	5% K-S Critical Value	0.215	Detected data appear Gamma Distributed at 5% Significance Level	
274	**Detected data appear Gamma Distributed at 5% Significance Level**			
275				
276	**Gamma Statistics**			
277	k hat (MLE)	11.58	k star (bias corrected MLE)	9.446
278	Theta hat (MLE)	5.902	Theta star (bias corrected MLE)	7.232
279	nu hat (MLE)	370.4	nu star (bias corrected)	302.3
280	MLE Mean (bias corrected)	68.31	MLE Sd (bias corrected)	22.23
281			Approximate Chi Square Value (0.05)	263
282	Adjusted Level of Significance	0.0335	Adjusted Chi Square Value	258.8
283				
284	**Assuming Gamma Distribution**			
285	95% Approximate Gamma UCL	78.51	95% Adjusted Gamma UCL	79.78
286				
287	**Lognormal GOF Test**			
288	Shapiro Wilk Test Statistic	0.924	**Shapiro Wilk Lognormal GOF Test**	
289	10% Shapiro Wilk Critical Value	0.906	Data appear Lognormal at 10% Significance Level	
290	Lilliefors Test Statistic	0.171	**Lilliefors Lognormal GOF Test**	
291	10% Lilliefors Critical Value	0.196	Data appear Lognormal at 10% Significance Level	
292	**Data appear Lognormal at 10% Significance Level**			
293				
294	**Lognormal Statistics**			
295	Minimum of Logged Data	3.714	Mean of logged Data	4.18
296	Maximum of Logged Data	4.625	SD of logged Data	0.309
297				
298	**Assuming Lognormal Distribution**			
299	95% H-UCL	79.7	90% Chebyshev (MVUE) UCL	84.45
300	95% Chebyshev (MVUE) UCL	91.73	97.5% Chebyshev (MVUE) UCL	101.8
301	99% Chebyshev (MVUE) UCL	121.7		
302				
303	**Nonparametric Distribution Free UCL Statistics**			
304	**Data appear to follow a Discernible Distribution**			
305				
306	**Nonparametric Distribution Free UCLs**			
307	95% CLT UCL	76.71	95% BCA Bootstrap UCL	76.94
308	95% Standard Bootstrap UCL	76.57	95% Bootstrap-t UCL	77.7
309	95% Hall's Bootstrap UCL	76.62	95% Percentile Bootstrap UCL	76.56
310	90% Chebyshev(Mean, Sd) UCL	83.63	95% Chebyshev(Mean, Sd) UCL	90.57
311	97.5% Chebyshev(Mean, Sd) UCL	100.2	99% Chebyshev(Mean, Sd) UCL	119.1
312				
313	**Suggested UCL to Use**			
314	95% Student's-t UCL	77.26		
315				
316	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
317	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.			
318	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			
319				
320				
321	GF-WRD			
322				
323	**General Statistics**			
324	Total Number of Observations	7	Number of Distinct Observations	7
325			Number of Missing Observations	0
326	Minimum	45.79	Mean	64.52
327	Maximum	80	Median	66.6
328	SD	10.85	Std. Error of Mean	4.101

Coefficient of Variation	0.168	Skewness	-0.481

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.977	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.73	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.153	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.35	Data appear Normal at 1% Significance Level	

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	72.49	95% Adjusted-CLT UCL (Chen-1995)	70.46
		95% Modified-t UCL (Johnson-1978)	72.36

Gamma GOF Test

A-D Test Statistic	0.243	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.707	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.171	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.311	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	38.54	k star (bias corrected MLE)	22.12
Theta hat (MLE)	1.674	Theta star (bias corrected MLE)	2.917
nu hat (MLE)	539.5	nu star (bias corrected)	309.6
MLE Mean (bias corrected)	64.52	MLE Sd (bias corrected)	13.72
		Approximate Chi Square Value (0.05)	269.9
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	258.6

Assuming Gamma Distribution

95% Approximate Gamma UCL	74.02	95% Adjusted Gamma UCL	77.25

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.947	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.838	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.18	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.28	Data appear Lognormal at 10% Significance Level	

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	3.824	Mean of logged Data	4.154
Maximum of Logged Data	4.382	SD of logged Data	0.178

Assuming Lognormal Distribution

95% H-UCL	74.59	90% Chebyshev (MVUE) UCL	77.58
95% Chebyshev (MVUE) UCL	83.49	97.5% Chebyshev (MVUE) UCL	91.68
99% Chebyshev (MVUE) UCL	107.8		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	71.26	95% BCA Bootstrap UCL	70.28
95% Standard Bootstrap UCL	70.93	95% Bootstrap-t UCL	71.84
95% Hall's Bootstrap UCL	71.28	95% Percentile Bootstrap UCL	70.67
90% Chebyshev(Mean, Sd) UCL	76.82	95% Chebyshev(Mean, Sd) UCL	82.39
97.5% Chebyshev(Mean, Sd) UCL	90.13	99% Chebyshev(Mean, Sd) UCL	105.3

Suggested UCL to Use

95% Student's-t UCL	72.49		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be
reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 12/2/2024 9:16:19 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

LMM-TLA

General Statistics			
Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	838.9	Mean	5535
Maximum	10884	Median	4470
SD	3492	Std. Error of Mean	1320
Coefficient of Variation	0.631	Skewness	0.499

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test		
Shapiro Wilk Test Statistic	0.942	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.73	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.197	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.35	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	8099	95% Adjusted-CLT UCL (Chen-1995)	7972
		95% Modified-t UCL (Johnson-1978)	8141

Gamma GOF Test		
A-D Test Statistic	0.282	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.714	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.177	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.315	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics			
k hat (MLE)	2.259	k star (bias corrected MLE)	1.386
Theta hat (MLE)	2450	Theta star (bias corrected MLE)	3993
nu hat (MLE)	31.63	nu star (bias corrected)	19.41
MLE Mean (bias corrected)	5535	MLE Sd (bias corrected)	4701
		Approximate Chi Square Value (0.05)	10.41
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	8.499

Assuming Gamma Distribution			
95% Approximate Gamma UCL	10313	95% Adjusted Gamma UCL	12637

Lognormal GOF Test		
Shapiro Wilk Test Statistic	0.891	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.838	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.233	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.28	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics			
Minimum of Logged Data	6.732	Mean of logged Data	8.381
Maximum of Logged Data	9.295	SD of logged Data	0.845

Assuming Lognormal Distribution			
95% H-UCL	19275	90% Chebyshev (MVUE) UCL	11515
95% Chebyshev (MVUE) UCL	14075	97.5% Chebyshev (MVUE) UCL	17629
99% Chebyshev (MVUE) UCL	24608		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
95% CLT UCL	7706	95% BCA Bootstrap UCL	7886
95% Standard Bootstrap UCL	7580	95% Bootstrap-t UCL	9484
95% Hall's Bootstrap UCL	11783	95% Percentile Bootstrap UCL	7668

90% Chebyshev(Mean, Sd) UCL	9494	95% Chebyshev(Mean, Sd) UCL	11288
97.5% Chebyshev(Mean, Sd) UCL	13777	99% Chebyshev(Mean, Sd) UCL	18667

Suggested UCL to Use

95% Student's-t UCL	8099		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

LMM-WRA

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	0
Minimum	93.12	Mean	1284
Maximum	4610	Median	544
SD	1417	Std. Error of Mean	393
Coefficient of Variation	1.104	Skewness	1.218

Normal GOF Test

Shapiro Wilk Test Statistic	0.801	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.814	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.307	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.271	Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1985	95% Adjusted-CLT UCL (Chen-1995)	2072
		95% Modified-t UCL (Johnson-1978)	2007

Gamma GOF Test

A-D Test Statistic	0.65	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.765	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.225	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.245	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.857	k star (bias corrected MLE)	0.71
Theta hat (MLE)	1499	Theta star (bias corrected MLE)	1808
nu hat (MLE)	22.28	nu star (bias corrected)	18.47
MLE Mean (bias corrected)	1284	MLE Sd (bias corrected)	1524
		Approximate Chi Square Value (0.05)	9.731
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	8.84

Assuming Gamma Distribution

95% Approximate Gamma UCL	2437	95% Adjusted Gamma UCL	2683

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.924	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.889	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.197	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.215	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.534	Mean of logged Data	6.471
Maximum of Logged Data	8.436	SD of logged Data	1.295

Assuming Lognormal Distribution

95% H-UCL	5299	90% Chebyshev (MVUE) UCL	2952
95% Chebyshev (MVUE) UCL	3678	97.5% Chebyshev (MVUE) UCL	4685
99% Chebyshev (MVUE) UCL	6664		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	1931	95% BCA Bootstrap UCL	2047
95% Standard Bootstrap UCL	1919	95% Bootstrap-t UCL	2319
95% Hall's Bootstrap UCL	2022	95% Percentile Bootstrap UCL	1939
90% Chebyshev(Mean, Sd) UCL	2463	95% Chebyshev(Mean, Sd) UCL	2997
97.5% Chebyshev(Mean, Sd) UCL	3739	99% Chebyshev(Mean, Sd) UCL	5195

Suggested UCL to Use

95% Adjusted Gamma UCL	2683		

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.
Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

LMM-WRB

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	142.8	Mean	1885
Maximum	8150	Median	854.5
SD	3093	Std. Error of Mean	1263
Coefficient of Variation	1.64	Skewness	2.366

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.61	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.713	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.435	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.373	Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	4429	95% Adjusted-CLT UCL (Chen-1995)	5265
		95% Modified-t UCL (Johnson-1978)	4633

Gamma GOF Test

A-D Test Statistic	0.57	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.725	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.329	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.345	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	0.675	k star (bias corrected MLE)	0.449
Theta hat (MLE)	2793	Theta star (bias corrected MLE)	4203
nu hat (MLE)	8.099	nu star (bias corrected)	5.383
MLE Mean (bias corrected)	1885	MLE Sd (bias corrected)	2815
		Approximate Chi Square Value (0.05)	1.333
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	0.739

Assuming Gamma Distribution

95% Approximate Gamma UCL	7612	95% Adjusted Gamma UCL	13728

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.925	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.826	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.236	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.298	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	4.961	Mean of logged Data	6.642
Maximum of Logged Data	9.006	SD of logged Data	1.423

Assuming Lognormal Distribution

95% H-UCL	74666	90% Chebyshev (MVUE) UCL	4359
95% Chebyshev (MVUE) UCL	5590	97.5% Chebyshev (MVUE) UCL	7298
99% Chebyshev (MVUE) UCL	10654		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	3962	95% BCA Bootstrap UCL	4620
95% Standard Bootstrap UCL	3789	95% Bootstrap-t UCL	14725
95% Hall's Bootstrap UCL	18211	95% Percentile Bootstrap UCL	4282
90% Chebyshev(Mean, Sd) UCL	5673	95% Chebyshev(Mean, Sd) UCL	7389
97.5% Chebyshev(Mean, Sd) UCL	9770	99% Chebyshev(Mean, Sd) UCL	14447

	A	B	C	D	E	F	G	H	I	J	K	L
247	**Suggested UCL to Use**											
248	Recommendation cannot be provided											
249												
250	**The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.**											
251	**Please verify the data were collected from random locations.**											
252	**If the data were collected using judgmental or other non-random methods,**											
253	**then contact a statistician to correctly calculate UCLs.**											
254												
255	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
256	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
257	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
258												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Uncensored Full Data Sets											
2												
3	User Selected Options											
4	Date/Time of Computation			ProUCL 5.2 11/18/2024 12:17:31 PM								
5	From File			WorkSheet.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	SH-WRA											
12												
13	General Statistics											
14	Total Number of Observations					10	Number of Distinct Observations					7
15							Number of Missing Observations					0
16	Minimum					9	Mean					20.56
17	Maximum					81.8	Median					13
18	SD					21.76	Std. Error of Mean					6.883
19	Coefficient of Variation					1.059	Skewness					3.033
20												
21	Normal GOF Test											
22	Shapiro Wilk Test Statistic					0.499	Shapiro Wilk GOF Test					
23	1% Shapiro Wilk Critical Value					0.781	Data Not Normal at 1% Significance Level					
24	Lilliefors Test Statistic					0.392	Lilliefors GOF Test					
25	1% Lilliefors Critical Value					0.304	Data Not Normal at 1% Significance Level					
26	Data Not Normal at 1% Significance Level											
27												
28	Assuming Normal Distribution											
29	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
30	95% Student's-t UCL					33.18	95% Adjusted-CLT UCL (Chen-1995)					38.93
31							95% Modified-t UCL (Johnson-1978)					34.28
32												
33	Gamma GOF Test											
34	A-D Test Statistic					1.685	Anderson-Darling Gamma GOF Test					
35	5% A-D Critical Value					0.735	Data Not Gamma Distributed at 5% Significance Level					
36	K-S Test Statistic					0.323	Kolmogorov-Smirnov Gamma GOF Test					
37	5% K-S Critical Value					0.27	Data Not Gamma Distributed at 5% Significance Level					
38	Data Not Gamma Distributed at 5% Significance Level											
39												
40	Gamma Statistics											
41	k hat (MLE)					2.174	k star (bias corrected MLE)					1.588
42	Theta hat (MLE)					9.459	Theta star (bias corrected MLE)					12.95
43	nu hat (MLE)					43.47	nu star (bias corrected)					31.76
44	MLE Mean (bias corrected)					20.56	MLE Sd (bias corrected)					16.31
45							Approximate Chi Square Value (0.05)					19.88
46	Adjusted Level of Significance					0.0267	Adjusted Chi Square Value					18.27
47												
48	Assuming Gamma Distribution											
49	95% Approximate Gamma UCL					32.84	95% Adjusted Gamma UCL					35.75
50												
51	Lognormal GOF Test											
52	Shapiro Wilk Test Statistic					0.705	Shapiro Wilk Lognormal GOF Test					
53	10% Shapiro Wilk Critical Value					0.869	Data Not Lognormal at 10% Significance Level					
54	Lilliefors Test Statistic					0.271	Lilliefors Lognormal GOF Test					
55	10% Lilliefors Critical Value					0.241	Data Not Lognormal at 10% Significance Level					

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.197	Mean of logged Data	2.776
Maximum of Logged Data	4.404	SD of logged Data	0.615

Assuming Lognormal Distribution

95% H-UCL	31.69	90% Chebyshev (MVUE) UCL	30.36
95% Chebyshev (MVUE) UCL	35.51	97.5% Chebyshev (MVUE) UCL	42.65
99% Chebyshev (MVUE) UCL	56.69		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	31.88	95% BCA Bootstrap UCL	40.52
95% Standard Bootstrap UCL	31.29	95% Bootstrap-t UCL	102.5
95% Hall's Bootstrap UCL	86.63	95% Percentile Bootstrap UCL	33.82
90% Chebyshev(Mean, Sd) UCL	41.21	95% Chebyshev(Mean, Sd) UCL	50.56
97.5% Chebyshev(Mean, Sd) UCL	63.54	99% Chebyshev(Mean, Sd) UCL	89.04

Suggested UCL to Use

95% Student's-t UCL	33.18		

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.
Please verify the data were collected from random locations.
If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

SH-WRB

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	19	Mean	47.87
Maximum	80.8	Median	59
SD	23.13	Std. Error of Mean	7.71
Coefficient of Variation	0.483	Skewness	-0.0607

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.872	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.764	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.24	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.316	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	62.2	95% Adjusted-CLT UCL (Chen-1995)	60.38
		95% Modified-t UCL (Johnson-1978)	62.18
Gamma GOF Test			
A-D Test Statistic	0.692	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.725	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.283	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.28	Data Not Gamma Distributed at 5% Significance Level	
Detected data follow Appr. Gamma Distribution at 5% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Gamma Statistics			
k hat (MLE)	4.192	k star (bias corrected MLE)	2.869
Theta hat (MLE)	11.42	Theta star (bias corrected MLE)	16.68
nu hat (MLE)	75.46	nu star (bias corrected)	51.64
MLE Mean (bias corrected)	47.87	MLE Sd (bias corrected)	28.26
		Approximate Chi Square Value (0.05)	36.14
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	33.42
Assuming Gamma Distribution			
95% Approximate Gamma UCL	68.4	95% Adjusted Gamma UCL	73.96
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.86	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.283	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.252	Data Not Lognormal at 10% Significance Level	
Data appear Approximate Lognormal at 10% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Lognormal Statistics			
Minimum of Logged Data	2.944	Mean of logged Data	3.744
Maximum of Logged Data	4.392	SD of logged Data	0.551
Assuming Lognormal Distribution			
95% H-UCL	77.28	90% Chebyshev (MVUE) UCL	75.34
95% Chebyshev (MVUE) UCL	87.58	97.5% Chebyshev (MVUE) UCL	104.6
99% Chebyshev (MVUE) UCL	138		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	60.55	95% BCA Bootstrap UCL	59.56
95% Standard Bootstrap UCL	59.82	95% Bootstrap-t UCL	61.46
95% Hall's Bootstrap UCL	58.43	95% Percentile Bootstrap UCL	59.87
90% Chebyshev(Mean, Sd) UCL	71	95% Chebyshev(Mean, Sd) UCL	81.47
97.5% Chebyshev(Mean, Sd) UCL	96.01	99% Chebyshev(Mean, Sd) UCL	124.6
Suggested UCL to Use			

95% Student's-t UCL	62.2

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

SH-WRC

General Statistics

Total Number of Observations	9	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	12	Mean	17.16
Maximum	21	Median	16
SD	3.784	Std. Error of Mean	1.261
Coefficient of Variation	0.221	Skewness	0.0146

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.801	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.764	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.29	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.316	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	19.5	95% Adjusted-CLT UCL (Chen-1995)	19.24
		95% Modified-t UCL (Johnson-1978)	19.5

Gamma GOF Test

A-D Test Statistic	0.866	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.721	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.301	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.279	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	22.67	k star (bias corrected MLE)	15.19
Theta hat (MLE)	0.757	Theta star (bias corrected MLE)	1.13
nu hat (MLE)	408	nu star (bias corrected)	273.4
MLE Mean (bias corrected)	17.16	MLE Sd (bias corrected)	4.402
		Approximate Chi Square Value (0.05)	236.1
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	228.7

Assuming Gamma Distribution

	A	B	C	D	E	F	G	H	I	J	K	L
221					95% Approximate Gamma UCL	19.87					95% Adjusted Gamma UCL	20.5
222												
223						**Lognormal GOF Test**						
224					Shapiro Wilk Test Statistic	0.822			**Shapiro Wilk Lognormal GOF Test**			
225					10% Shapiro Wilk Critical Value	0.859			Data Not Lognormal at 10% Significance Level			
226					Lilliefors Test Statistic	0.285			**Lilliefors Lognormal GOF Test**			
227					10% Lilliefors Critical Value	0.252			Data Not Lognormal at 10% Significance Level			
228						**Data Not Lognormal at 10% Significance Level**						
229												
230						**Lognormal Statistics**						
231					Minimum of Logged Data	2.485					Mean of logged Data	2.82
232					Maximum of Logged Data	3.045					SD of logged Data	0.225
233												
234						**Assuming Lognormal Distribution**						
235					95% H-UCL	20.07					90% Chebyshev (MVUE) UCL	21.03
236					95% Chebyshev (MVUE) UCL	22.79					97.5% Chebyshev (MVUE) UCL	25.22
237					99% Chebyshev (MVUE) UCL	30.01						
238												
239						**Nonparametric Distribution Free UCL Statistics**						
240						**Data appear to follow a Discernible Distribution**						
241												
242						**Nonparametric Distribution Free UCLs**						
243					95% CLT UCL	19.23					95% BCA Bootstrap UCL	19.11
244					95% Standard Bootstrap UCL	19.12					95% Bootstrap-t UCL	19.36
245					95% Hall's Bootstrap UCL	18.74					95% Percentile Bootstrap UCL	19.11
246					90% Chebyshev(Mean, Sd) UCL	20.94					95% Chebyshev(Mean, Sd) UCL	22.65
247					97.5% Chebyshev(Mean, Sd) UCL	25.03					99% Chebyshev(Mean, Sd) UCL	29.71
248												
249						**Suggested UCL to Use**						
250					95% Student's-t UCL	19.5						
251												
252	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
253	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
254	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
255												

UCL Statistics for Uncensored Full Data Sets			
User Selected Options			
Date/Time of Computation	ProUCL 5.2 11/18/2024 12:24:51 PM		
From File	WorkSheet.xls		
Full Precision	OFF		
Confidence Coefficient	95%		
Number of Bootstrap Operations	2000		

TL-WRA

General Statistics			
Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	175.2	Mean	282.2
Maximum	454	Median	250.2
SD	112.8	Std. Error of Mean	39.87
Coefficient of Variation	0.4	Skewness	0.426

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test		
Shapiro Wilk Test Statistic	0.843	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.749	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.284	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.333	Data appear Normal at 1% Significance Level
Data appear Normal at 1% Significance Level		
Note GOF tests may be unreliable for small sample sizes		

Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	357.7	95% Adjusted-CLT UCL (Chen-1995)	354.2
		95% Modified-t UCL (Johnson-1978)	358.7

Gamma GOF Test		
A-D Test Statistic	0.693	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.717	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.296	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.295	Data Not Gamma Distributed at 5% Significance Level
Detected data follow Appr. Gamma Distribution at 5% Significance Level		
Note GOF tests may be unreliable for small sample sizes		

Gamma Statistics			
k hat (MLE)	7.275	k star (bias corrected MLE)	4.63
Theta hat (MLE)	38.79	Theta star (bias corrected MLE)	60.94
nu hat (MLE)	116.4	nu star (bias corrected)	74.08
MLE Mean (bias corrected)	282.2	MLE Sd (bias corrected)	131.1
		Approximate Chi Square Value (0.05)	55.26
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	51.17

Assuming Gamma Distribution

95% Approximate Gamma UCL	378.3	95% Adjusted Gamma UCL	408.5

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.833	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.851	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.278	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.265	Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.166	Mean of logged Data	5.572
Maximum of Logged Data	6.118	SD of logged Data	0.4

Assuming Lognormal Distribution

95% H-UCL	397.3	90% Chebyshev (MVUE) UCL	402.6
95% Chebyshev (MVUE) UCL	457.2	97.5% Chebyshev (MVUE) UCL	533
99% Chebyshev (MVUE) UCL	681.9		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	347.8	95% BCA Bootstrap UCL	351.1
95% Standard Bootstrap UCL	344.5	95% Bootstrap-t UCL	372.1
95% Hall's Bootstrap UCL	335.6	95% Percentile Bootstrap UCL	345.6
90% Chebyshev(Mean, Sd) UCL	401.8	95% Chebyshev(Mean, Sd) UCL	456
97.5% Chebyshev(Mean, Sd) UCL	531.2	99% Chebyshev(Mean, Sd) UCL	678.9

Suggested UCL to Use

95% Student's-t UCL	357.7		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

TL-WRB

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	35.7	Mean	122.5
Maximum	194	Median	137.3
SD	57.99	Std. Error of Mean	21.92
Coefficient of Variation	0.473	Skewness	-0.322

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.952	**Shapiro Wilk GOF Test**

1% Shapiro Wilk Critical Value	0.73	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.172	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.35	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	165.1	95% Adjusted-CLT UCL (Chen-1995)	155.7
		95% Modified-t UCL (Johnson-1978)	164.6
Gamma GOF Test			
A-D Test Statistic	0.329	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.71	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.226	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.313	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Gamma Statistics			
k hat (MLE)	3.986	k star (bias corrected MLE)	2.373
Theta hat (MLE)	30.72	Theta star (bias corrected MLE)	51.61
nu hat (MLE)	55.81	nu star (bias corrected)	33.22
MLE Mean (bias corrected)	122.5	MLE Sd (bias corrected)	79.5
		Approximate Chi Square Value (0.05)	21.04
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	18.18
Assuming Gamma Distribution			
95% Approximate Gamma UCL	193.4	95% Adjusted Gamma UCL	223.8
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.896	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.838	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.229	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.28	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Lognormal Statistics			
Minimum of Logged Data	3.575	Mean of logged Data	4.677
Maximum of Logged Data	5.268	SD of logged Data	0.602
Assuming Lognormal Distribution			
95% H-UCL	248.7	90% Chebyshev (MVUE) UCL	211.1
95% Chebyshev (MVUE) UCL	250	97.5% Chebyshev (MVUE) UCL	304
99% Chebyshev (MVUE) UCL	410.2		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	158.5	95% BCA Bootstrap UCL	154.9
95% Standard Bootstrap UCL	156	95% Bootstrap-t UCL	162.7
95% Hall's Bootstrap UCL	151.3	95% Percentile Bootstrap UCL	155.6
90% Chebyshev(Mean, Sd) UCL	188.2	95% Chebyshev(Mean, Sd) UCL	218

97.5% Chebyshev(Mean, Sd) UCL	259.3	99% Chebyshev(Mean, Sd) UCL	340.5

Suggested UCL to Use

95% Student's-t UCL	165.1		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

TL-WRC

General Statistics

Total Number of Observations	9	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	99	Mean	165.2
Maximum	205	Median	156
SD	36.84	Std. Error of Mean	12.28
Coefficient of Variation	0.223	Skewness	-0.428

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.885	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.764	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.181	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.316	Data appear Normal at 1% Significance Level	

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	188.1	95% Adjusted-CLT UCL (Chen-1995)	183.5
		95% Modified-t UCL (Johnson-1978)	187.8

Gamma GOF Test

A-D Test Statistic	0.527	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.721	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.193	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	20.57	k star (bias corrected MLE)	13.79
Theta hat (MLE)	8.034	Theta star (bias corrected MLE)	11.99
nu hat (MLE)	370.2	nu star (bias corrected)	248.1
MLE Mean (bias corrected)	165.2	MLE Sd (bias corrected)	44.5

		Approximate Chi Square Value (0.05)	212.7
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	205.7
Assuming Gamma Distribution			
95% Approximate Gamma UCL	192.8	95% Adjusted Gamma UCL	199.3
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.869	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.189	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.252	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Lognormal Statistics			
Minimum of Logged Data	4.595	Mean of logged Data	5.083
Maximum of Logged Data	5.323	SD of logged Data	0.242
Assuming Lognormal Distribution			
95% H-UCL	196.1	90% Chebyshev (MVUE) UCL	205.6
95% Chebyshev (MVUE) UCL	223.8	97.5% Chebyshev (MVUE) UCL	249
99% Chebyshev (MVUE) UCL	298.6		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	185.4	95% BCA Bootstrap UCL	181.8
95% Standard Bootstrap UCL	184.2	95% Bootstrap-t UCL	187.5
95% Hall's Bootstrap UCL	182.7	95% Percentile Bootstrap UCL	183.3
90% Chebyshev(Mean, Sd) UCL	202.1	95% Chebyshev(Mean, Sd) UCL	218.8
97.5% Chebyshev(Mean, Sd) UCL	241.9	99% Chebyshev(Mean, Sd) UCL	287.4
Suggested UCL to Use			
95% Student's-t UCL	188.1		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

	A–E	F	G–K	L
1	UCL Statistics for Uncensored Full Data Sets			
2				
3	User Selected Options			
4	Date/Time of Computation	ProUCL 5.2 12/2/2024 9:19:04 PM		
5	From File	ProUCL Input.xls		
6	Full Precision	OFF		
7	Confidence Coefficient	95%		
8	Number of Bootstrap Operations	2000		
9				
10				
11	UMM-TLA			
12				
13	General Statistics			
14	Total Number of Observations	6	Number of Distinct Observations	6
15			Number of Missing Observations	0
16	Minimum	376.9	Mean	4501
17	Maximum	10200	Median	3246
18	SD	3630	Std. Error of Mean	1482
19	Coefficient of Variation	0.806	Skewness	0.81
20				
21	Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,			
22	refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,			
23	but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).			
24	The Chebyshev UCL often results in gross overestimates of the mean.			
25	Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.			
26				
27	Normal GOF Test			
28	Shapiro Wilk Test Statistic	0.91	Shapiro Wilk GOF Test	
29	1% Shapiro Wilk Critical Value	0.713	Data appear Normal at 1% Significance Level	
30	Lilliefors Test Statistic	0.299	Lilliefors GOF Test	
31	1% Lilliefors Critical Value	0.373	Data appear Normal at 1% Significance Level	
32	Data appear Normal at 1% Significance Level			
33	Note GOF tests may be unreliable for small sample sizes			
34				
35	Assuming Normal Distribution			
36	95% Normal UCL		95% UCLs (Adjusted for Skewness)	
37	95% Student's-t UCL	7487	95% Adjusted-CLT UCL (Chen-1995)	7462
38			95% Modified-t UCL (Johnson-1978)	7569
39				
40	Gamma GOF Test			
41	A-D Test Statistic	0.304	Anderson-Darling Gamma GOF Test	
42	5% A-D Critical Value	0.709	Detected data appear Gamma Distributed at 5% Significance Level	
43	K-S Test Statistic	0.194	Kolmogorov-Smirnov Gamma GOF Test	
44	5% K-S Critical Value	0.338	Detected data appear Gamma Distributed at 5% Significance Level	
45	Detected data appear Gamma Distributed at 5% Significance Level			
46	Note GOF tests may be unreliable for small sample sizes			
47				
48	Gamma Statistics			
49	k hat (MLE)	1.384	k star (bias corrected MLE)	0.803
50	Theta hat (MLE)	3253	Theta star (bias corrected MLE)	5606
51	nu hat (MLE)	16.6	nu star (bias corrected)	9.635
52	MLE Mean (bias corrected)	4501	MLE Sd (bias corrected)	5024
53			Approximate Chi Square Value (0.05)	3.715
54	Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	2.515
55				
56	Assuming Gamma Distribution			
57	95% Approximate Gamma UCL	11675	95% Adjusted Gamma UCL	17244
58				
59	Lognormal GOF Test			
60	Shapiro Wilk Test Statistic	0.887	Shapiro Wilk Lognormal GOF Test	
61	10% Shapiro Wilk Critical Value	0.826	Data appear Lognormal at 10% Significance Level	
62	Lilliefors Test Statistic	0.262	Lilliefors Lognormal GOF Test	
63	10% Lilliefors Critical Value	0.298	Data appear Lognormal at 10% Significance Level	
64	Data appear Lognormal at 10% Significance Level			
65	Note GOF tests may be unreliable for small sample sizes			
66				
67	Lognormal Statistics			
68	Minimum of Logged Data	5.932	Mean of logged Data	8.009
69	Maximum of Logged Data	9.23	SD of logged Data	1.157
70				
71	Assuming Lognormal Distribution			
72	95% H-UCL	66037	90% Chebyshev (MVUE) UCL	12034
73	95% Chebyshev (MVUE) UCL	15194	97.5% Chebyshev (MVUE) UCL	19579
74	99% Chebyshev (MVUE) UCL	28194		
75				
76	Nonparametric Distribution Free UCL Statistics			
77	Data appear to follow a Discernible Distribution			
78				
79	Nonparametric Distribution Free UCLs			
80	95% CLT UCL	6939	95% BCA Bootstrap UCL	6958
81	95% Standard Bootstrap UCL	6734	95% Bootstrap-t UCL	11005
82	95% Hall's Bootstrap UCL	32454	95% Percentile Bootstrap UCL	6852

90% Chebyshev(Mean, Sd) UCL	8947	95% Chebyshev(Mean, Sd) UCL	10961
97.5% Chebyshev(Mean, Sd) UCL	13756	99% Chebyshev(Mean, Sd) UCL	19246

Suggested UCL to Use

95% Student's-t UCL	7487		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

UMM-TLB

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
		Number of Missing Observations	0
Minimum	794.4	Mean	4273
Maximum	11400	Median	2907
SD	3462	Std. Error of Mean	999.4
Coefficient of Variation	0.81	Skewness	1.061

Normal GOF Test

Shapiro Wilk Test Statistic	0.864	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.805	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.198	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.281	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	6067	95% Adjusted-CLT UCL (Chen-1995)	6244
		95% Modified-t UCL (Johnson-1978)	6118

Gamma GOF Test

A-D Test Statistic	0.348	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.744	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.167	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.249	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.747	k star (bias corrected MLE)	1.365
Theta hat (MLE)	2446	Theta star (bias corrected MLE)	3129
nu hat (MLE)	41.92	nu star (bias corrected)	32.77
MLE Mean (bias corrected)	4273	MLE Sd (bias corrected)	3656
		Approximate Chi Square Value (0.05)	20.68
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	19.23

Assuming Gamma Distribution

95% Approximate Gamma UCL	6769	95% Adjusted Gamma UCL	7281

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.958	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.883	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.139	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.223	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	6.678	Mean of logged Data	8.047
Maximum of Logged Data	9.341	SD of logged Data	0.845

Assuming Lognormal Distribution

95% H-UCL	8758	90% Chebyshev (MVUE) UCL	7623
95% Chebyshev (MVUE) UCL	9128	97.5% Chebyshev (MVUE) UCL	11217
99% Chebyshev (MVUE) UCL	15319		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	5916	95% BCA Bootstrap UCL	6118
95% Standard Bootstrap UCL	5819	95% Bootstrap-t UCL	6817
95% Hall's Bootstrap UCL	6689	95% Percentile Bootstrap UCL	5894
90% Chebyshev(Mean, Sd) UCL	7271	95% Chebyshev(Mean, Sd) UCL	8629
97.5% Chebyshev(Mean, Sd) UCL	10514	99% Chebyshev(Mean, Sd) UCL	14216

Suggested UCL to Use

95% Student's-t UCL	6067		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

UMM-TLC

General Statistics

Total Number of Observations	23	Number of Distinct Observations	23
		Number of Missing Observations	0
Minimum	410	Mean	2433
Maximum	8750	Median	2125
SD	1871	Std. Error of Mean	390.1
Coefficient of Variation	0.769	Skewness	1.98

Normal GOF Test

Shapiro Wilk Test Statistic	0.814	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.881	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.221	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.209	Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	3103	95% Adjusted-CLT UCL (Chen-1995)	3247
		95% Modified-t UCL (Johnson-1978)	3130

Gamma GOF Test

A-D Test Statistic	0.308	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.754	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.132	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.184	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.179	k star (bias corrected MLE)	1.924
Theta hat (MLE)	1116	Theta star (bias corrected MLE)	1265
nu hat (MLE)	100.3	nu star (bias corrected)	88.51
MLE Mean (bias corrected)	2433	MLE Sd (bias corrected)	1754
		Approximate Chi Square Value (0.05)	67.82
Adjusted Level of Significance	0.0389	Adjusted Chi Square Value	66.51

Assuming Gamma Distribution

95% Approximate Gamma UCL	3175	95% Adjusted Gamma UCL	3238

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.982	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.928	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.111	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.165	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	6.016	Mean of logged Data	7.55
Maximum of Logged Data	9.077	SD of logged Data	0.73

Assuming Lognormal Distribution

95% H-UCL	3494	90% Chebyshev (MVUE) UCL	3651
95% Chebyshev (MVUE) UCL	4196	97.5% Chebyshev (MVUE) UCL	4953
99% Chebyshev (MVUE) UCL	6440		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	3075	95% BCA Bootstrap UCL	3289
95% Standard Bootstrap UCL	3052	95% Bootstrap-t UCL	3446
95% Hall's Bootstrap UCL	3943	95% Percentile Bootstrap UCL	3075
90% Chebyshev(Mean, Sd) UCL	3603	95% Chebyshev(Mean, Sd) UCL	4134
97.5% Chebyshev(Mean, Sd) UCL	4869	99% Chebyshev(Mean, Sd) UCL	6315

Suggested UCL to Use

95% Adjusted Gamma UCL	3238

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

UMM-WRA

General Statistics

Total Number of Observations	16	Number of Distinct Observations	16
		Number of Missing Observations	0

Minimum	75.44	Mean	930.7
Maximum	2920	Median	724.9
SD	753.4	Std. Error of Mean	188.3
Coefficient of Variation	0.809	Skewness	1.522

Normal GOF Test

Shapiro Wilk Test Statistic	0.857	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.844	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.187	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.248	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1261	95% Adjusted-CLT UCL (Chen-1995)	1317
		95% Modified-t UCL (Johnson-1978)	1273

Gamma GOF Test

A-D Test Statistic	0.198	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.753	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.114	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.219	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.646	k star (bias corrected MLE)	1.379
Theta hat (MLE)	565.4	Theta star (bias corrected MLE)	674.9
nu hat (MLE)	52.68	nu star (bias corrected)	44.13
MLE Mean (bias corrected)	930.7	MLE Sd (bias corrected)	792.5
		Approximate Chi Square Value (0.05)	29.9
Adjusted Level of Significance	0.0335	Adjusted Chi Square Value	28.57

Assuming Gamma Distribution

95% Approximate Gamma UCL	1374	95% Adjusted Gamma UCL	1438

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.955	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.906	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.153	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.196	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.323	Mean of logged Data	6.502
Maximum of Logged Data	7.979	SD of logged Data	0.928

Assuming Lognormal Distribution

95% H-UCL	1910	90% Chebyshev (MVUE) UCL	1739
95% Chebyshev (MVUE) UCL	2079	97.5% Chebyshev (MVUE) UCL	2550
99% Chebyshev (MVUE) UCL	3477		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	1241	95% BCA Bootstrap UCL	1315
95% Standard Bootstrap UCL	1238	95% Bootstrap-t UCL	1422
95% Hall's Bootstrap UCL	1963	95% Percentile Bootstrap UCL	1262
90% Chebyshev(Mean, Sd) UCL	1496	95% Chebyshev(Mean, Sd) UCL	1752
97.5% Chebyshev(Mean, Sd) UCL	2107	99% Chebyshev(Mean, Sd) UCL	2805

Suggested UCL to Use

95% Student's-t UCL	1261		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

UMM-WRB

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	741.1	Mean	4928
Maximum	14142	Median	1800
SD	6264	Std. Error of Mean	2367
Coefficient of Variation	1.271	Skewness	1.206

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).

The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.661	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.73	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.395	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.35	Data Not Normal at 1% Significance Level	

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	9528	95% Adjusted-CLT UCL (Chen-1995)	9975
		95% Modified-t UCL (Johnson-1978)	9708

Gamma GOF Test

A-D Test Statistic	0.904	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.734	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.341	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.322	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.815	k star (bias corrected MLE)	0.561
Theta hat (MLE)	6045	Theta star (bias corrected MLE)	8783
nu hat (MLE)	11.41	nu star (bias corrected)	7.855
MLE Mean (bias corrected)	4928	MLE Sd (bias corrected)	6579
		Approximate Chi Square Value (0.05)	2.651
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	1.83

Assuming Gamma Distribution

95% Approximate Gamma UCL	14600	95% Adjusted Gamma UCL	21154

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.805	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.838	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.273	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.28	Data appear Lognormal at 10% Significance Level	

Data appear Approximate Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	6.608	Mean of logged Data	7.776
Maximum of Logged Data	9.557	SD of logged Data	1.267

Assuming Lognormal Distribution

95% H-UCL	53783	90% Chebyshev (MVUE) UCL	10939
95% Chebyshev (MVUE) UCL	13851	97.5% Chebyshev (MVUE) UCL	17894
99% Chebyshev (MVUE) UCL	25834		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	8822	95% BCA Bootstrap UCL	10249
95% Standard Bootstrap UCL	8579	95% Bootstrap-t UCL	47055
95% Hall's Bootstrap UCL	50830	95% Percentile Bootstrap UCL	8686
90% Chebyshev(Mean, Sd) UCL	12030	95% Chebyshev(Mean, Sd) UCL	15247
97.5% Chebyshev(Mean, Sd) UCL	19713	99% Chebyshev(Mean, Sd) UCL	28484

Suggested UCL to Use

Recommendation cannot be provided			

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.
Please verify the data were collected from random locations.
If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

UCL Statistics for Uncensored Full Data Sets			
User Selected Options			
Date/Time of Computation	ProUCL 5.2 11/18/2024 1:18:00 PM		
From File	WorkSheet.xls		
Full Precision	OFF		
Confidence Coefficient	95%		
Number of Bootstrap Operations	2000		
UUMM-WRA			
General Statistics			
Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	1170	Mean	1737
Maximum	2435	Median	1704
SD	429.8	Std. Error of Mean	175.5
Coefficient of Variation	0.247	Skewness	0.556
Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,			
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,			
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).			
The Chebyshev UCL often results in gross overestimates of the mean.			
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.			
Normal GOF Test			
Shapiro Wilk Test Statistic	0.97	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.713	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.192	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.373	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2091	95% Adjusted-CLT UCL (Chen-1995)	2068
		95% Modified-t UCL (Johnson-1978)	2097
Gamma GOF Test			
A-D Test Statistic	0.2	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.697	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.164	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Gamma Statistics			
k hat (MLE)	19.81	k star (bias corrected MLE)	10.02
Theta hat (MLE)	87.68	Theta star (bias corrected MLE)	173.4
nu hat (MLE)	237.7	nu star (bias corrected)	120.2
MLE Mean (bias corrected)	1737	MLE Sd (bias corrected)	548.8
		Approximate Chi Square Value (0.05)	95.89
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	88.05

	A–E	F	G–K	L
56	**Assuming Gamma Distribution**			
57	95% Approximate Gamma UCL	2178	95% Adjusted Gamma UCL	2371
58				
59	**Lognormal GOF Test**			
60	Shapiro Wilk Test Statistic	0.984	**Shapiro Wilk Lognormal GOF Test**	
61	10% Shapiro Wilk Critical Value	0.826	Data appear Lognormal at 10% Significance Level	
62	Lilliefors Test Statistic	0.17	**Lilliefors Lognormal GOF Test**	
63	10% Lilliefors Critical Value	0.298	Data appear Lognormal at 10% Significance Level	
64	**Data appear Lognormal at 10% Significance Level**			
65	**Note GOF tests may be unreliable for small sample sizes**			
66				
67	**Lognormal Statistics**			
68	Minimum of Logged Data	7.065	Mean of logged Data	7.434
69	Maximum of Logged Data	7.798	SD of logged Data	0.248
70				
71	**Assuming Lognormal Distribution**			
72	95% H-UCL	2214	90% Chebyshev (MVUE) UCL	2264
73	95% Chebyshev (MVUE) UCL	2503	97.5% Chebyshev (MVUE) UCL	2835
74	99% Chebyshev (MVUE) UCL	3486		
75				
76	**Nonparametric Distribution Free UCL Statistics**			
77	**Data appear to follow a Discernible Distribution**			
78				
79	**Nonparametric Distribution Free UCLs**			
80	95% CLT UCL	2026	95% BCA Bootstrap UCL	2024
81	95% Standard Bootstrap UCL	2003	95% Bootstrap-t UCL	2176
82	95% Hall's Bootstrap UCL	2408	95% Percentile Bootstrap UCL	2021
83	90% Chebyshev(Mean, Sd) UCL	2263	95% Chebyshev(Mean, Sd) UCL	2502
84	97.5% Chebyshev(Mean, Sd) UCL	2833	99% Chebyshev(Mean, Sd) UCL	3483
85				
86	**Suggested UCL to Use**			
87	95% Student's-t UCL	2091		
88				
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.			
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			
92				
93				
94	**UUMM-WRB**			
95				
96	**General Statistics**			
97	Total Number of Observations	10	Number of Distinct Observations	10
98			Number of Missing Observations	0
99	Minimum	96	Mean	137.8
100	Maximum	202	Median	129
101	SD	37.42	Std. Error of Mean	11.83
102	Coefficient of Variation	0.272	Skewness	0.618
103				
104	**Normal GOF Test**			
105	Shapiro Wilk Test Statistic	0.908	**Shapiro Wilk GOF Test**	
106	1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level	
107	Lilliefors Test Statistic	0.179	**Lilliefors GOF Test**	
108	1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level	
109	**Data appear Normal at 1% Significance Level**			
110				

Row	A–E	F	G–K	L
111	**Assuming Normal Distribution**			
112	**95% Normal UCL**		**95% UCLs (Adjusted for Skewness)**	
113	95% Student's-t UCL	159.5	95% Adjusted-CLT UCL (Chen-1995)	159.7
114			95% Modified-t UCL (Johnson-1978)	159.9
115				
116	**Gamma GOF Test**			
117	A-D Test Statistic	0.383	**Anderson-Darling Gamma GOF Test**	
118	5% A-D Critical Value	0.725	Detected data appear Gamma Distributed at 5% Significance Level	
119	K-S Test Statistic	0.191	**Kolmogorov-Smirnov Gamma GOF Test**	
120	5% K-S Critical Value	0.266	Detected data appear Gamma Distributed at 5% Significance Level	
121	**Detected data appear Gamma Distributed at 5% Significance Level**			
122				
123	**Gamma Statistics**			
124	k hat (MLE)	15.8	k star (bias corrected MLE)	11.13
125	Theta hat (MLE)	8.721	Theta star (bias corrected MLE)	12.38
126	nu hat (MLE)	316	nu star (bias corrected)	222.5
127	MLE Mean (bias corrected)	137.8	MLE Sd (bias corrected)	41.31
128			Approximate Chi Square Value (0.05)	189
129	Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	183.6
130				
131	**Assuming Gamma Distribution**			
132	95% Approximate Gamma UCL	162.2	95% Adjusted Gamma UCL	167
133				
134	**Lognormal GOF Test**			
135	Shapiro Wilk Test Statistic	0.927	**Shapiro Wilk Lognormal GOF Test**	
136	10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level	
137	Lilliefors Test Statistic	0.178	**Lilliefors Lognormal GOF Test**	
138	10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level	
139	**Data appear Lognormal at 10% Significance Level**			
140				
141	**Lognormal Statistics**			
142	Minimum of Logged Data	4.564	Mean of logged Data	4.894
143	Maximum of Logged Data	5.308	SD of logged Data	0.264
144				
145	**Assuming Lognormal Distribution**			
146	95% H-UCL	164	90% Chebyshev (MVUE) UCL	172.4
147	95% Chebyshev (MVUE) UCL	188.1	97.5% Chebyshev (MVUE) UCL	209.9
148	99% Chebyshev (MVUE) UCL	252.8		
149				
150	**Nonparametric Distribution Free UCL Statistics**			
151	**Data appear to follow a Discernible Distribution**			
152				
153	**Nonparametric Distribution Free UCLs**			
154	95% CLT UCL	157.3	95% BCA Bootstrap UCL	159.1
155	95% Standard Bootstrap UCL	156.7	95% Bootstrap-t UCL	164.5
156	95% Hall's Bootstrap UCL	157.5	95% Percentile Bootstrap UCL	157.1
157	90% Chebyshev(Mean, Sd) UCL	173.3	95% Chebyshev(Mean, Sd) UCL	189.4
158	97.5% Chebyshev(Mean, Sd) UCL	211.7	99% Chebyshev(Mean, Sd) UCL	255.6
159				
160	**Suggested UCL to Use**			
161	95% Student's-t UCL	159.5		
162				
163	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
164	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.			
165	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			

UUMM-WRC

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	16	Mean	17.75
Maximum	20	Median	17.5
SD	1.708	Std. Error of Mean	0.854
Coefficient of Variation	0.0962	Skewness	0.753

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.972	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.192	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	19.76	95% Adjusted-CLT UCL (Chen-1995)	19.5
		95% Modified-t UCL (Johnson-1978)	19.81

Gamma GOF Test

A-D Test Statistic	0.227	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.189	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	146.8	k star (bias corrected MLE)	36.88
Theta hat (MLE)	0.121	Theta star (bias corrected MLE)	0.481
nu hat (MLE)	1175	nu star (bias corrected)	295
MLE Mean (bias corrected)	17.75	MLE Sd (bias corrected)	2.923
		Approximate Chi Square Value (0.05)	256.2
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	20.44	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.982	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.177	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	2.773	Mean of logged Data	2.873
Maximum of Logged Data	2.996	SD of logged Data	0.0949

Assuming Lognormal Distribution

95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	20.27
95% Chebyshev (MVUE) UCL	21.42	97.5% Chebyshev (MVUE) UCL	23.01
99% Chebyshev (MVUE) UCL	26.13		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	19.15	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
90% Chebyshev(Mean, Sd) UCL	20.31	95% Chebyshev(Mean, Sd) UCL	21.47
97.5% Chebyshev(Mean, Sd) UCL	23.08	99% Chebyshev(Mean, Sd) UCL	26.25

Suggested UCL to Use

95% Student's-t UCL	19.76		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

UUMM-WRD

General Statistics

Total Number of Observations	5	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	269	Mean	286.6
Maximum	334	Median	279
SD	27.13	Std. Error of Mean	12.14
Coefficient of Variation	0.0947	Skewness	1.982

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,

refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,

but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).

The Chebyshev UCL often results in gross overestimates of the mean.

Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.729	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.686	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.367	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.396	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	312.5	95% Adjusted-CLT UCL (Chen-1995)	318.1
		95% Modified-t UCL (Johnson-1978)	314.3
Gamma GOF Test			
A-D Test Statistic	0.747	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.678	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.367	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.357	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	149.4	k star (bias corrected MLE)	59.88
Theta hat (MLE)	1.919	Theta star (bias corrected MLE)	4.786
nu hat (MLE)	1494	nu star (bias corrected)	598.8
MLE Mean (bias corrected)	286.6	MLE Sd (bias corrected)	37.04
		Approximate Chi Square Value (0.05)	543.1
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	519.5
Assuming Gamma Distribution			
95% Approximate Gamma UCL	316	95% Adjusted Gamma UCL	330.4
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.744	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.806	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.357	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.319	Data Not Lognormal at 10% Significance Level	
Data Not Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	5.595	Mean of logged Data	5.655
Maximum of Logged Data	5.811	SD of logged Data	0.09
Assuming Lognormal Distribution			
95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	321.2
95% Chebyshev (MVUE) UCL	336.8	97.5% Chebyshev (MVUE) UCL	358.6
99% Chebyshev (MVUE) UCL	401.3		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	306.6	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
90% Chebyshev(Mean, Sd) UCL	323	95% Chebyshev(Mean, Sd) UCL	339.5
97.5% Chebyshev(Mean, Sd) UCL	362.4	99% Chebyshev(Mean, Sd) UCL	407.3
Suggested UCL to Use			
95% Student's-t UCL	312.5		
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.			
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			

UUMM-WRE

General Statistics			
Total Number of Observations	4	Number of Distinct Observations	3
		Number of Missing Observations	0
Minimum	24	Mean	24.75
Maximum	26	Median	24.5
SD	0.957	Std. Error of Mean	0.479
Coefficient of Variation	0.0387	Skewness	0.855

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test			
Shapiro Wilk Test Statistic	0.865	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.283	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	25.88	95% Adjusted-CLT UCL (Chen-1995)	25.76
		95% Modified-t UCL (Johnson-1978)	25.91
Gamma GOF Test			
A-D Test Statistic	0.427	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.318	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Gamma Statistics			
k hat (MLE)	900.3	k star (bias corrected MLE)	225.2
Theta hat (MLE)	0.0275	Theta star (bias corrected MLE)	0.11
nu hat (MLE)	7202	nu star (bias corrected)	1802
MLE Mean (bias corrected)	24.75	MLE Sd (bias corrected)	1.649
		Approximate Chi Square Value (0.05)	1704
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A
Assuming Gamma Distribution			
95% Approximate Gamma UCL	26.17	95% Adjusted Gamma UCL	N/A
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.865	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.284	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			

386	Note GOF tests may be unreliable for small sample sizes			
387				
388	**Lognormal Statistics**			
389	Minimum of Logged Data	3.178	Mean of logged Data	3.208
390	Maximum of Logged Data	3.258	SD of logged Data	0.0384
391				
392	**Assuming Lognormal Distribution**			
393	95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	26.17
394	95% Chebyshev (MVUE) UCL	26.82	97.5% Chebyshev (MVUE) UCL	27.72
395	99% Chebyshev (MVUE) UCL	29.48		
396				
397	**Nonparametric Distribution Free UCL Statistics**			
398	**Data appear to follow a Discernible Distribution**			
399				
400	**Nonparametric Distribution Free UCLs**			
401	95% CLT UCL	25.54	95% BCA Bootstrap UCL	N/A
402	95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
403	95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
404	90% Chebyshev(Mean, Sd) UCL	26.19	95% Chebyshev(Mean, Sd) UCL	26.84
405	97.5% Chebyshev(Mean, Sd) UCL	27.74	99% Chebyshev(Mean, Sd) UCL	29.51
406				
407	**Suggested UCL to Use**			
408	95% Student's-t UCL	25.88		
409				
410	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
411	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.			
412	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			
413				
414				
415	UUMM-WRF			
416				
417	**General Statistics**			
418	Total Number of Observations	11	Number of Distinct Observations	11
419			Number of Missing Observations	0
420	Minimum	290	Mean	528.1
421	Maximum	786	Median	534
422	SD	147	Std. Error of Mean	44.31
423	Coefficient of Variation	0.278	Skewness	0.243
424				
425	**Normal GOF Test**			
426	Shapiro Wilk Test Statistic	0.985	**Shapiro Wilk GOF Test**	
427	1% Shapiro Wilk Critical Value	0.792	Data appear Normal at 1% Significance Level	
428	Lilliefors Test Statistic	0.118	**Lilliefors GOF Test**	
429	1% Lilliefors Critical Value	0.291	Data appear Normal at 1% Significance Level	
430	**Data appear Normal at 1% Significance Level**			
431				
432	**Assuming Normal Distribution**			
433	**95% Normal UCL**		**95% UCLs (Adjusted for Skewness)**	
434	95% Student's-t UCL	608.4	95% Adjusted-CLT UCL (Chen-1995)	604.4
435			95% Modified-t UCL (Johnson-1978)	608.9
436				
437	**Gamma GOF Test**			
438	A-D Test Statistic	0.129	**Anderson-Darling Gamma GOF Test**	
439	5% A-D Critical Value	0.729	Detected data appear Gamma Distributed at 5% Significance Level	
440	K-S Test Statistic	0.0977	**Kolmogorov-Smirnov Gamma GOF Test**	

	A	B	C	D	E	F	G	H	I	J	K	L
441					5% K-S Critical Value	0.255	Detected data appear Gamma Distributed at 5% Significance Level					
442	**Detected data appear Gamma Distributed at 5% Significance Level**											
443												
444	**Gamma Statistics**											
445					k hat (MLE)	13.71					k star (bias corrected MLE)	10.03
446					Theta hat (MLE)	38.52					Theta star (bias corrected MLE)	52.65
447					nu hat (MLE)	301.6					nu star (bias corrected)	220.7
448					MLE Mean (bias corrected)	528.1					MLE Sd (bias corrected)	166.7
449											Approximate Chi Square Value (0.05)	187.3
450					Adjusted Level of Significance	0.0278					Adjusted Chi Square Value	182.3
451												
452	**Assuming Gamma Distribution**											
453					95% Approximate Gamma UCL	622.2					95% Adjusted Gamma UCL	639.3
454												
455	**Lognormal GOF Test**											
456					Shapiro Wilk Test Statistic	0.981	**Shapiro Wilk Lognormal GOF Test**					
457					10% Shapiro Wilk Critical Value	0.876	Data appear Lognormal at 10% Significance Level					
458					Lilliefors Test Statistic	0.111	**Lilliefors Lognormal GOF Test**					
459					10% Lilliefors Critical Value	0.231	Data appear Lognormal at 10% Significance Level					
460	**Data appear Lognormal at 10% Significance Level**											
461												
462	**Lognormal Statistics**											
463					Minimum of Logged Data	5.67					Mean of logged Data	6.232
464					Maximum of Logged Data	6.667					SD of logged Data	0.29
465												
466	**Assuming Lognormal Distribution**											
467					95% H-UCL	634.1					90% Chebyshev (MVUE) UCL	668.5
468					95% Chebyshev (MVUE) UCL	731.8					97.5% Chebyshev (MVUE) UCL	819.7
469					99% Chebyshev (MVUE) UCL	992.3						
470												
471	**Nonparametric Distribution Free UCL Statistics**											
472	**Data appear to follow a Discernible Distribution**											
473												
474	**Nonparametric Distribution Free UCLs**											
475					95% CLT UCL	601					95% BCA Bootstrap UCL	604.3
476					95% Standard Bootstrap UCL	598.2					95% Bootstrap-t UCL	621.6
477					95% Hall's Bootstrap UCL	620.6					95% Percentile Bootstrap UCL	598.3
478					90% Chebyshev(Mean, Sd) UCL	661					95% Chebyshev(Mean, Sd) UCL	721.2
479					97.5% Chebyshev(Mean, Sd) UCL	804.8					99% Chebyshev(Mean, Sd) UCL	969
480												
481	**Suggested UCL to Use**											
482					95% Student's-t UCL	608.4						
483												
484	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
485	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
486	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
487												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 3:57:38 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

CEM-WRA-0.5-1

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	51	Mean	56.25
Maximum	64	Median	55
SD	6.021	Std. Error of Mean	3.01
Coefficient of Variation	0.107	Skewness	0.762

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.909	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.26	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	63.33	95% Adjusted-CLT UCL (Chen-1995)	62.43
		95% Modified-t UCL (Johnson-1978)	63.53

Gamma GOF Test

A-D Test Statistic	0.345	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.293	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	119	k star (bias corrected MLE)	29.92
Theta hat (MLE)	0.473	Theta star (bias corrected MLE)	1.88
nu hat (MLE)	952.1	nu star (bias corrected)	239.4
MLE Mean (bias corrected)	56.25	MLE Sd (bias corrected)	10.28
		Approximate Chi Square Value (0.05)	204.5
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	65.82	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.913	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.26	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	3.932	Mean of logged Data	4.026
Maximum of Logged Data	4.159	SD of logged Data	0.105

Assuming Lognormal Distribution

95% H-UCL	64.52	90% Chebyshev (MVUE) UCL	65.13
95% Chebyshev (MVUE) UCL	69.15	97.5% Chebyshev (MVUE) UCL	74.74
99% Chebyshev (MVUE) UCL	85.7		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	61.2	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					65.28	95% Chebyshev(Mean, Sd) UCL					69.37
84	97.5% Chebyshev(Mean, Sd) UCL					75.05	99% Chebyshev(Mean, Sd) UCL					86.2
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					63.33						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 4:01:02 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

CEM-WRA-0.5-2

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	100	Mean	166.2
Maximum	264	Median	150
SD	48.81	Std. Error of Mean	15.43
Coefficient of Variation	0.294	Skewness	0.898

Normal GOF Test

Shapiro Wilk Test Statistic	0.913	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.242	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	194.5	95% Adjusted-CLT UCL (Chen-1995)	196.3
		95% Modified-t UCL (Johnson-1978)	195.2

Gamma GOF Test

A-D Test Statistic	0.393	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.725	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.211	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.266	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	13.79	k star (bias corrected MLE)	9.722
Theta hat (MLE)	12.05	Theta star (bias corrected MLE)	17.1
nu hat (MLE)	275.9	nu star (bias corrected)	194.4
MLE Mean (bias corrected)	166.2	MLE Sd (bias corrected)	53.3
		Approximate Chi Square Value (0.05)	163.2
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	158.2

Assuming Gamma Distribution

95% Approximate Gamma UCL	198	95% Adjusted Gamma UCL	204.3

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.955	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.193	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.605	Mean of logged Data	5.077
Maximum of Logged Data	5.576	SD of logged Data	0.283

Assuming Lognormal Distribution

95% H-UCL	200.6	90% Chebyshev (MVUE) UCL	210.9
95% Chebyshev (MVUE) UCL	231.2	97.5% Chebyshev (MVUE) UCL	259.4
99% Chebyshev (MVUE) UCL	314.8		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	191.6	95% BCA Bootstrap UCL	195.2
95% Standard Bootstrap UCL	190.1	95% Bootstrap-t UCL	202.4
95% Hall's Bootstrap UCL	198.8	95% Percentile Bootstrap UCL	191.5
90% Chebyshev(Mean, Sd) UCL	212.5	95% Chebyshev(Mean, Sd) UCL	233.5
97.5% Chebyshev(Mean, Sd) UCL	262.6	99% Chebyshev(Mean, Sd) UCL	319.8

Suggested UCL to Use

95% Student's-t UCL	194.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
83												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 4:02:36 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

CEM-WRA-0.5-3

General Statistics			
Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	37	Mean	41
Maximum	44	Median	41.5
SD	3.162	Std. Error of Mean	1.581
Coefficient of Variation	0.0771	Skewness	-0.632

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test			
Shapiro Wilk Test Statistic	0.941	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.236	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	44.72	95% Adjusted-CLT UCL (Chen-1995)	43.07
		95% Modified-t UCL (Johnson-1978)	44.64
Gamma GOF Test			
A-D Test Statistic	0.297	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.269	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Gamma Statistics			
k hat (MLE)	219.9	k star (bias corrected MLE)	55.15
Theta hat (MLE)	0.186	Theta star (bias corrected MLE)	0.743
nu hat (MLE)	1759	nu star (bias corrected)	441.2
MLE Mean (bias corrected)	41	MLE Sd (bias corrected)	5.521
		Approximate Chi Square Value (0.05)	393.5
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A
Assuming Gamma Distribution			
95% Approximate Gamma UCL	45.97	95% Adjusted Gamma UCL	N/A
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.936	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.238	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Lognormal Statistics			
Minimum of Logged Data	3.611	Mean of logged Data	3.711
Maximum of Logged Data	3.784	SD of logged Data	0.0783
Assuming Lognormal Distribution			
95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	45.81
95% Chebyshev (MVUE) UCL	47.99	97.5% Chebyshev (MVUE) UCL	51.02
99% Chebyshev (MVUE) UCL	56.96		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	43.6	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					45.74	95% Chebyshev(Mean, Sd) UCL					47.89
84	97.5% Chebyshev(Mean, Sd) UCL					50.87	99% Chebyshev(Mean, Sd) UCL					56.73
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					44.72						
88	**Recommended UCL exceeds the maximum observation**											
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												
94	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
95	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
96												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 4:03:59 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

CEM-WRA-0.5-4

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	56	Mean	72.75
Maximum	89	Median	73
SD	13.87	Std. Error of Mean	6.933
Coefficient of Variation	0.191	Skewness	-0.0961

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	N/A	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.143	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Approximate Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	89.07	95% Adjusted-CLT UCL (Chen-1995)	83.8
		95% Modified-t UCL (Johnson-1978)	89.01

Gamma GOF Test

A-D Test Statistic	0.199	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.656	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.175	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	35.74	k star (bias corrected MLE)	9.102
Theta hat (MLE)	2.035	Theta star (bias corrected MLE)	7.992
nu hat (MLE)	285.9	nu star (bias corrected)	72.82
MLE Mean (bias corrected)	72.75	MLE Sd (bias corrected)	24.11
		Approximate Chi Square Value (0.05)	54.17
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	97.8	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.992	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.171	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	4.025	Mean of logged Data	4.273
Maximum of Logged Data	4.489	SD of logged Data	0.195

Assuming Lognormal Distribution

95% H-UCL	96.37	90% Chebyshev (MVUE) UCL	94.01
95% Chebyshev (MVUE) UCL	103.6	97.5% Chebyshev (MVUE) UCL	117
99% Chebyshev (MVUE) UCL	143.2		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	84.15	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					93.55	95% Chebyshev(Mean, Sd) UCL					103
84	97.5% Chebyshev(Mean, Sd) UCL					116	99% Chebyshev(Mean, Sd) UCL					141.7
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					89.07						
88	**Recommended UCL exceeds the maximum observation**											
89												
90	When a data set follows an approximate distribution passing only one of the GOF tests,											
91	it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL											
92												
93	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
94	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
95	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
96												
97	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
98	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
99												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 4:05:27 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

CEM-WRA-0.5-4-DS

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	30	Mean	33.25
Maximum	38	Median	32.5
SD	3.594	Std. Error of Mean	1.797
Coefficient of Variation	0.108	Skewness	0.889

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.929	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.234	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	37.48	95% Adjusted-CLT UCL (Chen-1995)	37.06
		95% Modified-t UCL (Johnson-1978)	37.61

Gamma GOF Test

A-D Test Statistic	0.3	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.264	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	117.2	k star (bias corrected MLE)	29.47
Theta hat (MLE)	0.284	Theta star (bias corrected MLE)	1.128
nu hat (MLE)	937.7	nu star (bias corrected)	235.8
MLE Mean (bias corrected)	33.25	MLE Sd (bias corrected)	6.125
		Approximate Chi Square Value (0.05)	201.2
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	38.96	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.938	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.232	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	3.401	Mean of logged Data	3.5
Maximum of Logged Data	3.638	SD of logged Data	0.106

Assuming Lognormal Distribution

95% H-UCL	38.18	90% Chebyshev (MVUE) UCL	38.53
95% Chebyshev (MVUE) UCL	40.93	97.5% Chebyshev (MVUE) UCL	44.25
99% Chebyshev (MVUE) UCL	50.78		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	36.21	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					38.64	95% Chebyshev(Mean, Sd) UCL					41.08
84	97.5% Chebyshev(Mean, Sd) UCL					44.47	99% Chebyshev(Mean, Sd) UCL					51.13
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					37.48						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 4:08:55 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

CEM-WRB-0.5-1

General Statistics			
Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	125	Mean	169.8
Maximum	242	Median	158
SD	41.87	Std. Error of Mean	13.24
Coefficient of Variation	0.247	Skewness	0.567
Normal GOF Test			
Shapiro Wilk Test Statistic	0.907	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.173	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	194.1	95% Adjusted-CLT UCL (Chen-1995)	194.1
		95% Modified-t UCL (Johnson-1978)	194.5
Gamma GOF Test			
A-D Test Statistic	0.388	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.725	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.164	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.266	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	19.02	k star (bias corrected MLE)	13.38
Theta hat (MLE)	8.927	Theta star (bias corrected MLE)	12.69
nu hat (MLE)	380.4	nu star (bias corrected)	267.6
MLE Mean (bias corrected)	169.8	MLE Sd (bias corrected)	46.42
		Approximate Chi Square Value (0.05)	230.7
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	224.8
Assuming Gamma Distribution			
95% Approximate Gamma UCL	196.9	95% Adjusted Gamma UCL	202.2
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.92	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.147	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	4.828	Mean of logged Data	5.108
Maximum of Logged Data	5.489	SD of logged Data	0.241
Assuming Lognormal Distribution			
95% H-UCL	198.6	90% Chebyshev (MVUE) UCL	208.7
95% Chebyshev (MVUE) UCL	226.3	97.5% Chebyshev (MVUE) UCL	250.8
99% Chebyshev (MVUE) UCL	298.9		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	191.6	95% BCA Bootstrap UCL	192.4
95% Standard Bootstrap UCL	190	95% Bootstrap-t UCL	196.5
95% Hall's Bootstrap UCL	190.5	95% Percentile Bootstrap UCL	190.4
90% Chebyshev(Mean, Sd) UCL	209.5	95% Chebyshev(Mean, Sd) UCL	227.5
97.5% Chebyshev(Mean, Sd) UCL	252.5	99% Chebyshev(Mean, Sd) UCL	301.6
Suggested UCL to Use			
95% Student's-t UCL	194.1		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
83												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 4:10:58 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

CEM-WRC-0.5-1

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	94	Mean	127.3
Maximum	187	Median	121
SD	31.91	Std. Error of Mean	10.64
Coefficient of Variation	0.251	Skewness	1.079

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.876	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.764	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.221	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.316	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	147.1	95% Adjusted-CLT UCL (Chen-1995)	148.9
		95% Modified-t UCL (Johnson-1978)	147.8

Gamma GOF Test

A-D Test Statistic	0.44	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.721	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.198	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	19.75	k star (bias corrected MLE)	13.24
Theta hat (MLE)	6.446	Theta star (bias corrected MLE)	9.615
nu hat (MLE)	355.6	nu star (bias corrected)	238.4
MLE Mean (bias corrected)	127.3	MLE Sd (bias corrected)	34.99
		Approximate Chi Square Value (0.05)	203.6
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	196.8

Assuming Gamma Distribution

95% Approximate Gamma UCL	149.1	95% Adjusted Gamma UCL	154.2

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.917	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.182	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.252	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	4.543	Mean of logged Data	4.821
Maximum of Logged Data	5.231	SD of logged Data	0.235

Assuming Lognormal Distribution

95% H-UCL	149.9	90% Chebyshev (MVUE) UCL	157.1
95% Chebyshev (MVUE) UCL	170.7	97.5% Chebyshev (MVUE) UCL	189.5
99% Chebyshev (MVUE) UCL	226.5		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	144.8	95% BCA Bootstrap UCL	148.3
95% Standard Bootstrap UCL	143.7	95% Bootstrap-t UCL	161.6
95% Hall's Bootstrap UCL	171.6	95% Percentile Bootstrap UCL	145.4

	A	B	C	D	E	F	G	H	I	J	K	L
83				90% Chebyshev(Mean, Sd) UCL		159.2				95% Chebyshev(Mean, Sd) UCL		173.7
84				97.5% Chebyshev(Mean, Sd) UCL		193.8				99% Chebyshev(Mean, Sd) UCL		233.2
85												
86						**Suggested UCL to Use**						
87				95% Student's-t UCL		147.1						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

	A–E	F	G–K	L
1	UCL Statistics for Uncensored Full Data Sets			
2				
3	User Selected Options			
4	Date/Time of Computation	ProUCL 5.2 10/31/2024 4:12:20 PM		
5	From File	ProUCL Input.xls		
6	Full Precision	OFF		
7	Confidence Coefficient	95%		
8	Number of Bootstrap Operations	2000		
9				
10				
11	CEM-WRC-0.5-2			
12				
13	General Statistics			
14	Total Number of Observations	4	Number of Distinct Observations	4
15			Number of Missing Observations	0
16	Minimum	52	Mean	60.25
17	Maximum	68	Median	60.5
18	SD	7.136	Std. Error of Mean	3.568
19	Coefficient of Variation	0.118	Skewness	-0.142
20				
21	**Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,**			
22	**refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,**			
23	**but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).**			
24	**The Chebyshev UCL often results in gross overestimates of the mean.**			
25	**Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.**			
26				
27	Normal GOF Test			
28	Shapiro Wilk Test Statistic	0.969	**Shapiro Wilk GOF Test**	
29	1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level	
30	Lilliefors Test Statistic	0.2	**Lilliefors GOF Test**	
31	1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level	
32	**Data appear Normal at 1% Significance Level**			
33	**Note GOF tests may be unreliable for small sample sizes**			
34				
35	Assuming Normal Distribution			
36	**95% Normal UCL**		**95% UCLs (Adjusted for Skewness)**	
37	95% Student's-t UCL	68.65	95% Adjusted-CLT UCL (Chen-1995)	65.85
38			95% Modified-t UCL (Johnson-1978)	68.6
39				
40	Gamma GOF Test			
41	A-D Test Statistic	0.248	**Anderson-Darling Gamma GOF Test**	
42	5% A-D Critical Value	0.656	Detected data appear Gamma Distributed at 5% Significance Level	
43	K-S Test Statistic	0.234	**Kolmogorov-Smirnov Gamma GOF Test**	
44	5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level	
45	**Detected data appear Gamma Distributed at 5% Significance Level**			
46	**Note GOF tests may be unreliable for small sample sizes**			
47				
48	Gamma Statistics			
49	k hat (MLE)	93.96	k star (bias corrected MLE)	23.66
50	Theta hat (MLE)	0.641	Theta star (bias corrected MLE)	2.547
51	nu hat (MLE)	751.6	nu star (bias corrected)	189.2
52	MLE Mean (bias corrected)	60.25	MLE Sd (bias corrected)	12.39
53			Approximate Chi Square Value (0.05)	158.4
54	Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A
55				
56	Assuming Gamma Distribution			
57	95% Approximate Gamma UCL	71.97	95% Adjusted Gamma UCL	N/A
58				
59	Lognormal GOF Test			
60	Shapiro Wilk Test Statistic	0.967	**Shapiro Wilk Lognormal GOF Test**	
61	10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level	
62	Lilliefors Test Statistic	0.209	**Lilliefors Lognormal GOF Test**	
63	10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level	
64	**Data appear Lognormal at 10% Significance Level**			
65	**Note GOF tests may be unreliable for small sample sizes**			
66				
67	Lognormal Statistics			
68	Minimum of Logged Data	3.951	Mean of logged Data	4.093
69	Maximum of Logged Data	4.22	SD of logged Data	0.12
70				
71	Assuming Lognormal Distribution			
72	95% H-UCL	70.57	90% Chebyshev (MVUE) UCL	71.05
73	95% Chebyshev (MVUE) UCL	75.94	97.5% Chebyshev (MVUE) UCL	82.73
74	99% Chebyshev (MVUE) UCL	96.07		
75				
76	**Nonparametric Distribution Free UCL Statistics**			
77	**Data appear to follow a Discernible Distribution**			
78				
79	Nonparametric Distribution Free UCLs			
80	95% CLT UCL	66.12	95% BCA Bootstrap UCL	N/A
81	95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
82	95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					70.95	95% Chebyshev(Mean, Sd) UCL					75.8
84	97.5% Chebyshev(Mean, Sd) UCL					82.53	99% Chebyshev(Mean, Sd) UCL					95.75
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					68.65						
88	**Recommended UCL exceeds the maximum observation**											
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												
94	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
95	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
96												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 4:07:04 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

CEM-WRD-0.5-1

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	56	Mean	66.5
Maximum	87	Median	61.5
SD	13.92	Std. Error of Mean	6.958
Coefficient of Variation	0.209	Skewness	1.781

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.793	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.377	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	82.88	95% Adjusted-CLT UCL (Chen-1995)	84.57
		95% Modified-t UCL (Johnson-1978)	83.91

Gamma GOF Test

A-D Test Statistic	0.562	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.385	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	33.76	k star (bias corrected MLE)	8.606
Theta hat (MLE)	1.97	Theta star (bias corrected MLE)	7.727
nu hat (MLE)	270.1	nu star (bias corrected)	68.85
MLE Mean (bias corrected)	66.5	MLE Sd (bias corrected)	22.67
		Approximate Chi Square Value (0.05)	50.75
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	90.22	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.824	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.362	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data Not Lognormal at 10% Significance Level

Data appear Approximate Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	4.025	Mean of logged Data	4.182
Maximum of Logged Data	4.466	SD of logged Data	0.194

Assuming Lognormal Distribution

95% H-UCL	87.85	90% Chebyshev (MVUE) UCL	85.76
95% Chebyshev (MVUE) UCL	94.5	97.5% Chebyshev (MVUE) UCL	106.6
99% Chebyshev (MVUE) UCL	130.5		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	77.95	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					87.37	95% Chebyshev(Mean, Sd) UCL					96.83
84	97.5% Chebyshev(Mean, Sd) UCL					110	99% Chebyshev(Mean, Sd) UCL					135.7
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					82.88						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 3:34:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

CM-Placer Spoils

General Statistics			
Total Number of Observations	4	Number of Distinct Observations	3
		Number of Missing Observations	0
Minimum	25	Mean	32.5
Maximum	36	Median	34.5
SD	5.196	Std. Error of Mean	2.598
Coefficient of Variation	0.16	Skewness	-1.597

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test			
Shapiro Wilk Test Statistic	0.802	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.288	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	38.61	95% Adjusted-CLT UCL (Chen-1995)	34.56
		95% Modified-t UCL (Johnson-1978)	38.27
Gamma GOF Test			
A-D Test Statistic	0.57	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.656	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.311	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Gamma Statistics			
k hat (MLE)	47.18	k star (bias corrected MLE)	11.96
Theta hat (MLE)	0.689	Theta star (bias corrected MLE)	2.717
nu hat (MLE)	377.5	nu star (bias corrected)	95.7
MLE Mean (bias corrected)	32.5	MLE Sd (bias corrected)	9.397
		Approximate Chi Square Value (0.05)	74.13
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A
Assuming Gamma Distribution			
95% Approximate Gamma UCL	41.95	95% Adjusted Gamma UCL	N/A
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.785	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.792	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.31	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level	
Data appear Approximate Lognormal at 10% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Lognormal Statistics			
Minimum of Logged Data	3.219	Mean of logged Data	3.471
Maximum of Logged Data	3.584	SD of logged Data	0.173
Assuming Lognormal Distribution			
95% H-UCL	41.43	90% Chebyshev (MVUE) UCL	40.92
95% Chebyshev (MVUE) UCL	44.73	97.5% Chebyshev (MVUE) UCL	50.02
99% Chebyshev (MVUE) UCL	60.4		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	36.77	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					40.29	95% Chebyshev(Mean, Sd) UCL					43.82
84	97.5% Chebyshev(Mean, Sd) UCL					48.72	99% Chebyshev(Mean, Sd) UCL					58.35
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					38.61						
88	**Recommended UCL exceeds the maximum observation**											
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												
94	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
95	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
96												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Uncensored Full Data Sets											
2												
3	User Selected Options											
4	Date/Time of Computation			ProUCL 5.2 10/28/2024 3:30:20 PM								
5	From File			WorkSheet.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	CM-WRA-0.5-1											
12												
13	General Statistics											
14	Total Number of Observations					4	Number of Distinct Observations					3
15							Number of Missing Observations					0
16	Minimum					5	Mean					7
17	Maximum					9	Median					7
18	SD					1.633	Std. Error of Mean					0.816
19	Coefficient of Variation					0.233	Skewness					0
20												
21	Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,											
22	refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,											
23	but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).											
24	The Chebyshev UCL often results in gross overestimates of the mean.											
25	Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.											
26												
27	Normal GOF Test											
28	Shapiro Wilk Test Statistic					0.944	Shapiro Wilk GOF Test					
29	1% Shapiro Wilk Critical Value					0.687	Data appear Normal at 1% Significance Level					
30	Lilliefors Test Statistic					0.25	Lilliefors GOF Test					
31	1% Lilliefors Critical Value					0.413	Data appear Normal at 1% Significance Level					
32	Data appear Normal at 1% Significance Level											
33	Note GOF tests may be unreliable for small sample sizes											
34												
35	Assuming Normal Distribution											
36	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
37	95% Student's-t UCL					8.922	95% Adjusted-CLT UCL (Chen-1995)					8.343
38							95% Modified-t UCL (Johnson-1978)					8.922
39												
40	Gamma GOF Test											
41	A-D Test Statistic					0.338	Anderson-Darling Gamma GOF Test					
42	5% A-D Critical Value					0.657	Detected data appear Gamma Distributed at 5% Significance Level					
43	K-S Test Statistic					0.277	Kolmogorov-Smirnov Gamma GOF Test					
44	5% K-S Critical Value					0.394	Detected data appear Gamma Distributed at 5% Significance Level					
45	Detected data appear Gamma Distributed at 5% Significance Level											
46	Note GOF tests may be unreliable for small sample sizes											
47												
48	Gamma Statistics											
49	k hat (MLE)					23.65	k star (bias corrected MLE)					6.079
50	Theta hat (MLE)					0.296	Theta star (bias corrected MLE)					1.151
51	nu hat (MLE)					189.2	nu star (bias corrected)					48.64
52	MLE Mean (bias corrected)					7	MLE Sd (bias corrected)					2.839
53							Approximate Chi Square Value (0.05)					33.63
54	Adjusted Level of Significance					N/A	Adjusted Chi Square Value					N/A
55												
56	Assuming Gamma Distribution											
57	95% Approximate Gamma UCL					10.12	95% Adjusted Gamma UCL					N/A
58												
59	Lognormal GOF Test											
60	Shapiro Wilk Test Statistic					0.935	Shapiro Wilk Lognormal GOF Test					
61	10% Shapiro Wilk Critical Value					0.792	Data appear Lognormal at 10% Significance Level					
62	Lilliefors Test Statistic					0.285	Lilliefors Lognormal GOF Test					
63	10% Lilliefors Critical Value					0.346	Data appear Lognormal at 10% Significance Level					
64	Data appear Lognormal at 10% Significance Level											
65	Note GOF tests may be unreliable for small sample sizes											
66												
67	Lognormal Statistics											
68	Minimum of Logged Data					1.609	Mean of logged Data					1.925
69	Maximum of Logged Data					2.197	SD of logged Data					0.241
70												
71	Assuming Lognormal Distribution											
72	95% H-UCL					10.11	90% Chebyshev (MVUE) UCL					9.526
73	95% Chebyshev (MVUE) UCL					10.67	97.5% Chebyshev (MVUE) UCL					12.25
74	99% Chebyshev (MVUE) UCL					15.37						
75												
76	Nonparametric Distribution Free UCL Statistics											
77	Data appear to follow a Discernible Distribution											
78												
79	Nonparametric Distribution Free UCLs											
80	95% CLT UCL					8.343	95% BCA Bootstrap UCL					N/A
81	95% Standard Bootstrap UCL					N/A	95% Bootstrap-t UCL					N/A
82	95% Hall's Bootstrap UCL					N/A	95% Percentile Bootstrap UCL					N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					9.449	95% Chebyshev(Mean, Sd) UCL					10.56
84	97.5% Chebyshev(Mean, Sd) UCL					12.1	99% Chebyshev(Mean, Sd) UCL					15.12
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					8.922						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Uncensored Full Data Sets											
2												
3	User Selected Options											
4	Date/Time of Computation			ProUCL 5.2 10/28/2024 3:32:42 PM								
5	From File			WorkSheet.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	CM-WRA-0.5-2											
12												
13	General Statistics											
14	Total Number of Observations					4	Number of Distinct Observations					3
15							Number of Missing Observations					0
16	Minimum					11	Mean					12
17	Maximum					13	Median					12
18	SD					0.816	Std. Error of Mean					0.408
19	Coefficient of Variation					0.068	Skewness					0
20												
21	Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,											
22	refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,											
23	but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).											
24	The Chebyshev UCL often results in gross overestimates of the mean.											
25	Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.											
26												
27	Normal GOF Test											
28	Shapiro Wilk Test Statistic					0.944	Shapiro Wilk GOF Test					
29	1% Shapiro Wilk Critical Value					0.687	Data appear Normal at 1% Significance Level					
30	Lilliefors Test Statistic					0.25	Lilliefors GOF Test					
31	1% Lilliefors Critical Value					0.413	Data appear Normal at 1% Significance Level					
32	Data appear Normal at 1% Significance Level											
33	Note GOF tests may be unreliable for small sample sizes											
34												
35	Assuming Normal Distribution											
36	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
37	95% Student's-t UCL					12.96	95% Adjusted-CLT UCL (Chen-1995)					12.67
38							95% Modified-t UCL (Johnson-1978)					12.96
39												
40	Gamma GOF Test											
41	A-D Test Statistic					0.331	Anderson-Darling Gamma GOF Test					
42	5% A-D Critical Value					0.657	Detected data appear Gamma Distributed at 5% Significance Level					
43	K-S Test Statistic					0.258	Kolmogorov-Smirnov Gamma GOF Test					
44	5% K-S Critical Value					0.394	Detected data appear Gamma Distributed at 5% Significance Level					
45	Detected data appear Gamma Distributed at 5% Significance Level											
46	Note GOF tests may be unreliable for small sample sizes											
47												
48	Gamma Statistics											
49	k hat (MLE)					287.2	k star (bias corrected MLE)					71.96
50	Theta hat (MLE)					0.0418	Theta star (bias corrected MLE)					0.167
51	nu hat (MLE)					2297	nu star (bias corrected)					575.7
52	MLE Mean (bias corrected)					12	MLE Sd (bias corrected)					1.415
53							Approximate Chi Square Value (0.05)					521
54	Adjusted Level of Significance					N/A	Adjusted Chi Square Value					N/A
55												
56	Assuming Gamma Distribution											
57	95% Approximate Gamma UCL					13.26	95% Adjusted Gamma UCL					N/A
58												
59	Lognormal GOF Test											
60	Shapiro Wilk Test Statistic					0.944	Shapiro Wilk Lognormal GOF Test					
61	10% Shapiro Wilk Critical Value					0.792	Data appear Lognormal at 10% Significance Level					
62	Lilliefors Test Statistic					0.26	Lilliefors Lognormal GOF Test					
63	10% Lilliefors Critical Value					0.346	Data appear Lognormal at 10% Significance Level					
64	Data appear Lognormal at 10% Significance Level											
65	Note GOF tests may be unreliable for small sample sizes											
66												
67	Lognormal Statistics											
68	Minimum of Logged Data					2.398	Mean of logged Data					2.483
69	Maximum of Logged Data					2.565	SD of logged Data					0.0682
70												
71	Assuming Lognormal Distribution											
72	95% H-UCL					N/A	90% Chebyshev (MVUE) UCL					13.23
73	95% Chebyshev (MVUE) UCL					13.78	97.5% Chebyshev (MVUE) UCL					14.56
74	99% Chebyshev (MVUE) UCL					16.07						
75												
76	Nonparametric Distribution Free UCL Statistics											
77	Data appear to follow a Discernible Distribution											
78												
79	Nonparametric Distribution Free UCLs											
80	95% CLT UCL					12.67	95% BCA Bootstrap UCL					N/A
81	95% Standard Bootstrap UCL					N/A	95% Bootstrap-t UCL					N/A
82	95% Hall's Bootstrap UCL					N/A	95% Percentile Bootstrap UCL					N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					13.22	95% Chebyshev(Mean, Sd) UCL					13.78
84	97.5% Chebyshev(Mean, Sd) UCL					14.55	99% Chebyshev(Mean, Sd) UCL					16.06
85												
86	Suggested UCL to Use											
87	95% Student's-t UCL					12.96						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 3:39:21 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

CM-WRB-1

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	5	Mean	8.5
Maximum	11	Median	9
SD	2.646	Std. Error of Mean	1.323
Coefficient of Variation	0.311	Skewness	-0.864

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.947	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.215	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	11.61	95% Adjusted-CLT UCL (Chen-1995)	10.07
		95% Modified-t UCL (Johnson-1978)	11.52

Gamma GOF Test

A-D Test Statistic	0.327	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.249	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.395	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	11.87	k star (bias corrected MLE)	3.133
Theta hat (MLE)	0.716	Theta star (bias corrected MLE)	2.713
nu hat (MLE)	94.93	nu star (bias corrected)	25.07
MLE Mean (bias corrected)	8.5	MLE Sd (bias corrected)	4.802
		Approximate Chi Square Value (0.05)	14.66
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	14.53	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.905	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.23	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	1.609	Mean of logged Data	2.097
Maximum of Logged Data	2.398	SD of logged Data	0.352

Assuming Lognormal Distribution

95% H-UCL	15.84	90% Chebyshev (MVUE) UCL	12.98
95% Chebyshev (MVUE) UCL	15	97.5% Chebyshev (MVUE) UCL	17.8
99% Chebyshev (MVUE) UCL	23.3		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	10.68	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83			90% Chebyshev(Mean, Sd) UCL			12.47			95% Chebyshev(Mean, Sd) UCL			14.27
84			97.5% Chebyshev(Mean, Sd) UCL			16.76			99% Chebyshev(Mean, Sd) UCL			21.66
85												
86	**Suggested UCL to Use**											
87			95% Student's-t UCL			11.61						
88	**Recommended UCL exceeds the maximum observation**											
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												
94	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
95	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
96												

1	**UCL Statistics for Uncensored Full Data Sets**			
2				
3	User Selected Options			
4	Date/Time of Computation	ProUCL 5.2 10/28/2024 3:37:19 PM		
5	From File	WorkSheet.xls		
6	Full Precision	OFF		
7	Confidence Coefficient	95%		
8	Number of Bootstrap Operations	2000		
9				
10				
11	CM-WRB-2			
12				
13	**General Statistics**			
14	Total Number of Observations	4	Number of Distinct Observations	3
15			Number of Missing Observations	0
16	Minimum	11	Mean	12.25
17	Maximum	14	Median	12
18	SD	1.5	Std. Error of Mean	0.75
19	Coefficient of Variation	0.122	Skewness	0.37
20				
21	**Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,**			
22	**refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,**			
23	**but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).**			
24	**The Chebyshev UCL often results in gross overestimates of the mean.**			
25	**Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.**			
26				
27	**Normal GOF Test**			
28	Shapiro Wilk Test Statistic	0.851	**Shapiro Wilk GOF Test**	
29	1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level	
30	Lilliefors Test Statistic	0.298	**Lilliefors GOF Test**	
31	1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level	
32	**Data appear Normal at 1% Significance Level**			
33	**Note GOF tests may be unreliable for small sample sizes**			
34				
35	**Assuming Normal Distribution**			
36	**95% Normal UCL**		**95% UCLs (Adjusted for Skewness)**	
37	95% Student's-t UCL	14.02	95% Adjusted-CLT UCL (Chen-1995)	13.63
38			95% Modified-t UCL (Johnson-1978)	14.04
39				
40	**Gamma GOF Test**			
41	A-D Test Statistic	0.476	**Anderson-Darling Gamma GOF Test**	
42	5% A-D Critical Value	0.656	Detected data appear Gamma Distributed at 5% Significance Level	
43	K-S Test Statistic	0.333	**Kolmogorov-Smirnov Gamma GOF Test**	
44	5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level	
45	**Detected data appear Gamma Distributed at 5% Significance Level**			
46	**Note GOF tests may be unreliable for small sample sizes**			
47				
48	**Gamma Statistics**			
49	k hat (MLE)	89.83	k star (bias corrected MLE)	22.62
50	Theta hat (MLE)	0.136	Theta star (bias corrected MLE)	0.541
51	nu hat (MLE)	718.6	nu star (bias corrected)	181
52	MLE Mean (bias corrected)	12.25	MLE Sd (bias corrected)	2.575
53			Approximate Chi Square Value (0.05)	150.9
54	Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A
55				
56	**Assuming Gamma Distribution**			
57	95% Approximate Gamma UCL	14.7	95% Adjusted Gamma UCL	N/A
58				
59	**Lognormal GOF Test**			
60	Shapiro Wilk Test Statistic	0.845	**Shapiro Wilk Lognormal GOF Test**	
61	10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level	
62	Lilliefors Test Statistic	0.299	**Lilliefors Lognormal GOF Test**	
63	10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level	
64	**Data appear Lognormal at 10% Significance Level**			
65	**Note GOF tests may be unreliable for small sample sizes**			
66				
67	**Lognormal Statistics**			
68	Minimum of Logged Data	2.398	Mean of logged Data	2.5
69	Maximum of Logged Data	2.639	SD of logged Data	0.122
70				
71	**Assuming Lognormal Distribution**			
72	95% H-UCL	14.39	90% Chebyshev (MVUE) UCL	14.48
73	95% Chebyshev (MVUE) UCL	15.49	97.5% Chebyshev (MVUE) UCL	16.9
74	99% Chebyshev (MVUE) UCL	19.66		
75				
76	**Nonparametric Distribution Free UCL Statistics**			
77	**Data appear to follow a Discernible Distribution**			
78				
79	**Nonparametric Distribution Free UCLs**			
80	95% CLT UCL	13.48	95% BCA Bootstrap UCL	N/A
81	95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
82	95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83					90% Chebyshev(Mean, Sd) UCL	14.5					95% Chebyshev(Mean, Sd) UCL	15.52
84					97.5% Chebyshev(Mean, Sd) UCL	16.93					99% Chebyshev(Mean, Sd) UCL	19.71
85												
86	**Suggested UCL to Use**											
87					95% Student's-t UCL	14.02						
88	**Recommended UCL exceeds the maximum observation**											
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 3:43:26 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

CM-WRC-1

General Statistics

Total Number of Observations	4	Number of Distinct Observations	3
		Number of Missing Observations	0
Minimum	60	Mean	65.75
Maximum	81	Median	61
SD	10.21	Std. Error of Mean	5.105
Coefficient of Variation	0.155	Skewness	1.95

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.697	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.393	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	77.76	95% Adjusted-CLT UCL (Chen-1995)	79.47
		95% Modified-t UCL (Johnson-1978)	78.59

Gamma GOF Test

A-D Test Statistic	0.772	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.656	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.409	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	60.47	k star (bias corrected MLE)	15.28
Theta hat (MLE)	1.087	Theta star (bias corrected MLE)	4.302
nu hat (MLE)	483.8	nu star (bias corrected)	122.3
MLE Mean (bias corrected)	65.75	MLE Sd (bias corrected)	16.82
		Approximate Chi Square Value (0.05)	97.74
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	82.26	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.707	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.386	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.094	Mean of logged Data	4.178
Maximum of Logged Data	4.394	SD of logged Data	0.145

Assuming Lognormal Distribution

95% H-UCL	80.09	90% Chebyshev (MVUE) UCL	80.04
95% Chebyshev (MVUE) UCL	86.52	97.5% Chebyshev (MVUE) UCL	95.52
99% Chebyshev (MVUE) UCL	113.2		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	74.15	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
90% Chebyshev(Mean, Sd) UCL	81.07	95% Chebyshev(Mean, Sd) UCL	88
97.5% Chebyshev(Mean, Sd) UCL	97.63	99% Chebyshev(Mean, Sd) UCL	116.5

	A	B	C	D	E	F	G	H	I	J	K	L
83												
84						**Suggested UCL to Use**						
85					95% Student's-t UCL	77.76						
86												
87	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
88	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
89	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
90												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 3:49:21 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

CM-WRC-2

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	62	Mean	84
Maximum	113	Median	84
SD	18.77	Std. Error of Mean	8.396
Coefficient of Variation	0.224	Skewness	0.82

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.947	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.686	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.258	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.396	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	101.9	95% Adjusted-CLT UCL (Chen-1995)	101.1
		95% Modified-t UCL (Johnson-1978)	102.4

Gamma GOF Test

A-D Test Statistic	0.249	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.679	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.226	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	25.96	k star (bias corrected MLE)	10.52
Theta hat (MLE)	3.235	Theta star (bias corrected MLE)	7.986
nu hat (MLE)	259.6	nu star (bias corrected)	105.2
MLE Mean (bias corrected)	84	MLE Sd (bias corrected)	25.9
		Approximate Chi Square Value (0.05)	82.52
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	73.77

Assuming Gamma Distribution

95% Approximate Gamma UCL	107.1	95% Adjusted Gamma UCL	119.8

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.973	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.806	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.222	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.319	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	4.127	Mean of logged Data	4.411
Maximum of Logged Data	4.727	SD of logged Data	0.219

Assuming Lognormal Distribution

95% H-UCL	107.8	90% Chebyshev (MVUE) UCL	108.6
95% Chebyshev (MVUE) UCL	119.8	97.5% Chebyshev (MVUE) UCL	135.2
99% Chebyshev (MVUE) UCL	165.6		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	97.81	95% BCA Bootstrap UCL	99.6
95% Standard Bootstrap UCL	96.73	95% Bootstrap-t UCL	106.1
95% Hall's Bootstrap UCL	117.5	95% Percentile Bootstrap UCL	97

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					109.2	95% Chebyshev(Mean, Sd) UCL					120.6
84	97.5% Chebyshev(Mean, Sd) UCL					136.4	99% Chebyshev(Mean, Sd) UCL					167.5
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					101.9						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 3:52:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

CM-WRC-3

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	36	Mean	48.25
Maximum	63	Median	47
SD	12.89	Std. Error of Mean	6.447
Coefficient of Variation	0.267	Skewness	0.276

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.904	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.263	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	63.42	95% Adjusted-CLT UCL (Chen-1995)	59.8
		95% Modified-t UCL (Johnson-1978)	63.57

Gamma GOF Test

A-D Test Statistic	0.372	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.291	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	18.68	k star (bias corrected MLE)	4.836
Theta hat (MLE)	2.583	Theta star (bias corrected MLE)	9.977
nu hat (MLE)	149.4	nu star (bias corrected)	38.69
MLE Mean (bias corrected)	48.25	MLE Sd (bias corrected)	21.94
		Approximate Chi Square Value (0.05)	25.44
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	73.37	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.903	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.255	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	3.584	Mean of logged Data	3.849
Maximum of Logged Data	4.143	SD of logged Data	0.269

Assuming Lognormal Distribution

95% H-UCL	73.67	90% Chebyshev (MVUE) UCL	67.58
95% Chebyshev (MVUE) UCL	76.34	97.5% Chebyshev (MVUE) UCL	88.49
99% Chebyshev (MVUE) UCL	112.4		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	58.85	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83			90% Chebyshev(Mean, Sd) UCL			67.59			95% Chebyshev(Mean, Sd) UCL			76.35
84			97.5% Chebyshev(Mean, Sd) UCL			88.51			99% Chebyshev(Mean, Sd) UCL			112.4
85												
86	**Suggested UCL to Use**											
87			95% Student's-t UCL			63.42						
88	**Recommended UCL exceeds the maximum observation**											
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												

	A–E	F	G–K	L
1	UCL Statistics for Uncensored Full Data Sets			
2				
3	User Selected Options			
4	Date/Time of Computation	ProUCL 5.2 10/28/2024 3:54:46 PM		
5	From File	WorkSheet.xls		
6	Full Precision	OFF		
7	Confidence Coefficient	95%		
8	Number of Bootstrap Operations	2000		
9				
10				
11	CM-WRC-4			
12				
13	General Statistics			
14	Total Number of Observations	4	Number of Distinct Observations	4
15			Number of Missing Observations	0
16	Minimum	309	Mean	329.5
17	Maximum	375	Median	317
18	SD	30.84	Std. Error of Mean	15.42
19	Coefficient of Variation	0.0936	Skewness	1.814
20				
21	**Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,**			
22	**refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,**			
23	**but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).**			
24	**The Chebyshev UCL often results in gross overestimates of the mean.**			
25	**Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.**			
26				
27	Normal GOF Test			
28	Shapiro Wilk Test Statistic	0.775	**Shapiro Wilk GOF Test**	
29	1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level	
30	Lilliefors Test Statistic	0.346	**Lilliefors GOF Test**	
31	1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level	
32	**Data appear Normal at 1% Significance Level**			
33	**Note GOF tests may be unreliable for small sample sizes**			
34				
35	Assuming Normal Distribution			
36	**95% Normal UCL**		**95% UCLs (Adjusted for Skewness)**	
37	95% Student's-t UCL	365.8	95% Adjusted-CLT UCL (Chen-1995)	369.8
38			95% Modified-t UCL (Johnson-1978)	368.1
39				
40	Gamma GOF Test			
41	A-D Test Statistic	0.598	**Anderson-Darling Gamma GOF Test**	
42	5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level	
43	K-S Test Statistic	0.354	**Kolmogorov-Smirnov Gamma GOF Test**	
44	5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level	
45	**Detected data appear Gamma Distributed at 5% Significance Level**			
46	**Note GOF tests may be unreliable for small sample sizes**			
47				
48	Gamma Statistics			
49	k hat (MLE)	160.4	k star (bias corrected MLE)	40.26
50	Theta hat (MLE)	2.055	Theta star (bias corrected MLE)	8.184
51	nu hat (MLE)	1283	nu star (bias corrected)	322.1
52	MLE Mean (bias corrected)	329.5	MLE Sd (bias corrected)	51.93
53			Approximate Chi Square Value (0.05)	281.5
54	Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A
55				
56	Assuming Gamma Distribution			
57	95% Approximate Gamma UCL	377	95% Adjusted Gamma UCL	N/A
58				
59	Lognormal GOF Test			
60	Shapiro Wilk Test Statistic	0.786	**Shapiro Wilk Lognormal GOF Test**	
61	10% Shapiro Wilk Critical Value	0.792	Data Not Lognormal at 10% Significance Level	
62	Lilliefors Test Statistic	0.337	**Lilliefors Lognormal GOF Test**	
63	10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level	
64	**Data appear Approximate Lognormal at 10% Significance Level**			
65	**Note GOF tests may be unreliable for small sample sizes**			
66				
67	Lognormal Statistics			
68	Minimum of Logged Data	5.733	Mean of logged Data	5.794
69	Maximum of Logged Data	5.927	SD of logged Data	0.09
70				
71	Assuming Lognormal Distribution			
72	95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	373.9
73	95% Chebyshev (MVUE) UCL	394.1	97.5% Chebyshev (MVUE) UCL	422.1
74	99% Chebyshev (MVUE) UCL	477		
75				
76	Nonparametric Distribution Free UCL Statistics			
77	Data appear to follow a Discernible Distribution			
78				
79	Nonparametric Distribution Free UCLs			
80	95% CLT UCL	354.9	95% BCA Bootstrap UCL	N/A
81	95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
82	95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					375.8	95% Chebyshev(Mean, Sd) UCL					396.7
84	97.5% Chebyshev(Mean, Sd) UCL					425.8	99% Chebyshev(Mean, Sd) UCL					482.9
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					365.8						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 3:56:51 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

CM-WRC-5

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	77	Mean	92.75
Maximum	106	Median	94
SD	14.93	Std. Error of Mean	7.465
Coefficient of Variation	0.161	Skewness	-0.134

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.834	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.294	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	110.3	95% Adjusted-CLT UCL (Chen-1995)	104.5
		95% Modified-t UCL (Johnson-1978)	110.2

Gamma GOF Test

A-D Test Statistic	0.499	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.656	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.328	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	50.69	k star (bias corrected MLE)	12.84
Theta hat (MLE)	1.83	Theta star (bias corrected MLE)	7.224
nu hat (MLE)	405.5	nu star (bias corrected)	102.7
MLE Mean (bias corrected)	92.75	MLE Sd (bias corrected)	25.88
		Approximate Chi Square Value (0.05)	80.33
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	118.6	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.841	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.294	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	4.344	Mean of logged Data	4.52
Maximum of Logged Data	4.663	SD of logged Data	0.163

Assuming Lognormal Distribution

95% H-UCL	116.3	90% Chebyshev (MVUE) UCL	115.4
95% Chebyshev (MVUE) UCL	125.7	97.5% Chebyshev (MVUE) UCL	139.9
99% Chebyshev (MVUE) UCL	167.9		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	105	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					115.1	95% Chebyshev(Mean, Sd) UCL					125.3
84	97.5% Chebyshev(Mean, Sd) UCL					139.4	99% Chebyshev(Mean, Sd) UCL					167
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					110.3						
88	**Recommended UCL exceeds the maximum observation**											
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												
94	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
95	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
96												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 4:02:25 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

GC03-WRA

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	30	Mean	35.5
Maximum	45	Median	33.5
SD	6.856	Std. Error of Mean	3.428
Coefficient of Variation	0.193	Skewness	1.241

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.881	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.244	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level	

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	43.57	95% Adjusted-CLT UCL (Chen-1995)	43.41
		95% Modified-t UCL (Johnson-1978)	43.92

Gamma GOF Test

A-D Test Statistic	0.371	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.656	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.277	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	38.07	k star (bias corrected MLE)	9.684
Theta hat (MLE)	0.932	Theta star (bias corrected MLE)	3.666
nu hat (MLE)	304.6	nu star (bias corrected)	77.47
MLE Mean (bias corrected)	35.5	MLE Sd (bias corrected)	11.41
		Approximate Chi Square Value (0.05)	58.2
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	47.26	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.9	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.246	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level	

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	3.401	Mean of logged Data	3.556
Maximum of Logged Data	3.807	SD of logged Data	0.185

Assuming Lognormal Distribution

95% H-UCL	46.14	90% Chebyshev (MVUE) UCL	45.3
95% Chebyshev (MVUE) UCL	49.74	97.5% Chebyshev (MVUE) UCL	55.91
99% Chebyshev (MVUE) UCL	68.02		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	41.14	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					45.78	95% Chebyshev(Mean, Sd) UCL					50.44
84	97.5% Chebyshev(Mean, Sd) UCL					56.91	99% Chebyshev(Mean, Sd) UCL					69.61
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					43.57						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 4:03:49 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

GC03-WRB

General Statistics

Total Number of Observations	8	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	75	Mean	217.6
Maximum	485	Median	186
SD	128.4	Std. Error of Mean	45.41
Coefficient of Variation	0.59	Skewness	1.408

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.874	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.749	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.236	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.333	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	303.7	95% Adjusted-CLT UCL (Chen-1995)	316.5
		95% Modified-t UCL (Johnson-1978)	307.4

Gamma GOF Test

A-D Test Statistic	0.296	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.719	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.191	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.296	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	3.721	k star (bias corrected MLE)	2.409
Theta hat (MLE)	58.49	Theta star (bias corrected MLE)	90.35
nu hat (MLE)	59.53	nu star (bias corrected)	38.54
MLE Mean (bias corrected)	217.6	MLE Sd (bias corrected)	140.2
		Approximate Chi Square Value (0.05)	25.32
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	22.65

Assuming Gamma Distribution

95% Approximate Gamma UCL	331.2	95% Adjusted Gamma UCL	370.3

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.968	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.851	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.177	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.265	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	4.317	Mean of logged Data	5.242
Maximum of Logged Data	6.184	SD of logged Data	0.566

Assuming Lognormal Distribution

95% H-UCL	376.4	90% Chebyshev (MVUE) UCL	349
95% Chebyshev (MVUE) UCL	408.7	97.5% Chebyshev (MVUE) UCL	491.6
99% Chebyshev (MVUE) UCL	654.5		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	292.3	95% BCA Bootstrap UCL	312.8
95% Standard Bootstrap UCL	287.6	95% Bootstrap-t UCL	347.9
95% Hall's Bootstrap UCL	689.1	95% Percentile Bootstrap UCL	293.4

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					353.9	95% Chebyshev(Mean, Sd) UCL					415.6
84	97.5% Chebyshev(Mean, Sd) UCL					501.2	99% Chebyshev(Mean, Sd) UCL					669.5
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					303.7						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

Row				
1	UCL Statistics for Uncensored Full Data Sets			
2				
3	User Selected Options			
4	Date/Time of Computation	ProUCL 5.2 10/31/2024 3:44:08 PM		
5	From File	ProUCL Input.xls		
6	Full Precision	OFF		
7	Confidence Coefficient	95%		
8	Number of Bootstrap Operations	2000		
9				
10				
11	GC5-WRA-0.5-1			
12				
13	**General Statistics**			
14	Total Number of Observations	4	Number of Distinct Observations	4
15			Number of Missing Observations	0
16	Minimum	86	Mean	99.5
17	Maximum	133	Median	89.5
18	SD	22.4	Std. Error of Mean	11.2
19	Coefficient of Variation	0.225	Skewness	1.965
20				
21	**Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,**			
22	**refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,**			
23	**but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).**			
24	**The Chebyshev UCL often results in gross overestimates of the mean.**			
25	**Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.**			
26				
27	**Normal GOF Test**			
28	Shapiro Wilk Test Statistic	0.7	**Shapiro Wilk GOF Test**	
29	1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level	
30	Lilliefors Test Statistic	0.414	**Lilliefors GOF Test**	
31	1% Lilliefors Critical Value	0.413	Data Not Normal at 1% Significance Level	
32	**Data appear Approximate Normal at 1% Significance Level**			
33	**Note GOF tests may be unreliable for small sample sizes**			
34				
35	**Assuming Normal Distribution**			
36	**95% Normal UCL**		**95% UCLs (Adjusted for Skewness)**	
37	95% Student's-t UCL	125.9	95% Adjusted-CLT UCL (Chen-1995)	129.7
38			95% Modified-t UCL (Johnson-1978)	127.7
39				
40	**Gamma GOF Test**			
41	A-D Test Statistic	0.775	**Anderson-Darling Gamma GOF Test**	
42	5% A-D Critical Value	0.657	Data Not Gamma Distributed at 5% Significance Level	
43	K-S Test Statistic	0.433	**Kolmogorov-Smirnov Gamma GOF Test**	
44	5% K-S Critical Value	0.394	Data Not Gamma Distributed at 5% Significance Level	
45	**Data Not Gamma Distributed at 5% Significance Level**			
46				
47	**Gamma Statistics**			
48	k hat (MLE)	29.8	k star (bias corrected MLE)	7.617
49	Theta hat (MLE)	3.339	Theta star (bias corrected MLE)	13.06
50	nu hat (MLE)	238.4	nu star (bias corrected)	60.93
51	MLE Mean (bias corrected)	99.5	MLE Sd (bias corrected)	36.05
52			Approximate Chi Square Value (0.05)	43.98
53	Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A
54				
55	**Assuming Gamma Distribution**			
56	95% Approximate Gamma UCL	137.9	95% Adjusted Gamma UCL	N/A
57				
58	**Lognormal GOF Test**			
59	Shapiro Wilk Test Statistic	0.717	**Shapiro Wilk Lognormal GOF Test**	
60	10% Shapiro Wilk Critical Value	0.792	Data Not Lognormal at 10% Significance Level	
61	Lilliefors Test Statistic	0.408	**Lilliefors Lognormal GOF Test**	
62	10% Lilliefors Critical Value	0.346	Data Not Lognormal at 10% Significance Level	
63	**Data Not Lognormal at 10% Significance Level**			
64				
65	**Lognormal Statistics**			
66	Minimum of Logged Data	4.454	Mean of logged Data	4.583
67	Maximum of Logged Data	4.89	SD of logged Data	0.206
68				
69	**Assuming Lognormal Distribution**			
70	95% H-UCL	134.1	90% Chebyshev (MVUE) UCL	130
71	95% Chebyshev (MVUE) UCL	143.8	97.5% Chebyshev (MVUE) UCL	163
72	99% Chebyshev (MVUE) UCL	200.7		
73				
74	**Nonparametric Distribution Free UCL Statistics**			
75	**Data appear to follow a Discernible Distribution**			
76				
77	**Nonparametric Distribution Free UCLs**			
78	95% CLT UCL	117.9	95% BCA Bootstrap UCL	N/A
79	95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
80	95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
81	90% Chebyshev(Mean, Sd) UCL	133.1	95% Chebyshev(Mean, Sd) UCL	148.3
82	97.5% Chebyshev(Mean, Sd) UCL	169.4	99% Chebyshev(Mean, Sd) UCL	210.9

	A	B	C	D	E	F	G	H	I	J	K	L
83												
84	**Suggested UCL to Use**											
85	95% Student's-t UCL					125.9						
86												
87	When a data set follows an approximate distribution passing only one of the GOF tests,											
88	it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL											
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Uncensored Full Data Sets											
2												
3	User Selected Options											
4	Date/Time of Computation			ProUCL 5.2 10/31/2024 3:45:38 PM								
5	From File			ProUCL Input.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	GC5-WRA-0.5-2											
12												
13	General Statistics											
14	Total Number of Observations					4	Number of Distinct Observations					4
15							Number of Missing Observations					0
16	Minimum					54	Mean					69
17	Maximum					81	Median					70.5
18	SD					11.17	Std. Error of Mean					5.583
19	Coefficient of Variation					0.162	Skewness					-0.785
20												
21	Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,											
22	refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,											
23	but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).											
24	The Chebyshev UCL often results in gross overestimates of the mean.											
25	Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.											
26												
27	Normal GOF Test											
28	Shapiro Wilk Test Statistic					0.937	Shapiro Wilk GOF Test					
29	1% Shapiro Wilk Critical Value					0.687	Data appear Normal at 1% Significance Level					
30	Lilliefors Test Statistic					0.286	Lilliefors GOF Test					
31	1% Lilliefors Critical Value					0.413	Data appear Normal at 1% Significance Level					
32	Data appear Normal at 1% Significance Level											
33	Note GOF tests may be unreliable for small sample sizes											
34												
35	Assuming Normal Distribution											
36	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
37	95% Student's-t UCL					82.14	95% Adjusted-CLT UCL (Chen-1995)					75.84
38							95% Modified-t UCL (Johnson-1978)					81.77
39												
40	Gamma GOF Test											
41	A-D Test Statistic					0.359	Anderson-Darling Gamma GOF Test					
42	5% A-D Critical Value					0.656	Detected data appear Gamma Distributed at 5% Significance Level					
43	K-S Test Statistic					0.309	Kolmogorov-Smirnov Gamma GOF Test					
44	5% K-S Critical Value					0.394	Detected data appear Gamma Distributed at 5% Significance Level					
45	Detected data appear Gamma Distributed at 5% Significance Level											
46	Note GOF tests may be unreliable for small sample sizes											
47												
48	Gamma Statistics											
49	k hat (MLE)					47.99	k star (bias corrected MLE)					12.16
50	Theta hat (MLE)					1.438	Theta star (bias corrected MLE)					5.672
51	nu hat (MLE)					383.9	nu star (bias corrected)					97.32
52	MLE Mean (bias corrected)					69	MLE Sd (bias corrected)					19.78
53							Approximate Chi Square Value (0.05)					75.56
54	Adjusted Level of Significance					N/A	Adjusted Chi Square Value					N/A
55												
56	Assuming Gamma Distribution											
57	95% Approximate Gamma UCL					88.87	95% Adjusted Gamma UCL					N/A
58												
59	Lognormal GOF Test											
60	Shapiro Wilk Test Statistic					0.914	Shapiro Wilk Lognormal GOF Test					
61	10% Shapiro Wilk Critical Value					0.792	Data appear Lognormal at 10% Significance Level					
62	Lilliefors Test Statistic					0.308	Lilliefors Lognormal GOF Test					
63	10% Lilliefors Critical Value					0.346	Data appear Lognormal at 10% Significance Level					
64	Data appear Lognormal at 10% Significance Level											
65	Note GOF tests may be unreliable for small sample sizes											
66												
67	Lognormal Statistics											
68	Minimum of Logged Data					3.989	Mean of logged Data					4.224
69	Maximum of Logged Data					4.394	SD of logged Data					0.17
70												
71	Assuming Lognormal Distribution											
72	95% H-UCL					87.48	90% Chebyshev (MVUE) UCL					86.55
73	95% Chebyshev (MVUE) UCL					94.49	97.5% Chebyshev (MVUE) UCL					105.5
74	99% Chebyshev (MVUE) UCL					127.2						
75												
76	Nonparametric Distribution Free UCL Statistics											
77	Data appear to follow a Discernible Distribution											
78												
79	Nonparametric Distribution Free UCLs											
80	95% CLT UCL					78.18	95% BCA Bootstrap UCL					N/A
81	95% Standard Bootstrap UCL					N/A	95% Bootstrap-t UCL					N/A
82	95% Hall's Bootstrap UCL					N/A	95% Percentile Bootstrap UCL					N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					85.75	95% Chebyshev(Mean, Sd) UCL					93.33
84	97.5% Chebyshev(Mean, Sd) UCL					103.9	99% Chebyshev(Mean, Sd) UCL					124.5
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					82.14						
88	**Recommended UCL exceeds the maximum observation**											
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												
94	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
95	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
96												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 3:47:17 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

GC5-WRA-0.5-3

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	253	Mean	347.6
Maximum	446	Median	351
SD	62.31	Std. Error of Mean	19.71
Coefficient of Variation	0.179	Skewness	0.00327

Normal GOF Test

Shapiro Wilk Test Statistic	0.977	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.0962	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	383.7	95% Adjusted-CLT UCL (Chen-1995)	380
		95% Modified-t UCL (Johnson-1978)	383.7

Gamma GOF Test

A-D Test Statistic	0.173	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.724	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.112	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.266	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	33.76	k star (bias corrected MLE)	23.7
Theta hat (MLE)	10.3	Theta star (bias corrected MLE)	14.67
nu hat (MLE)	675.1	nu star (bias corrected)	473.9
MLE Mean (bias corrected)	347.6	MLE Sd (bias corrected)	71.41
		Approximate Chi Square Value (0.05)	424.4
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	416.3

Assuming Gamma Distribution

95% Approximate Gamma UCL	388.1	95% Adjusted Gamma UCL	395.7

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.971	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.122	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.533	Mean of logged Data	5.836
Maximum of Logged Data	6.1	SD of logged Data	0.183

Assuming Lognormal Distribution

95% H-UCL	390.4	90% Chebyshev (MVUE) UCL	408.3
95% Chebyshev (MVUE) UCL	435.8	97.5% Chebyshev (MVUE) UCL	474
99% Chebyshev (MVUE) UCL	548.9		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	380	95% BCA Bootstrap UCL	376.1
95% Standard Bootstrap UCL	377.9	95% Bootstrap-t UCL	383.9
95% Hall's Bootstrap UCL	379.6	95% Percentile Bootstrap UCL	376.8
90% Chebyshev(Mean, Sd) UCL	406.7	95% Chebyshev(Mean, Sd) UCL	433.5
97.5% Chebyshev(Mean, Sd) UCL	470.7	99% Chebyshev(Mean, Sd) UCL	543.7

Suggested UCL to Use

95% Student's-t UCL	383.7

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
83												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 3:48:52 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

GC5-WRA-0.5-4

General Statistics			
Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	81	Mean	149.7
Maximum	302	Median	124
SD	69.36	Std. Error of Mean	21.93
Coefficient of Variation	0.463	Skewness	1.394
Normal GOF Test			
Shapiro Wilk Test Statistic	0.851	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.207	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	189.9	95% Adjusted-CLT UCL (Chen-1995)	196.1
		95% Modified-t UCL (Johnson-1978)	191.5
Gamma GOF Test			
A-D Test Statistic	0.443	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.728	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.21	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.267	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	6.209	k star (bias corrected MLE)	4.413
Theta hat (MLE)	24.11	Theta star (bias corrected MLE)	33.92
nu hat (MLE)	124.2	nu star (bias corrected)	88.26
MLE Mean (bias corrected)	149.7	MLE Sd (bias corrected)	71.26
		Approximate Chi Square Value (0.05)	67.6
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	64.47
Assuming Gamma Distribution			
95% Approximate Gamma UCL	195.4	95% Adjusted Gamma UCL	205
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.934	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.192	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	4.394	Mean of logged Data	4.926
Maximum of Logged Data	5.71	SD of logged Data	0.414
Assuming Lognormal Distribution			
95% H-UCL	200.8	90% Chebyshev (MVUE) UCL	208
95% Chebyshev (MVUE) UCL	234.8	97.5% Chebyshev (MVUE) UCL	272
99% Chebyshev (MVUE) UCL	345.2		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	185.8	95% BCA Bootstrap UCL	192.6
95% Standard Bootstrap UCL	183.3	95% Bootstrap-t UCL	222.5
95% Hall's Bootstrap UCL	343.6	95% Percentile Bootstrap UCL	184.1
90% Chebyshev(Mean, Sd) UCL	215.5	95% Chebyshev(Mean, Sd) UCL	245.3
97.5% Chebyshev(Mean, Sd) UCL	286.7	99% Chebyshev(Mean, Sd) UCL	367.9
Suggested UCL to Use			
95% Student's-t UCL	189.9		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
83												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Uncensored Full Data Sets											
2												
3	User Selected Options											
4	Date/Time of Computation			ProUCL 5.2 10/31/2024 3:50:46 PM								
5	From File			ProUCL Input.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	GC5-WRA-0.5-4-DS											
12												
13	General Statistics											
14	Total Number of Observations					4					Number of Distinct Observations	4
15											Number of Missing Observations	0
16	Minimum					56					Mean	67.75
17	Maximum					76					Median	69.5
18	SD					9.179					Std. Error of Mean	4.589
19	Coefficient of Variation					0.135					Skewness	-0.722
20												
21	Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,											
22	refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,											
23	but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).											
24	The Chebyshev UCL often results in gross overestimates of the mean.											
25	Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.											
26												
27	Normal GOF Test											
28	Shapiro Wilk Test Statistic					0.921	Shapiro Wilk GOF Test					
29	1% Shapiro Wilk Critical Value					0.687	Data appear Normal at 1% Significance Level					
30	Lilliefors Test Statistic					0.252	Lilliefors GOF Test					
31	1% Lilliefors Critical Value					0.413	Data appear Normal at 1% Significance Level					
32	Data appear Normal at 1% Significance Level											
33	Note GOF tests may be unreliable for small sample sizes											
34												
35	Assuming Normal Distribution											
36	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
37	95% Student's-t UCL					78.55					95% Adjusted-CLT UCL (Chen-1995)	73.53
38											95% Modified-t UCL (Johnson-1978)	78.27
39												
40	Gamma GOF Test											
41	A-D Test Statistic					0.336	Anderson-Darling Gamma GOF Test					
42	5% A-D Critical Value					0.656	Detected data appear Gamma Distributed at 5% Significance Level					
43	K-S Test Statistic					0.284	Kolmogorov-Smirnov Gamma GOF Test					
44	5% K-S Critical Value					0.394	Detected data appear Gamma Distributed at 5% Significance Level					
45	Detected data appear Gamma Distributed at 5% Significance Level											
46	Note GOF tests may be unreliable for small sample sizes											
47												
48	Gamma Statistics											
49	k hat (MLE)					69.71					k star (bias corrected MLE)	17.59
50	Theta hat (MLE)					0.972					Theta star (bias corrected MLE)	3.851
51	nu hat (MLE)					557.6					nu star (bias corrected)	140.7
52	MLE Mean (bias corrected)					67.75					MLE Sd (bias corrected)	16.15
53											Approximate Chi Square Value (0.05)	114.3
54	Adjusted Level of Significance					N/A					Adjusted Chi Square Value	N/A
55												
56	Assuming Gamma Distribution											
57	95% Approximate Gamma UCL					83.4					95% Adjusted Gamma UCL	N/A
58												
59	Lognormal GOF Test											
60	Shapiro Wilk Test Statistic					0.913	Shapiro Wilk Lognormal GOF Test					
61	10% Shapiro Wilk Critical Value					0.792	Data appear Lognormal at 10% Significance Level					
62	Lilliefors Test Statistic					0.252	Lilliefors Lognormal GOF Test					
63	10% Lilliefors Critical Value					0.346	Data appear Lognormal at 10% Significance Level					
64	Data appear Lognormal at 10% Significance Level											
65	Note GOF tests may be unreliable for small sample sizes											
66												
67	Lognormal Statistics											
68	Minimum of Logged Data					4.025					Mean of logged Data	4.209
69	Maximum of Logged Data					4.331					SD of logged Data	0.14
70												
71	Assuming Lognormal Distribution											
72	95% H-UCL					81.87					90% Chebyshev (MVUE) UCL	81.97
73	95% Chebyshev (MVUE) UCL					88.4					97.5% Chebyshev (MVUE) UCL	97.33
74	99% Chebyshev (MVUE) UCL					114.9						
75												
76	Nonparametric Distribution Free UCL Statistics											
77	Data appear to follow a Discernible Distribution											
78												
79	Nonparametric Distribution Free UCLs											
80	95% CLT UCL					75.3					95% BCA Bootstrap UCL	N/A
81	95% Standard Bootstrap UCL					N/A					95% Bootstrap-t UCL	N/A
82	95% Hall's Bootstrap UCL					N/A					95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					81.52	95% Chebyshev(Mean, Sd) UCL					87.75
84	97.5% Chebyshev(Mean, Sd) UCL					96.41	99% Chebyshev(Mean, Sd) UCL					113.4
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					78.55						
88	**Recommended UCL exceeds the maximum observation**											
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												
94	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
95	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
96												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 3:54:03 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

GC5-WRB-0.5-1

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	129	Mean	139
Maximum	162	Median	132.5
SD	15.43	Std. Error of Mean	7.714
Coefficient of Variation	0.111	Skewness	1.926

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.731	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.401	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	157.2	95% Adjusted-CLT UCL (Chen-1995)	159.6
		95% Modified-t UCL (Johnson-1978)	158.4

Gamma GOF Test

A-D Test Statistic	0.715	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.657	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.42	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	115.5	k star (bias corrected MLE)	29.05
Theta hat (MLE)	1.203	Theta star (bias corrected MLE)	4.785
nu hat (MLE)	924.3	nu star (bias corrected)	232.4
MLE Mean (bias corrected)	139	MLE Sd (bias corrected)	25.79
		Approximate Chi Square Value (0.05)	198.1
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	163.1	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.742	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.397	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.86	Mean of logged Data	4.93
Maximum of Logged Data	5.088	SD of logged Data	0.106

Assuming Lognormal Distribution

95% H-UCL	159.5	90% Chebyshev (MVUE) UCL	161
95% Chebyshev (MVUE) UCL	171	97.5% Chebyshev (MVUE) UCL	184.8
99% Chebyshev (MVUE) UCL	212.1		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	151.7	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
90% Chebyshev(Mean, Sd) UCL	162.1	95% Chebyshev(Mean, Sd) UCL	172.6
97.5% Chebyshev(Mean, Sd) UCL	187.2	99% Chebyshev(Mean, Sd) UCL	215.7

	A	B	C	D	E	F	G	H	I	J	K	L
83												
84	Suggested UCL to Use											
85				95% Student's-t UCL		157.2						
86												
87	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
88	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
89	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
90												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 3:55:47 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

GC5-WRB-0.5-2

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	52	Mean	85
Maximum	120	Median	84
SD	27.83	Std. Error of Mean	13.92
Coefficient of Variation	0.327	Skewness	0.214

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.967	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.236	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	117.8	95% Adjusted-CLT UCL (Chen-1995)	109.5
		95% Modified-t UCL (Johnson-1978)	118

Gamma GOF Test

A-D Test Statistic	0.278	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.24	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.395	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	11.87	k star (bias corrected MLE)	3.135
Theta hat (MLE)	7.159	Theta star (bias corrected MLE)	27.11
nu hat (MLE)	94.99	nu star (bias corrected)	25.08
MLE Mean (bias corrected)	85	MLE Sd (bias corrected)	48.01
		Approximate Chi Square Value (0.05)	14.67
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	145.3	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.958	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.258	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	3.951	Mean of logged Data	4.4
Maximum of Logged Data	4.787	SD of logged Data	0.344

Assuming Lognormal Distribution

95% H-UCL	154.9	90% Chebyshev (MVUE) UCL	128.6
95% Chebyshev (MVUE) UCL	148.3	97.5% Chebyshev (MVUE) UCL	175.7
99% Chebyshev (MVUE) UCL	229.4		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	107.9	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					126.7	95% Chebyshev(Mean, Sd) UCL					145.7
84	97.5% Chebyshev(Mean, Sd) UCL					171.9	99% Chebyshev(Mean, Sd) UCL					223.5
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					117.8						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 2:13:25 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

GC6-WRA-0.5-1

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	172	Mean	194.4
Maximum	239	Median	189
SD	26.26	Std. Error of Mean	11.75
Coefficient of Variation	0.135	Skewness	1.694

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.832	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.686	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.321	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.396	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	219.4	95% Adjusted-CLT UCL (Chen-1995)	223.2
		95% Modified-t UCL (Johnson-1978)	220.9

Gamma GOF Test

A-D Test Statistic	0.483	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.678	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.309	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	74.11	k star (bias corrected MLE)	29.78
Theta hat (MLE)	2.623	Theta star (bias corrected MLE)	6.528
nu hat (MLE)	741.1	nu star (bias corrected)	297.8
MLE Mean (bias corrected)	194.4	MLE Sd (bias corrected)	35.62
		Approximate Chi Square Value (0.05)	258.8
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	242.8

Assuming Gamma Distribution

95% Approximate Gamma UCL	223.7	95% Adjusted Gamma UCL	238.5

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.862	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.806	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.301	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.319	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	5.147	Mean of logged Data	5.263
Maximum of Logged Data	5.476	SD of logged Data	0.128

Assuming Lognormal Distribution

95% H-UCL	222.2	90% Chebyshev (MVUE) UCL	227.6
95% Chebyshev (MVUE) UCL	242.6	97.5% Chebyshev (MVUE) UCL	263.5
99% Chebyshev (MVUE) UCL	304.6		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	213.7	95% BCA Bootstrap UCL	217.8
95% Standard Bootstrap UCL	212	95% Bootstrap-t UCL	242.4
95% Hall's Bootstrap UCL	300.7	95% Percentile Bootstrap UCL	215.6

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					229.6	95% Chebyshev(Mean, Sd) UCL					245.6
84	97.5% Chebyshev(Mean, Sd) UCL					267.8	99% Chebyshev(Mean, Sd) UCL					311.3
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					219.4						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Uncensored Full Data Sets											
2												
3	User Selected Options											
4	Date/Time of Computation			ProUCL 5.2 10/31/2024 2:15:50 PM								
5	From File			ProUCL Input.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	GC6-WRA-0.5-2											
12												
13	General Statistics											
14	Total Number of Observations					10	Number of Distinct Observations					10
15							Number of Missing Observations					0
16	Minimum					134	Mean					241.1
17	Maximum					422	Median					218
18	SD					94.69	Std. Error of Mean					29.94
19	Coefficient of Variation					0.393	Skewness					1
20												
21	Normal GOF Test											
22	Shapiro Wilk Test Statistic					0.899	Shapiro Wilk GOF Test					
23	1% Shapiro Wilk Critical Value					0.781	Data appear Normal at 1% Significance Level					
24	Lilliefors Test Statistic					0.18	Lilliefors GOF Test					
25	1% Lilliefors Critical Value					0.304	Data appear Normal at 1% Significance Level					
26	Data appear Normal at 1% Significance Level											
27												
28	Assuming Normal Distribution											
29	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
30	95% Student's-t UCL					296	95% Adjusted-CLT UCL (Chen-1995)					300.5
31							95% Modified-t UCL (Johnson-1978)					297.6
32												
33	Gamma GOF Test											
34	A-D Test Statistic					0.29	Anderson-Darling Gamma GOF Test					
35	5% A-D Critical Value					0.727	Detected data appear Gamma Distributed at 5% Significance Level					
36	K-S Test Statistic					0.147	Kolmogorov-Smirnov Gamma GOF Test					
37	5% K-S Critical Value					0.267	Detected data appear Gamma Distributed at 5% Significance Level					
38	Detected data appear Gamma Distributed at 5% Significance Level											
39												
40	Gamma Statistics											
41	k hat (MLE)					7.97	k star (bias corrected MLE)					5.645
42	Theta hat (MLE)					30.25	Theta star (bias corrected MLE)					42.71
43	nu hat (MLE)					159.4	nu star (bias corrected)					112.9
44	MLE Mean (bias corrected)					241.1	MLE Sd (bias corrected)					101.5
45							Approximate Chi Square Value (0.05)					89.38
46	Adjusted Level of Significance					0.0267	Adjusted Chi Square Value					85.74
47												
48	Assuming Gamma Distribution											
49	95% Approximate Gamma UCL					304.6	95% Adjusted Gamma UCL					317.5
50												
51	Lognormal GOF Test											
52	Shapiro Wilk Test Statistic					0.961	Shapiro Wilk Lognormal GOF Test					
53	10% Shapiro Wilk Critical Value					0.869	Data appear Lognormal at 10% Significance Level					
54	Lilliefors Test Statistic					0.125	Lilliefors Lognormal GOF Test					
55	10% Lilliefors Critical Value					0.241	Data appear Lognormal at 10% Significance Level					
56	Data appear Lognormal at 10% Significance Level											
57												
58	Lognormal Statistics											
59	Minimum of Logged Data					4.898	Mean of logged Data					5.421
60	Maximum of Logged Data					6.045	SD of logged Data					0.371
61												
62	Assuming Lognormal Distribution											
63	95% H-UCL					312.4	90% Chebyshev (MVUE) UCL					326.1
64	95% Chebyshev (MVUE) UCL					364.9	97.5% Chebyshev (MVUE) UCL					418.7
65	99% Chebyshev (MVUE) UCL					524.4						
66												
67	Nonparametric Distribution Free UCL Statistics											
68	Data appear to follow a Discernible Distribution											
69												
70	Nonparametric Distribution Free UCLs											
71	95% CLT UCL					290.4	95% BCA Bootstrap UCL					298
72	95% Standard Bootstrap UCL					288.6	95% Bootstrap-t UCL					332.3
73	95% Hall's Bootstrap UCL					364.7	95% Percentile Bootstrap UCL					289.2
74	90% Chebyshev(Mean, Sd) UCL					330.9	95% Chebyshev(Mean, Sd) UCL					371.6
75	97.5% Chebyshev(Mean, Sd) UCL					428.1	99% Chebyshev(Mean, Sd) UCL					539
76												
77	Suggested UCL to Use											
78	95% Student's-t UCL					296						
79												
80	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
81	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
82	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											

	A	B	C	D	E	F	G	H	I	J	K	L
83												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 2:19:41 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

GC6-WTP-0.5-1

General Statistics

Total Number of Observations	4	Number of Distinct Observations	3
		Number of Missing Observations	0
Minimum	5	Mean	7.25
Maximum	10	Median	7
SD	2.062	Std. Error of Mean	1.031
Coefficient of Variation	0.284	Skewness	0.713

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.926	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.298	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	9.676	95% Adjusted-CLT UCL (Chen-1995)	9.338
		95% Modified-t UCL (Johnson-1978)	9.737

Gamma GOF Test

A-D Test Statistic	0.337	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.274	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	16.81	k star (bias corrected MLE)	4.369
Theta hat (MLE)	0.431	Theta star (bias corrected MLE)	1.659
nu hat (MLE)	134.5	nu star (bias corrected)	34.95
MLE Mean (bias corrected)	7.25	MLE Sd (bias corrected)	3.469
		Approximate Chi Square Value (0.05)	22.43
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	11.3	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.944	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.257	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	1.609	Mean of logged Data	1.951
Maximum of Logged Data	2.303	SD of logged Data	0.283

Assuming Lognormal Distribution

95% H-UCL	11.42	90% Chebyshev (MVUE) UCL	10.31
95% Chebyshev (MVUE) UCL	11.69	97.5% Chebyshev (MVUE) UCL	13.62
99% Chebyshev (MVUE) UCL	17.39		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	8.945	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					10.34	95% Chebyshev(Mean, Sd) UCL					11.74
84	97.5% Chebyshev(Mean, Sd) UCL					13.69	99% Chebyshev(Mean, Sd) UCL					17.51
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					9.676						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 2:22:06 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

GC6-WTP-0.5-2

General Statistics

Total Number of Observations	4	Number of Distinct Observations	3
		Number of Missing Observations	0
Minimum	11	Mean	13
Maximum	16	Median	12.5
SD	2.449	Std. Error of Mean	1.225
Coefficient of Variation	0.188	Skewness	0.544

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.862	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.293	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	15.88	95% Adjusted-CLT UCL (Chen-1995)	15.37
		95% Modified-t UCL (Johnson-1978)	15.94

Gamma GOF Test

A-D Test Statistic	0.451	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.656	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.329	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	38.36	k star (bias corrected MLE)	9.757
Theta hat (MLE)	0.339	Theta star (bias corrected MLE)	1.332
nu hat (MLE)	306.9	nu star (bias corrected)	78.06
MLE Mean (bias corrected)	13	MLE Sd (bias corrected)	4.162
		Approximate Chi Square Value (0.05)	58.7
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	17.29	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.856	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.296	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	2.398	Mean of logged Data	2.552
Maximum of Logged Data	2.773	SD of logged Data	0.186

Assuming Lognormal Distribution

95% H-UCL	16.94	90% Chebyshev (MVUE) UCL	16.61
95% Chebyshev (MVUE) UCL	18.25	97.5% Chebyshev (MVUE) UCL	20.53
99% Chebyshev (MVUE) UCL	24.99		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	15.01	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					16.67	95% Chebyshev(Mean, Sd) UCL					18.34
84	97.5% Chebyshev(Mean, Sd) UCL					20.65	99% Chebyshev(Mean, Sd) UCL					25.19
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					15.88						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

	A–E	F	G–K	L
1	UCL Statistics for Uncensored Full Data Sets			
2				
3	User Selected Options			
4	Date/Time of Computation	ProUCL 5.2 10/31/2024 2:27:32 PM		
5	From File	ProUCL Input.xls		
6	Full Precision	OFF		
7	Confidence Coefficient	95%		
8	Number of Bootstrap Operations	2000		
9				
10				
11	GC6-WTP-0.5-3			
12				
13	General Statistics			
14	Total Number of Observations	4	Number of Distinct Observations	2
15			Number of Missing Observations	0
16	Minimum	6	Mean	6.5
17	Maximum	7	Median	6.5
18	SD	0.577	Std. Error of Mean	0.289
19	Coefficient of Variation	0.0888	Skewness	0
20				
21	Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,			
22	refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,			
23	but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).			
24	The Chebyshev UCL often results in gross overestimates of the mean.			
25	Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.			
26				
27	Normal GOF Test			
28	Shapiro Wilk Test Statistic	0.731	Shapiro Wilk GOF Test	
29	1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level	
30	Lilliefors Test Statistic	0.307	Lilliefors GOF Test	
31	1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level	
32	Data appear Normal at 1% Significance Level			
33	Note GOF tests may be unreliable for small sample sizes			
34				
35	Assuming Normal Distribution			
36	95% Normal UCL		95% UCLs (Adjusted for Skewness)	
37	95% Student's-t UCL	7.179	95% Adjusted-CLT UCL (Chen-1995)	6.975
38			95% Modified-t UCL (Johnson-1978)	7.179
39				
40	Gamma GOF Test			
41	A-D Test Statistic	0.719	Anderson-Darling Gamma GOF Test	
42	5% A-D Critical Value	0.657	Data Not Gamma Distributed at 5% Significance Level	
43	K-S Test Statistic	0.341	Kolmogorov-Smirnov Gamma GOF Test	
44	5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level	
45	Detected data follow Appr. Gamma Distribution at 5% Significance Level			
46	Note GOF tests may be unreliable for small sample sizes			
47				
48	Gamma Statistics			
49	k hat (MLE)	168.7	k star (bias corrected MLE)	42.33
50	Theta hat (MLE)	0.0385	Theta star (bias corrected MLE)	0.154
51	nu hat (MLE)	1349	nu star (bias corrected)	338.7
52	MLE Mean (bias corrected)	6.5	MLE Sd (bias corrected)	0.999
53			Approximate Chi Square Value (0.05)	297
54	Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A
55				
56	Assuming Gamma Distribution			
57	95% Approximate Gamma UCL	7.411	95% Adjusted Gamma UCL	N/A
58				
59	Lognormal GOF Test			
60	Shapiro Wilk Test Statistic	0.731	Shapiro Wilk Lognormal GOF Test	
61	10% Shapiro Wilk Critical Value	0.792	Data Not Lognormal at 10% Significance Level	
62	Lilliefors Test Statistic	0.307	Lilliefors Lognormal GOF Test	
63	10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level	
64	Data appear Approximate Lognormal at 10% Significance Level			
65	Note GOF tests may be unreliable for small sample sizes			
66				
67	Lognormal Statistics			
68	Minimum of Logged Data	1.792	Mean of logged Data	1.869
69	Maximum of Logged Data	1.946	SD of logged Data	0.089
70				
71	Assuming Lognormal Distribution			
72	95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	7.367
73	95% Chebyshev (MVUE) UCL	7.76	97.5% Chebyshev (MVUE) UCL	8.305
74	99% Chebyshev (MVUE) UCL	9.376		
75				
76	Nonparametric Distribution Free UCL Statistics			
77	Data appear to follow a Discernible Distribution			
78				
79	Nonparametric Distribution Free UCLs			
80	95% CLT UCL	6.975	95% BCA Bootstrap UCL	N/A
81	95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
82	95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					7.366	95% Chebyshev(Mean, Sd) UCL					7.758
84	97.5% Chebyshev(Mean, Sd) UCL					8.303	99% Chebyshev(Mean, Sd) UCL					9.372
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					7.179						
88	**Recommended UCL exceeds the maximum observation**											
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												

	A-E	F	G-K	L
1	UCL Statistics for Uncensored Full Data Sets			
2				
3	User Selected Options			
4	Date/Time of Computation	ProUCL 5.2 10/31/2024 2:30:01 PM		
5	From File	ProUCL Input.xls		
6	Full Precision	OFF		
7	Confidence Coefficient	95%		
8	Number of Bootstrap Operations	2000		
9				
10				
11	GC7-WRA-0.5-1			
12				
13	General Statistics			
14	Total Number of Observations	4	Number of Distinct Observations	3
15			Number of Missing Observations	0
16	Minimum	13	Mean	15
17	Maximum	17	Median	15
18	SD	1.633	Std. Error of Mean	0.816
19	Coefficient of Variation	0.109	Skewness	0
20				
21	Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,			
22	refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,			
23	but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).			
24	The Chebyshev UCL often results in gross overestimates of the mean.			
25	Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.			
26				
27	Normal GOF Test			
28	Shapiro Wilk Test Statistic	0.944	Shapiro Wilk GOF Test	
29	1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level	
30	Lilliefors Test Statistic	0.25	Lilliefors GOF Test	
31	1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level	
32	Data appear Normal at 1% Significance Level			
33	Note GOF tests may be unreliable for small sample sizes			
34				
35	Assuming Normal Distribution			
36	95% Normal UCL		95% UCLs (Adjusted for Skewness)	
37	95% Student's-t UCL	16.92	95% Adjusted-CLT UCL (Chen-1995)	16.34
38			95% Modified-t UCL (Johnson-1978)	16.92
39				
40	Gamma GOF Test			
41	A-D Test Statistic	0.332	Anderson-Darling Gamma GOF Test	
42	5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level	
43	K-S Test Statistic	0.263	Kolmogorov-Smirnov Gamma GOF Test	
44	5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level	
45	Detected data appear Gamma Distributed at 5% Significance Level			
46	Note GOF tests may be unreliable for small sample sizes			
47				
48	Gamma Statistics			
49	k hat (MLE)	111.7	k star (bias corrected MLE)	28.08
50	Theta hat (MLE)	0.134	Theta star (bias corrected MLE)	0.534
51	nu hat (MLE)	893.3	nu star (bias corrected)	224.7
52	MLE Mean (bias corrected)	15	MLE Sd (bias corrected)	2.831
53			Approximate Chi Square Value (0.05)	191
54	Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A
55				
56	Assuming Gamma Distribution			
57	95% Approximate Gamma UCL	17.65	95% Adjusted Gamma UCL	N/A
58				
59	Lognormal GOF Test			
60	Shapiro Wilk Test Statistic	0.942	Shapiro Wilk Lognormal GOF Test	
61	10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level	
62	Lilliefors Test Statistic	0.266	Lilliefors Lognormal GOF Test	
63	10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level	
64	Data appear Lognormal at 10% Significance Level			
65	Note GOF tests may be unreliable for small sample sizes			
66				
67	Lognormal Statistics			
68	Minimum of Logged Data	2.565	Mean of logged Data	2.704
69	Maximum of Logged Data	2.833	SD of logged Data	0.11
70				
71	Assuming Lognormal Distribution			
72	95% H-UCL	17.31	90% Chebyshev (MVUE) UCL	17.47
73	95% Chebyshev (MVUE) UCL	18.58	97.5% Chebyshev (MVUE) UCL	20.13
74	99% Chebyshev (MVUE) UCL	23.17		
75				
76	Nonparametric Distribution Free UCL Statistics			
77	Data appear to follow a Discernible Distribution			
78				
79	Nonparametric Distribution Free UCLs			
80	95% CLT UCL	16.34	95% BCA Bootstrap UCL	N/A
81	95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
82	95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83				90% Chebyshev(Mean, Sd) UCL		17.45				95% Chebyshev(Mean, Sd) UCL		18.56
84				97.5% Chebyshev(Mean, Sd) UCL		20.1				99% Chebyshev(Mean, Sd) UCL		23.12
85												
86						**Suggested UCL to Use**						
87				95% Student's-t UCL		16.92						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

	A–E	F	G–K	L
1	UCL Statistics for Uncensored Full Data Sets			
2				
3	User Selected Options			
4	Date/Time of Computation	ProUCL 5.2 10/31/2024 2:31:34 PM		
5	From File	ProUCL Input.xls		
6	Full Precision	OFF		
7	Confidence Coefficient	95%		
8	Number of Bootstrap Operations	2000		
9				
10				
11	GC7-WRA-0.5-2			
12				
13	General Statistics			
14	Total Number of Observations	4	Number of Distinct Observations	4
15			Number of Missing Observations	0
16	Minimum	10	Mean	12.5
17	Maximum	15	Median	12.5
18	SD	2.38	Std. Error of Mean	1.19
19	Coefficient of Variation	0.19	Skewness	0
20				
21	Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,			
22	refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,			
23	but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).			
24	The Chebyshev UCL often results in gross overestimates of the mean.			
25	Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.			
26				
27	Normal GOF Test			
28	Shapiro Wilk Test Statistic	0.913	Shapiro Wilk GOF Test	
29	1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level	
30	Lilliefors Test Statistic	0.236	Lilliefors GOF Test	
31	1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level	
32	Data appear Normal at 1% Significance Level			
33	Note GOF tests may be unreliable for small sample sizes			
34				
35	Assuming Normal Distribution			
36	95% Normal UCL		95% UCLs (Adjusted for Skewness)	
37	95% Student's-t UCL	15.3	95% Adjusted-CLT UCL (Chen-1995)	14.46
38			95% Modified-t UCL (Johnson-1978)	15.3
39				
40	Gamma GOF Test			
41	A-D Test Statistic	0.355	Anderson-Darling Gamma GOF Test	
42	5% A-D Critical Value	0.656	Detected data appear Gamma Distributed at 5% Significance Level	
43	K-S Test Statistic	0.274	Kolmogorov-Smirnov Gamma GOF Test	
44	5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level	
45	Detected data appear Gamma Distributed at 5% Significance Level			
46	Note GOF tests may be unreliable for small sample sizes			
47				
48	Gamma Statistics			
49	k hat (MLE)	36.31	k star (bias corrected MLE)	9.245
50	Theta hat (MLE)	0.344	Theta star (bias corrected MLE)	1.352
51	nu hat (MLE)	290.5	nu star (bias corrected)	73.96
52	MLE Mean (bias corrected)	12.5	MLE Sd (bias corrected)	4.111
53			Approximate Chi Square Value (0.05)	55.16
54	Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A
55				
56	Assuming Gamma Distribution			
57	95% Approximate Gamma UCL	16.76	95% Adjusted Gamma UCL	N/A
58				
59	Lognormal GOF Test			
60	Shapiro Wilk Test Statistic	0.913	Shapiro Wilk Lognormal GOF Test	
61	10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level	
62	Lilliefors Test Statistic	0.245	Lilliefors Lognormal GOF Test	
63	10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level	
64	Data appear Lognormal at 10% Significance Level			
65	Note GOF tests may be unreliable for small sample sizes			
66				
67	Lognormal Statistics			
68	Minimum of Logged Data	2.303	Mean of logged Data	2.512
69	Maximum of Logged Data	2.708	SD of logged Data	0.193
70				
71	Assuming Lognormal Distribution			
72	95% H-UCL	16.48	90% Chebyshev (MVUE) UCL	16.1
73	95% Chebyshev (MVUE) UCL	17.74	97.5% Chebyshev (MVUE) UCL	20
74	99% Chebyshev (MVUE) UCL	24.45		
75				
76	Nonparametric Distribution Free UCL Statistics			
77	Data appear to follow a Discernible Distribution			
78				
79	Nonparametric Distribution Free UCLs			
80	95% CLT UCL	14.46	95% BCA Bootstrap UCL	N/A
81	95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
82	95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83			90% Chebyshev(Mean, Sd) UCL			16.07			95% Chebyshev(Mean, Sd) UCL			17.69
84			97.5% Chebyshev(Mean, Sd) UCL			19.93			99% Chebyshev(Mean, Sd) UCL			24.34
85												
86						**Suggested UCL to Use**						
87			95% Student's-t UCL			15.3						
88						**Recommended UCL exceeds the maximum observation**						
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Uncensored Full Data Sets											
2												
3	User Selected Options											
4	Date/Time of Computation			ProUCL 5.2 10/31/2024 2:33:14 PM								
5	From File			ProUCL Input.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	GC7-WRA-0.5-3											
12												
13	General Statistics											
14	Total Number of Observations					4	Number of Distinct Observations					4
15							Number of Missing Observations					0
16	Minimum					19	Mean					26.75
17	Maximum					31	Median					28.5
18	SD					5.439	Std. Error of Mean					2.72
19	Coefficient of Variation					0.203	Skewness					-1.468
20												
21	Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,											
22	refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,											
23	but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).											
24	The Chebyshev UCL often results in gross overestimates of the mean.											
25	Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.											
26												
27	Normal GOF Test											
28	Shapiro Wilk Test Statistic					0.863	Shapiro Wilk GOF Test					
29	1% Shapiro Wilk Critical Value					0.687	Data appear Normal at 1% Significance Level					
30	Lilliefors Test Statistic					0.268	Lilliefors GOF Test					
31	1% Lilliefors Critical Value					0.413	Data appear Normal at 1% Significance Level					
32	Data appear Normal at 1% Significance Level											
33	Note GOF tests may be unreliable for small sample sizes											
34												
35	Assuming Normal Distribution											
36	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
37	95% Student's-t UCL					33.15	95% Adjusted-CLT UCL (Chen-1995)					29.09
38							95% Modified-t UCL (Johnson-1978)					32.82
39												
40	Gamma GOF Test											
41	A-D Test Statistic					0.474	Anderson-Darling Gamma GOF Test					
42	5% A-D Critical Value					0.657	Detected data appear Gamma Distributed at 5% Significance Level					
43	K-S Test Statistic					0.295	Kolmogorov-Smirnov Gamma GOF Test					
44	5% K-S Critical Value					0.394	Detected data appear Gamma Distributed at 5% Significance Level					
45	Detected data appear Gamma Distributed at 5% Significance Level											
46	Note GOF tests may be unreliable for small sample sizes											
47												
48	Gamma Statistics											
49	k hat (MLE)					28.46	k star (bias corrected MLE)					7.282
50	Theta hat (MLE)					0.94	Theta star (bias corrected MLE)					3.673
51	nu hat (MLE)					227.7	nu star (bias corrected)					58.26
52	MLE Mean (bias corrected)					26.75	MLE Sd (bias corrected)					9.913
53							Approximate Chi Square Value (0.05)					41.71
54	Adjusted Level of Significance					N/A	Adjusted Chi Square Value					N/A
55												
56	Assuming Gamma Distribution											
57	95% Approximate Gamma UCL					37.36	95% Adjusted Gamma UCL					N/A
58												
59	Lognormal GOF Test											
60	Shapiro Wilk Test Statistic					0.832	Shapiro Wilk Lognormal GOF Test					
61	10% Shapiro Wilk Critical Value					0.792	Data appear Lognormal at 10% Significance Level					
62	Lilliefors Test Statistic					0.298	Lilliefors Lognormal GOF Test					
63	10% Lilliefors Critical Value					0.346	Data appear Lognormal at 10% Significance Level					
64	Data appear Lognormal at 10% Significance Level											
65	Note GOF tests may be unreliable for small sample sizes											
66												
67	Lognormal Statistics											
68	Minimum of Logged Data					2.944	Mean of logged Data					3.269
69	Maximum of Logged Data					3.434	SD of logged Data					0.224
70												
71	Assuming Lognormal Distribution											
72	95% H-UCL					37.4	90% Chebyshev (MVUE) UCL					35.75
73	95% Chebyshev (MVUE) UCL					39.81	97.5% Chebyshev (MVUE) UCL					45.45
74	99% Chebyshev (MVUE) UCL					56.53						
75												
76	Nonparametric Distribution Free UCL Statistics											
77	Data appear to follow a Discernible Distribution											
78												
79	Nonparametric Distribution Free UCLs											
80	95% CLT UCL					31.22	95% BCA Bootstrap UCL					N/A
81	95% Standard Bootstrap UCL					N/A	95% Bootstrap-t UCL					N/A
82	95% Hall's Bootstrap UCL					N/A	95% Percentile Bootstrap UCL					N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83			90% Chebyshev(Mean, Sd) UCL			34.91			95% Chebyshev(Mean, Sd) UCL			38.6
84			97.5% Chebyshev(Mean, Sd) UCL			43.73			99% Chebyshev(Mean, Sd) UCL			53.81
85												
86	**Suggested UCL to Use**											
87			95% Student's-t UCL			33.15						
88	**Recommended UCL exceeds the maximum observation**											
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												
94	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
95	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
96												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 2:35:27 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

GC7-WRB-0.5-1

General Statistics

Total Number of Observations	4	Number of Distinct Observations	3
		Number of Missing Observations	0
Minimum	10	Mean	11.75
Maximum	16	Median	10.5
SD	2.872	Std. Error of Mean	1.436
Coefficient of Variation	0.244	Skewness	1.846

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.744	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.353	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	15.13	95% Adjusted-CLT UCL (Chen-1995)	15.53
		95% Modified-t UCL (Johnson-1978)	15.35

Gamma GOF Test

A-D Test Statistic	0.643	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.353	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	25.24	k star (bias corrected MLE)	6.477
Theta hat (MLE)	0.466	Theta star (bias corrected MLE)	1.814
nu hat (MLE)	201.9	nu star (bias corrected)	51.82
MLE Mean (bias corrected)	11.75	MLE Sd (bias corrected)	4.617
		Approximate Chi Square Value (0.05)	36.28
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	16.78	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.766	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.332	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Approximate Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	2.303	Mean of logged Data	2.444
Maximum of Logged Data	2.773	SD of logged Data	0.224

Assuming Lognormal Distribution

95% H-UCL	16.37	90% Chebyshev (MVUE) UCL	15.66
95% Chebyshev (MVUE) UCL	17.43	97.5% Chebyshev (MVUE) UCL	19.9
99% Chebyshev (MVUE) UCL	24.75		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	14.11	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83					90% Chebyshev(Mean, Sd) UCL	16.06					95% Chebyshev(Mean, Sd) UCL	18.01
84					97.5% Chebyshev(Mean, Sd) UCL	20.72					99% Chebyshev(Mean, Sd) UCL	26.04
85												
86	**Suggested UCL to Use**											
87					95% Student's-t UCL	15.13						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Uncensored Full Data Sets											
2												
3	User Selected Options											
4	Date/Time of Computation			ProUCL 5.2 10/31/2024 2:37:11 PM								
5	From File			ProUCL Input.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	GC7-WRB-0.5-2											
12												
13	General Statistics											
14	Total Number of Observations					4	Number of Distinct Observations					3
15							Number of Missing Observations					0
16	Minimum					10	Mean					11
17	Maximum					12	Median					11
18	SD					0.816	Std. Error of Mean					0.408
19	Coefficient of Variation					0.0742	Skewness					0
20												
21	Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,											
22	refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,											
23	but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).											
24	The Chebyshev UCL often results in gross overestimates of the mean.											
25	Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.											
26												
27	Normal GOF Test											
28	Shapiro Wilk Test Statistic					0.944	Shapiro Wilk GOF Test					
29	1% Shapiro Wilk Critical Value					0.687	Data appear Normal at 1% Significance Level					
30	Lilliefors Test Statistic					0.25	Lilliefors GOF Test					
31	1% Lilliefors Critical Value					0.413	Data appear Normal at 1% Significance Level					
32	Data appear Normal at 1% Significance Level											
33	Note GOF tests may be unreliable for small sample sizes											
34												
35	Assuming Normal Distribution											
36	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
37	95% Student's-t UCL					11.96	95% Adjusted-CLT UCL (Chen-1995)					11.67
38							95% Modified-t UCL (Johnson-1978)					11.96
39												
40	Gamma GOF Test											
41	A-D Test Statistic					0.331	Anderson-Darling Gamma GOF Test					
42	5% A-D Critical Value					0.657	Detected data appear Gamma Distributed at 5% Significance Level					
43	K-S Test Statistic					0.259	Kolmogorov-Smirnov Gamma GOF Test					
44	5% K-S Critical Value					0.394	Detected data appear Gamma Distributed at 5% Significance Level					
45	Detected data appear Gamma Distributed at 5% Significance Level											
46	Note GOF tests may be unreliable for small sample sizes											
47												
48	Gamma Statistics											
49	k hat (MLE)					241.2	k star (bias corrected MLE)					60.46
50	Theta hat (MLE)					0.0456	Theta star (bias corrected MLE)					0.182
51	nu hat (MLE)					1929	nu star (bias corrected)					483.7
52	MLE Mean (bias corrected)					11	MLE Sd (bias corrected)					1.415
53							Approximate Chi Square Value (0.05)					433.7
54	Adjusted Level of Significance					N/A	Adjusted Chi Square Value					N/A
55												
56	Assuming Gamma Distribution											
57	95% Approximate Gamma UCL					12.27	95% Adjusted Gamma UCL					N/A
58												
59	Lognormal GOF Test											
60	Shapiro Wilk Test Statistic					0.944	Shapiro Wilk Lognormal GOF Test					
61	10% Shapiro Wilk Critical Value					0.792	Data appear Lognormal at 10% Significance Level					
62	Lilliefors Test Statistic					0.261	Lilliefors Lognormal GOF Test					
63	10% Lilliefors Critical Value					0.346	Data appear Lognormal at 10% Significance Level					
64	Data appear Lognormal at 10% Significance Level											
65	Note GOF tests may be unreliable for small sample sizes											
66												
67	Lognormal Statistics											
68	Minimum of Logged Data					2.303	Mean of logged Data					2.396
69	Maximum of Logged Data					2.485	SD of logged Data					0.0745
70												
71	Assuming Lognormal Distribution											
72	95% H-UCL					N/A	90% Chebyshev (MVUE) UCL					12.23
73	95% Chebyshev (MVUE) UCL					12.78	97.5% Chebyshev (MVUE) UCL					13.56
74	99% Chebyshev (MVUE) UCL					15.07						
75												
76	Nonparametric Distribution Free UCL Statistics											
77	Data appear to follow a Discernible Distribution											
78												
79	Nonparametric Distribution Free UCLs											
80	95% CLT UCL					11.67	95% BCA Bootstrap UCL					N/A
81	95% Standard Bootstrap UCL					N/A	95% Bootstrap-t UCL					N/A
82	95% Hall's Bootstrap UCL					N/A	95% Percentile Bootstrap UCL					N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83					90% Chebyshev(Mean, Sd) UCL	12.22					95% Chebyshev(Mean, Sd) UCL	12.78
84					97.5% Chebyshev(Mean, Sd) UCL	13.55					99% Chebyshev(Mean, Sd) UCL	15.06
85												
86						**Suggested UCL to Use**						
87					95% Student's-t UCL	11.96						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Uncensored Full Data Sets											
2												
3	User Selected Options											
4	Date/Time of Computation			ProUCL 5.2 10/31/2024 5:04:24 PM								
5	From File			ProUCL Input.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	GF-DR-0.5-1											
12												
13	General Statistics											
14	Total Number of Observations					4	Number of Distinct Observations					4
15							Number of Missing Observations					0
16	Minimum					39	Mean					57.5
17	Maximum					83	Median					54
18	SD					18.57	Std. Error of Mean					9.287
19	Coefficient of Variation					0.323	Skewness					1.038
20												
21	**Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,**											
22	**refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,**											
23	**but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).**											
24	**The Chebyshev UCL often results in gross overestimates of the mean.**											
25	**Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.**											
26												
27	Normal GOF Test											
28	Shapiro Wilk Test Statistic					0.943	**Shapiro Wilk GOF Test**					
29	1% Shapiro Wilk Critical Value					0.687	Data appear Normal at 1% Significance Level					
30	Lilliefors Test Statistic					0.261	**Lilliefors GOF Test**					
31	1% Lilliefors Critical Value					0.413	Data appear Normal at 1% Significance Level					
32	**Data appear Normal at 1% Significance Level**											
33	**Note GOF tests may be unreliable for small sample sizes**											
34												
35	Assuming Normal Distribution											
36	**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**					
37	95% Student's-t UCL					79.36	95% Adjusted-CLT UCL (Chen-1995)					77.92
38							95% Modified-t UCL (Johnson-1978)					80.16
39												
40	Gamma GOF Test											
41	A-D Test Statistic					0.249	**Anderson-Darling Gamma GOF Test**					
42	5% A-D Critical Value					0.657	Detected data appear Gamma Distributed at 5% Significance Level					
43	K-S Test Statistic					0.227	**Kolmogorov-Smirnov Gamma GOF Test**					
44	5% K-S Critical Value					0.395	Detected data appear Gamma Distributed at 5% Significance Level					
45	**Detected data appear Gamma Distributed at 5% Significance Level**											
46	**Note GOF tests may be unreliable for small sample sizes**											
47												
48	Gamma Statistics											
49	k hat (MLE)					13.51	k star (bias corrected MLE)					3.544
50	Theta hat (MLE)					4.256	Theta star (bias corrected MLE)					16.22
51	nu hat (MLE)					108.1	nu star (bias corrected)					28.35
52	MLE Mean (bias corrected)					57.5	MLE Sd (bias corrected)					30.54
53							Approximate Chi Square Value (0.05)					17.2
54	Adjusted Level of Significance					N/A	Adjusted Chi Square Value					N/A
55												
56	Assuming Gamma Distribution											
57	95% Approximate Gamma UCL					94.77	95% Adjusted Gamma UCL					N/A
58												
59	Lognormal GOF Test											
60	Shapiro Wilk Test Statistic					0.982	**Shapiro Wilk Lognormal GOF Test**					
61	10% Shapiro Wilk Critical Value					0.792	Data appear Lognormal at 10% Significance Level					
62	Lilliefors Test Statistic					0.213	**Lilliefors Lognormal GOF Test**					
63	10% Lilliefors Critical Value					0.346	Data appear Lognormal at 10% Significance Level					
64	**Data appear Lognormal at 10% Significance Level**											
65	**Note GOF tests may be unreliable for small sample sizes**											
66												
67	Lognormal Statistics											
68	Minimum of Logged Data					3.664	Mean of logged Data					4.014
69	Maximum of Logged Data					4.419	SD of logged Data					0.313
70												
71	Assuming Lognormal Distribution											
72	95% H-UCL					96.95	90% Chebyshev (MVUE) UCL					84.24
73	95% Chebyshev (MVUE) UCL					96.37	97.5% Chebyshev (MVUE) UCL					113.2
74	99% Chebyshev (MVUE) UCL					146.3						
75												
76	**Nonparametric Distribution Free UCL Statistics**											
77	**Data appear to follow a Discernible Distribution**											
78												
79	Nonparametric Distribution Free UCLs											
80	95% CLT UCL					72.78	95% BCA Bootstrap UCL					N/A
81	95% Standard Bootstrap UCL					N/A	95% Bootstrap-t UCL					N/A
82	95% Hall's Bootstrap UCL					N/A	95% Percentile Bootstrap UCL					N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					85.36	95% Chebyshev(Mean, Sd) UCL					97.98
84	97.5% Chebyshev(Mean, Sd) UCL					115.5	99% Chebyshev(Mean, Sd) UCL					149.9
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					79.36						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 4:26:21 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

GF-WRA-0.5-1

General Statistics

Total Number of Observations	10	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	170	Mean	348.3
Maximum	491	Median	338
SD	92.04	Std. Error of Mean	29.11
Coefficient of Variation	0.264	Skewness	-0.313

Normal GOF Test

Shapiro Wilk Test Statistic	0.965	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.188	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	401.7	95% Adjusted-CLT UCL (Chen-1995)	393.1
		95% Modified-t UCL (Johnson-1978)	401.2

Gamma GOF Test

A-D Test Statistic	0.342	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.725	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.222	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.266	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	13.82	k star (bias corrected MLE)	9.741
Theta hat (MLE)	25.2	Theta star (bias corrected MLE)	35.75
nu hat (MLE)	276.4	nu star (bias corrected)	194.8
MLE Mean (bias corrected)	348.3	MLE Sd (bias corrected)	111.6
		Approximate Chi Square Value (0.05)	163.5
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	158.6

Assuming Gamma Distribution

95% Approximate Gamma UCL	414.9	95% Adjusted Gamma UCL	428

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.904	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.244	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.241	Data Not Lognormal at 10% Significance Level

Data appear Approximate Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.136	Mean of logged Data	5.816
Maximum of Logged Data	6.196	SD of logged Data	0.299

Assuming Lognormal Distribution

95% H-UCL	427.6	90% Chebyshev (MVUE) UCL	449.4
95% Chebyshev (MVUE) UCL	494.6	97.5% Chebyshev (MVUE) UCL	557.4
99% Chebyshev (MVUE) UCL	680.7		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	396.2	95% BCA Bootstrap UCL	393.2
95% Standard Bootstrap UCL	393.7	95% Bootstrap-t UCL	396.7
95% Hall's Bootstrap UCL	397.6	95% Percentile Bootstrap UCL	393.4
90% Chebyshev(Mean, Sd) UCL	435.6	95% Chebyshev(Mean, Sd) UCL	475.2
97.5% Chebyshev(Mean, Sd) UCL	530.1	99% Chebyshev(Mean, Sd) UCL	637.9

Suggested UCL to Use

95% Student's-t UCL	401.7

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
83												
84	Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be											
85	reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.											
86												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Uncensored Full Data Sets											
2												
3	User Selected Options											
4	Date/Time of Computation			ProUCL 5.2 10/31/2024 4:31:28 PM								
5	From File			ProUCL Input.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	GF-WRA-0.5-2											
12												
13	General Statistics											
14	Total Number of Observations					5					Number of Distinct Observations	4
15											Number of Missing Observations	0
16	Minimum					188					Mean	241.4
17	Maximum					279					Median	237
18	SD					35.03					Std. Error of Mean	15.67
19	Coefficient of Variation					0.145					Skewness	-0.818
20												
21	Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,											
22	refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,											
23	but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).											
24	The Chebyshev UCL often results in gross overestimates of the mean.											
25	Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.											
26												
27	Normal GOF Test											
28	Shapiro Wilk Test Statistic					0.927	Shapiro Wilk GOF Test					
29	1% Shapiro Wilk Critical Value					0.686	Data appear Normal at 1% Significance Level					
30	Lilliefors Test Statistic					0.25	Lilliefors GOF Test					
31	1% Lilliefors Critical Value					0.396	Data appear Normal at 1% Significance Level					
32	Data appear Normal at 1% Significance Level											
33	Note GOF tests may be unreliable for small sample sizes											
34												
35	Assuming Normal Distribution											
36	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
37	95% Student's-t UCL					274.8					95% Adjusted-CLT UCL (Chen-1995)	261
38											95% Modified-t UCL (Johnson-1978)	273.8
39												
40	Gamma GOF Test											
41	A-D Test Statistic					0.355	Anderson-Darling Gamma GOF Test					
42	5% A-D Critical Value					0.678	Detected data appear Gamma Distributed at 5% Significance Level					
43	K-S Test Statistic					0.263	Kolmogorov-Smirnov Gamma GOF Test					
44	5% K-S Critical Value					0.357	Detected data appear Gamma Distributed at 5% Significance Level					
45	Detected data appear Gamma Distributed at 5% Significance Level											
46	Note GOF tests may be unreliable for small sample sizes											
47												
48	Gamma Statistics											
49	k hat (MLE)					55.71					k star (bias corrected MLE)	22.42
50	Theta hat (MLE)					4.333					Theta star (bias corrected MLE)	10.77
51	nu hat (MLE)					557.1					nu star (bias corrected)	224.2
52	MLE Mean (bias corrected)					241.4					MLE Sd (bias corrected)	50.98
53											Approximate Chi Square Value (0.05)	190.5
54	Adjusted Level of Significance					0.0086					Adjusted Chi Square Value	176.9
55												
56	Assuming Gamma Distribution											
57	95% Approximate Gamma UCL					284					95% Adjusted Gamma UCL	306
58												
59	Lognormal GOF Test											
60	Shapiro Wilk Test Statistic					0.904	Shapiro Wilk Lognormal GOF Test					
61	10% Shapiro Wilk Critical Value					0.806	Data appear Lognormal at 10% Significance Level					
62	Lilliefors Test Statistic					0.275	Lilliefors Lognormal GOF Test					
63	10% Lilliefors Critical Value					0.319	Data appear Lognormal at 10% Significance Level					
64	Data appear Lognormal at 10% Significance Level											
65	Note GOF tests may be unreliable for small sample sizes											
66												
67	Lognormal Statistics											
68	Minimum of Logged Data					5.236					Mean of logged Data	5.477
69	Maximum of Logged Data					5.631					SD of logged Data	0.153
70												
71	Assuming Lognormal Distribution											
72	95% H-UCL					284.4					90% Chebyshev (MVUE) UCL	290.9
73	95% Chebyshev (MVUE) UCL					313.2					97.5% Chebyshev (MVUE) UCL	344.3
74	99% Chebyshev (MVUE) UCL					405.3						
75												
76	Nonparametric Distribution Free UCL Statistics											
77	Data appear to follow a Discernible Distribution											
78												
79	Nonparametric Distribution Free UCLs											
80	95% CLT UCL					267.2					95% BCA Bootstrap UCL	N/A
81	95% Standard Bootstrap UCL					N/A					95% Bootstrap-t UCL	N/A
82	95% Hall's Bootstrap UCL					N/A					95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					288.4	95% Chebyshev(Mean, Sd) UCL					309.7
84	97.5% Chebyshev(Mean, Sd) UCL					339.2	99% Chebyshev(Mean, Sd) UCL					397.3
85												
86	Suggested UCL to Use											
87	95% Student's-t UCL					274.8						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												
93	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
94	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
95												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Uncensored Full Data Sets											
2												
3	User Selected Options											
4	Date/Time of Computation			ProUCL 5.2 10/31/2024 4:33:25 PM								
5	From File			ProUCL Input.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	GF-WRA-0.5-3											
12												
13	General Statistics											
14	Total Number of Observations					10	Number of Distinct Observations					9
15							Number of Missing Observations					0
16	Minimum					224	Mean					292.4
17	Maximum					416	Median					272
18	SD					60.1	Std. Error of Mean					19
19	Coefficient of Variation					0.206	Skewness					1.28
20												
21	Normal GOF Test											
22	Shapiro Wilk Test Statistic					0.858	Shapiro Wilk GOF Test					
23	1% Shapiro Wilk Critical Value					0.781	Data appear Normal at 1% Significance Level					
24	Lilliefors Test Statistic					0.256	Lilliefors GOF Test					
25	1% Lilliefors Critical Value					0.304	Data appear Normal at 1% Significance Level					
26	Data appear Normal at 1% Significance Level											
27												
28	Assuming Normal Distribution											
29	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
30	95% Student's-t UCL					327.2	95% Adjusted-CLT UCL (Chen-1995)					331.9
31							95% Modified-t UCL (Johnson-1978)					328.5
32												
33	Gamma GOF Test											
34	A-D Test Statistic					0.573	Anderson-Darling Gamma GOF Test					
35	5% A-D Critical Value					0.725	Detected data appear Gamma Distributed at 5% Significance Level					
36	K-S Test Statistic					0.228	Kolmogorov-Smirnov Gamma GOF Test					
37	5% K-S Critical Value					0.266	Detected data appear Gamma Distributed at 5% Significance Level					
38	Detected data appear Gamma Distributed at 5% Significance Level											
39												
40	Gamma Statistics											
41	k hat (MLE)					29.22	k star (bias corrected MLE)					20.52
42	Theta hat (MLE)					10.01	Theta star (bias corrected MLE)					14.25
43	nu hat (MLE)					584.3	nu star (bias corrected)					410.4
44	MLE Mean (bias corrected)					292.4	MLE Sd (bias corrected)					64.55
45							Approximate Chi Square Value (0.05)					364.4
46	Adjusted Level of Significance					0.0267	Adjusted Chi Square Value					356.9
47												
48	Assuming Gamma Distribution											
49	95% Approximate Gamma UCL					329.3	95% Adjusted Gamma UCL					336.2
50												
51	Lognormal GOF Test											
52	Shapiro Wilk Test Statistic					0.904	Shapiro Wilk Lognormal GOF Test					
53	10% Shapiro Wilk Critical Value					0.869	Data appear Lognormal at 10% Significance Level					
54	Lilliefors Test Statistic					0.218	Lilliefors Lognormal GOF Test					
55	10% Lilliefors Critical Value					0.241	Data appear Lognormal at 10% Significance Level					
56	Data appear Lognormal at 10% Significance Level											
57												
58	Lognormal Statistics											
59	Minimum of Logged Data					5.412	Mean of logged Data					5.661
60	Maximum of Logged Data					6.031	SD of logged Data					0.191
61												
62	Assuming Lognormal Distribution											
63	95% H-UCL					329.8	90% Chebyshev (MVUE) UCL					345.2
64	95% Chebyshev (MVUE) UCL					369.3	97.5% Chebyshev (MVUE) UCL					402.7
65	99% Chebyshev (MVUE) UCL					468.2						
66												
67	Nonparametric Distribution Free UCL Statistics											
68	Data appear to follow a Discernible Distribution											
69												
70	Nonparametric Distribution Free UCLs											
71	95% CLT UCL					323.7	95% BCA Bootstrap UCL					331.6
72	95% Standard Bootstrap UCL					322.5	95% Bootstrap-t UCL					363.7
73	95% Hall's Bootstrap UCL					544.2	95% Percentile Bootstrap UCL					324.4
74	90% Chebyshev(Mean, Sd) UCL					349.4	95% Chebyshev(Mean, Sd) UCL					375.2
75	97.5% Chebyshev(Mean, Sd) UCL					411.1	99% Chebyshev(Mean, Sd) UCL					481.5
76												
77	Suggested UCL to Use											
78	95% Student's-t UCL					327.2						
79												
80	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
81	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
82	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											

	A	B	C	D	E	F	G	H	I	J	K	L
83												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 4:34:59 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

GF-WRB-0.5-1

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	103	Mean	119
Maximum	144	Median	114.5
SD	17.64	Std. Error of Mean	8.822
Coefficient of Variation	0.148	Skewness	1.357

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.901	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.295	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	139.8	95% Adjusted-CLT UCL (Chen-1995)	139.9
		95% Modified-t UCL (Johnson-1978)	140.8

Gamma GOF Test

A-D Test Statistic	0.346	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.656	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.287	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	64.11	k star (bias corrected MLE)	16.19
Theta hat (MLE)	1.856	Theta star (bias corrected MLE)	7.349
nu hat (MLE)	512.9	nu star (bias corrected)	129.5
MLE Mean (bias corrected)	119	MLE Sd (bias corrected)	29.57
		Approximate Chi Square Value (0.05)	104.3
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	147.9	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.926	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.276	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	4.635	Mean of logged Data	4.771
Maximum of Logged Data	4.97	SD of logged Data	0.143

Assuming Lognormal Distribution

95% H-UCL	144.3	90% Chebyshev (MVUE) UCL	144.4
95% Chebyshev (MVUE) UCL	155.9	97.5% Chebyshev (MVUE) UCL	171.8
99% Chebyshev (MVUE) UCL	203.2		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	133.5	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83				90% Chebyshev(Mean, Sd) UCL		145.5				95% Chebyshev(Mean, Sd) UCL		157.5
84				97.5% Chebyshev(Mean, Sd) UCL		174.1				99% Chebyshev(Mean, Sd) UCL		206.8
85												
86						Suggested UCL to Use						
87				95% Student's-t UCL		139.8						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Uncensored Full Data Sets											
2												
3	User Selected Options											
4	Date/Time of Computation			ProUCL 5.2 10/31/2024 4:36:18 PM								
5	From File			ProUCL Input.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	GF-WRB-0.5-2											
12												
13	General Statistics											
14	Total Number of Observations					4	Number of Distinct Observations					4
15							Number of Missing Observations					0
16	Minimum					68	Mean					78
17	Maximum					87	Median					78.5
18	SD					8.287	Std. Error of Mean					4.143
19	Coefficient of Variation					0.106	Skewness					-0.274
20												
21	Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,											
22	refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,											
23	but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).											
24	The Chebyshev UCL often results in gross overestimates of the mean.											
25	Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.											
26												
27	Normal GOF Test											
28	Shapiro Wilk Test Statistic					0.983	Shapiro Wilk GOF Test					
29	1% Shapiro Wilk Critical Value					0.687	Data appear Normal at 1% Significance Level					
30	Lilliefors Test Statistic					0.185	Lilliefors GOF Test					
31	1% Lilliefors Critical Value					0.413	Data appear Normal at 1% Significance Level					
32	Data appear Normal at 1% Significance Level											
33	Note GOF tests may be unreliable for small sample sizes											
34												
35	Assuming Normal Distribution											
36	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
37	95% Student's-t UCL					87.75	95% Adjusted-CLT UCL (Chen-1995)					84.21
38							95% Modified-t UCL (Johnson-1978)					87.66
39												
40	Gamma GOF Test											
41	A-D Test Statistic					0.224	Anderson-Darling Gamma GOF Test					
42	5% A-D Critical Value					0.657	Detected data appear Gamma Distributed at 5% Significance Level					
43	K-S Test Statistic					0.217	Kolmogorov-Smirnov Gamma GOF Test					
44	5% K-S Critical Value					0.394	Detected data appear Gamma Distributed at 5% Significance Level					
45	Detected data appear Gamma Distributed at 5% Significance Level											
46	Note GOF tests may be unreliable for small sample sizes											
47												
48	Gamma Statistics											
49	k hat (MLE)					116.4	k star (bias corrected MLE)					29.26
50	Theta hat (MLE)					0.67	Theta star (bias corrected MLE)					2.666
51	nu hat (MLE)					930.9	nu star (bias corrected)					234.1
52	MLE Mean (bias corrected)					78	MLE Sd (bias corrected)					14.42
53							Approximate Chi Square Value (0.05)					199.6
54	Adjusted Level of Significance					N/A	Adjusted Chi Square Value					N/A
55												
56	Assuming Gamma Distribution											
57	95% Approximate Gamma UCL					91.45	95% Adjusted Gamma UCL					N/A
58												
59	Lognormal GOF Test											
60	Shapiro Wilk Test Statistic					0.978	Shapiro Wilk Lognormal GOF Test					
61	10% Shapiro Wilk Critical Value					0.792	Data appear Lognormal at 10% Significance Level					
62	Lilliefors Test Statistic					0.193	Lilliefors Lognormal GOF Test					
63	10% Lilliefors Critical Value					0.346	Data appear Lognormal at 10% Significance Level					
64	Data appear Lognormal at 10% Significance Level											
65	Note GOF tests may be unreliable for small sample sizes											
66												
67	Lognormal Statistics											
68	Minimum of Logged Data					4.22	Mean of logged Data					4.352
69	Maximum of Logged Data					4.466	SD of logged Data					0.108
70												
71	Assuming Lognormal Distribution											
72	95% H-UCL					89.76	90% Chebyshev (MVUE) UCL					90.58
73	95% Chebyshev (MVUE) UCL					96.27	97.5% Chebyshev (MVUE) UCL					104.2
74	99% Chebyshev (MVUE) UCL					119.7						
75												
76	Nonparametric Distribution Free UCL Statistics											
77	Data appear to follow a Discernible Distribution											
78												
79	Nonparametric Distribution Free UCLs											
80	95% CLT UCL					84.82	95% BCA Bootstrap UCL					N/A
81	95% Standard Bootstrap UCL					N/A	95% Bootstrap-t UCL					N/A
82	95% Hall's Bootstrap UCL					N/A	95% Percentile Bootstrap UCL					N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					90.43	95% Chebyshev(Mean, Sd) UCL					96.06
84	97.5% Chebyshev(Mean, Sd) UCL					103.9	99% Chebyshev(Mean, Sd) UCL					119.2
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					87.75						
88	**Recommended UCL exceeds the maximum observation**											
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												
94	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
95	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
96												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 4:37:39 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

GF-WRB-0.5-3

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	60	Mean	71
Maximum	87	Median	68.5
SD	12.57	Std. Error of Mean	6.285
Coefficient of Variation	0.177	Skewness	0.705

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.907	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.263	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	85.79	95% Adjusted-CLT UCL (Chen-1995)	83.7
		95% Modified-t UCL (Johnson-1978)	86.16

Gamma GOF Test

A-D Test Statistic	0.349	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.656	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.296	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	43.79	k star (bias corrected MLE)	11.11
Theta hat (MLE)	1.621	Theta star (bias corrected MLE)	6.388
nu hat (MLE)	350.3	nu star (bias corrected)	88.92
MLE Mean (bias corrected)	71	MLE Sd (bias corrected)	21.3
		Approximate Chi Square Value (0.05)	68.18
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	92.6	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.912	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.263	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	4.094	Mean of logged Data	4.251
Maximum of Logged Data	4.466	SD of logged Data	0.174

Assuming Lognormal Distribution

95% H-UCL	90.58	90% Chebyshev (MVUE) UCL	89.44
95% Chebyshev (MVUE) UCL	97.8	97.5% Chebyshev (MVUE) UCL	109.4
99% Chebyshev (MVUE) UCL	132.2		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	81.34	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					89.85	95% Chebyshev(Mean, Sd) UCL					98.4
84	97.5% Chebyshev(Mean, Sd) UCL					110.2	99% Chebyshev(Mean, Sd) UCL					133.5
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					85.79						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

UCL Statistics for Uncensored Full Data Sets			
User Selected Options			
Date/Time of Computation	ProUCL 5.2 10/31/2024 4:46:09 PM		
From File	ProUCL Input.xls		
Full Precision	OFF		
Confidence Coefficient	95%		
Number of Bootstrap Operations	2000		
GF-WRC-0.5-1			
General Statistics			
Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	78	Mean	85
Maximum	102	Median	80
SD	11.4	Std. Error of Mean	5.701
Coefficient of Variation	0.134	Skewness	1.93
Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,			
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,			
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).			
The Chebyshev UCL often results in gross overestimates of the mean.			
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.			
Normal GOF Test			
Shapiro Wilk Test Statistic	0.726	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.387	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	98.42	95% Adjusted-CLT UCL (Chen-1995)	100.3
		95% Modified-t UCL (Johnson-1978)	99.33
Gamma GOF Test			
A-D Test Statistic	0.71	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.656	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.402	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.394	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	80.08	k star (bias corrected MLE)	20.19
Theta hat (MLE)	1.061	Theta star (bias corrected MLE)	4.211
nu hat (MLE)	640.7	nu star (bias corrected)	161.5
MLE Mean (bias corrected)	85	MLE Sd (bias corrected)	18.92
		Approximate Chi Square Value (0.05)	133.1
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A
Assuming Gamma Distribution			
95% Approximate Gamma UCL	103.1	95% Adjusted Gamma UCL	N/A
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.738	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.792	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.38	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.346	Data Not Lognormal at 10% Significance Level	
Data Not Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	4.357	Mean of logged Data	4.436
Maximum of Logged Data	4.625	SD of logged Data	0.127
Assuming Lognormal Distribution			
95% H-UCL	100.6	90% Chebyshev (MVUE) UCL	101.1
95% Chebyshev (MVUE) UCL	108.4	97.5% Chebyshev (MVUE) UCL	118.6
99% Chebyshev (MVUE) UCL	138.5		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	94.38	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
90% Chebyshev(Mean, Sd) UCL	102.1	95% Chebyshev(Mean, Sd) UCL	109.8
97.5% Chebyshev(Mean, Sd) UCL	120.6	99% Chebyshev(Mean, Sd) UCL	141.7

	A	B	C	D	E	F	G	H	I	J	K	L
83												
84	**Suggested UCL to Use**											
85				95% Student's-t UCL		98.42						
86												
87	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
88	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
89	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
90												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 4:47:42 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

GF-WRC-0.5-2

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	75	Mean	87
Maximum	100	Median	86.5
SD	10.3	Std. Error of Mean	5.148
Coefficient of Variation	0.118	Skewness	0.282

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.983	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.211	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	99.11	95% Adjusted-CLT UCL (Chen-1995)	96.24
		95% Modified-t UCL (Johnson-1978)	99.24

Gamma GOF Test

A-D Test Statistic	0.229	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.656	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.192	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	95.47	k star (bias corrected MLE)	24.03
Theta hat (MLE)	0.911	Theta star (bias corrected MLE)	3.62
nu hat (MLE)	763.7	nu star (bias corrected)	192.3
MLE Mean (bias corrected)	87	MLE Sd (bias corrected)	17.75
		Approximate Chi Square Value (0.05)	161.2
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	103.8	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.987	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.194	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	4.317	Mean of logged Data	4.461
Maximum of Logged Data	4.605	SD of logged Data	0.118

Assuming Lognormal Distribution

95% H-UCL	101.7	90% Chebyshev (MVUE) UCL	102.4
95% Chebyshev (MVUE) UCL	109.4	97.5% Chebyshev (MVUE) UCL	119.1
99% Chebyshev (MVUE) UCL	138.1		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	95.47	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					102.4	95% Chebyshev(Mean, Sd) UCL					109.4
84	97.5% Chebyshev(Mean, Sd) UCL					119.1	99% Chebyshev(Mean, Sd) UCL					138.2
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					99.11						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 4:51:58 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

GF-WRC-0.5-3

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	41	Mean	46
Maximum	50	Median	46.5
SD	3.742	Std. Error of Mean	1.871
Coefficient of Variation	0.0813	Skewness	-0.764

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.961	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.25	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	50.4	95% Adjusted-CLT UCL (Chen-1995)	48.31
		95% Modified-t UCL (Johnson-1978)	50.28

Gamma GOF Test

A-D Test Statistic	0.287	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.259	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	196.6	k star (bias corrected MLE)	49.32
Theta hat (MLE)	0.234	Theta star (bias corrected MLE)	0.933
nu hat (MLE)	1573	nu star (bias corrected)	394.5
MLE Mean (bias corrected)	46	MLE Sd (bias corrected)	6.55
		Approximate Chi Square Value (0.05)	349.5
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	51.93	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.95	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.262	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	3.714	Mean of logged Data	3.826
Maximum of Logged Data	3.912	SD of logged Data	0.0829

Assuming Lognormal Distribution

95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	51.72
95% Chebyshev (MVUE) UCL	54.31	97.5% Chebyshev (MVUE) UCL	57.91
99% Chebyshev (MVUE) UCL	64.97		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	49.08	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					51.61	95% Chebyshev(Mean, Sd) UCL					54.15
84	97.5% Chebyshev(Mean, Sd) UCL					57.68	99% Chebyshev(Mean, Sd) UCL					64.61
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					50.4						
88	**Recommended UCL exceeds the maximum observation**											
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												
94	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
95	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
96												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 4:53:20 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

GF-WRC-0.5-4

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	42	Mean	55.25
Maximum	67	Median	56
SD	10.37	Std. Error of Mean	5.186
Coefficient of Variation	0.188	Skewness	-0.409

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.987	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.202	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	67.45	95% Adjusted-CLT UCL (Chen-1995)	62.65
		95% Modified-t UCL (Johnson-1978)	67.28

Gamma GOF Test

A-D Test Statistic	0.241	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.656	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.218	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	36.08	k star (bias corrected MLE)	9.187
Theta hat (MLE)	1.531	Theta star (bias corrected MLE)	6.014
nu hat (MLE)	288.7	nu star (bias corrected)	73.5
MLE Mean (bias corrected)	55.25	MLE Sd (bias corrected)	18.23
		Approximate Chi Square Value (0.05)	54.76
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	74.16	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.968	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.232	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	3.738	Mean of logged Data	3.998
Maximum of Logged Data	4.205	SD of logged Data	0.195

Assuming Lognormal Distribution

95% H-UCL	73.21	90% Chebyshev (MVUE) UCL	71.42
95% Chebyshev (MVUE) UCL	78.73	97.5% Chebyshev (MVUE) UCL	88.88
99% Chebyshev (MVUE) UCL	108.8		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	63.78	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					70.81	95% Chebyshev(Mean, Sd) UCL					77.86
84	97.5% Chebyshev(Mean, Sd) UCL					87.64	99% Chebyshev(Mean, Sd) UCL					106.9
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					67.45						
88	**Recommended UCL exceeds the maximum observation**											
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												
94	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
95	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
96												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 4:54:30 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

GF-WRC-0.5-4-DS

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	31	Mean	48.25
Maximum	62	Median	50
SD	13.23	Std. Error of Mean	6.613
Coefficient of Variation	0.274	Skewness	-0.679

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.977	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.182	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	63.81	95% Adjusted-CLT UCL (Chen-1995)	56.73
		95% Modified-t UCL (Johnson-1978)	63.44

Gamma GOF Test

A-D Test Statistic	0.271	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.208	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.395	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	15.93	k star (bias corrected MLE)	4.15
Theta hat (MLE)	3.028	Theta star (bias corrected MLE)	11.63
nu hat (MLE)	127.5	nu star (bias corrected)	33.2
MLE Mean (bias corrected)	48.25	MLE Sd (bias corrected)	23.69
		Approximate Chi Square Value (0.05)	21.03
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	76.19	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.94	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.229	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	3.434	Mean of logged Data	3.845
Maximum of Logged Data	4.127	SD of logged Data	0.3

Assuming Lognormal Distribution

95% H-UCL	79.05	90% Chebyshev (MVUE) UCL	69.92
95% Chebyshev (MVUE) UCL	79.7	97.5% Chebyshev (MVUE) UCL	93.27
99% Chebyshev (MVUE) UCL	119.9		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	59.13	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83			90% Chebyshev(Mean, Sd) UCL			68.09			95% Chebyshev(Mean, Sd) UCL			77.07
84			97.5% Chebyshev(Mean, Sd) UCL			89.55			99% Chebyshev(Mean, Sd) UCL			114
85												
86						**Suggested UCL to Use**						
87				95% Student's-t UCL		63.81						
88						**Recommended UCL exceeds the maximum observation**						
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												
94	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
95	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
96												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 4:55:57 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

GF-WRD-0.5-1

General Statistics

Total Number of Observations	4	Number of Distinct Observations	3
		Number of Missing Observations	0
Minimum	59	Mean	62
Maximum	69	Median	60
SD	4.69	Std. Error of Mean	2.345
Coefficient of Variation	0.0757	Skewness	1.938

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.716	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.415	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data Not Normal at 1% Significance Level

Data appear Approximate Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	67.52	95% Adjusted-CLT UCL (Chen-1995)	68.29
		95% Modified-t UCL (Johnson-1978)	67.9

Gamma GOF Test

A-D Test Statistic	0.762	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.657	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.437	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	243.9	k star (bias corrected MLE)	61.15
Theta hat (MLE)	0.254	Theta star (bias corrected MLE)	1.014
nu hat (MLE)	1951	nu star (bias corrected)	489.2
MLE Mean (bias corrected)	62	MLE Sd (bias corrected)	7.928
		Approximate Chi Square Value (0.05)	438.9
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	69.1	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.722	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.413	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.078	Mean of logged Data	4.125
Maximum of Logged Data	4.234	SD of logged Data	0.0731

Assuming Lognormal Distribution

95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	68.79
95% Chebyshev (MVUE) UCL	71.87	97.5% Chebyshev (MVUE) UCL	76.14
99% Chebyshev (MVUE) UCL	84.54		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	65.86	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
90% Chebyshev(Mean, Sd) UCL	69.04	95% Chebyshev(Mean, Sd) UCL	72.22
97.5% Chebyshev(Mean, Sd) UCL	76.65	99% Chebyshev(Mean, Sd) UCL	85.33

	A	B	C	D	E	F	G	H	I	J	K	L
83												
84	**Suggested UCL to Use**											
85	95% Student's-t UCL					67.52						
86												
87	When a data set follows an approximate distribution passing only one of the GOF tests,											
88	it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL											
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 4:58:14 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

GF-WRD-0.5-3

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	55	Mean	61.75
Maximum	74	Median	59
SD	8.732	Std. Error of Mean	4.366
Coefficient of Variation	0.141	Skewness	1.342

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.865	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.245	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	72.02	95% Adjusted-CLT UCL (Chen-1995)	72.06
		95% Modified-t UCL (Johnson-1978)	72.51

Gamma GOF Test

A-D Test Statistic	0.406	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.656	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.278	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	70.36	k star (bias corrected MLE)	17.76
Theta hat (MLE)	0.878	Theta star (bias corrected MLE)	3.477
nu hat (MLE)	562.9	nu star (bias corrected)	142.1
MLE Mean (bias corrected)	61.75	MLE Sd (bias corrected)	14.65
		Approximate Chi Square Value (0.05)	115.5
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	75.94	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.88	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.247	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	4.007	Mean of logged Data	4.116
Maximum of Logged Data	4.304	SD of logged Data	0.136

Assuming Lognormal Distribution

95% H-UCL	74.14	90% Chebyshev (MVUE) UCL	74.32
95% Chebyshev (MVUE) UCL	80.02	97.5% Chebyshev (MVUE) UCL	87.93
99% Chebyshev (MVUE) UCL	103.5		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	68.93	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83				90% Chebyshev(Mean, Sd) UCL		74.85				95% Chebyshev(Mean, Sd) UCL		80.78
84				97.5% Chebyshev(Mean, Sd) UCL		89.02				99% Chebyshev(Mean, Sd) UCL		105.2
85												
86						**Suggested UCL to Use**						
87				95% Student's-t UCL		72.02						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Uncensored Full Data Sets											
2												
3	User Selected Options											
4	Date/Time of Computation			ProUCL 5.2 10/31/2024 4:59:32 PM								
5	From File			ProUCL Input.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	GF-WRD-0.5-4											
12												
13	General Statistics											
14	Total Number of Observations					4	Number of Distinct Observations					4
15							Number of Missing Observations					0
16	Minimum					42	Mean					50.75
17	Maximum					57	Median					52
18	SD					6.752	Std. Error of Mean					3.376
19	Coefficient of Variation					0.133	Skewness					-0.768
20												
21	Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,											
22	refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,											
23	but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).											
24	The Chebyshev UCL often results in gross overestimates of the mean.											
25	Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.											
26												
27	Normal GOF Test											
28	Shapiro Wilk Test Statistic					0.936	Shapiro Wilk GOF Test					
29	1% Shapiro Wilk Critical Value					0.687	Data appear Normal at 1% Significance Level					
30	Lilliefors Test Statistic					0.235	Lilliefors GOF Test					
31	1% Lilliefors Critical Value					0.413	Data appear Normal at 1% Significance Level					
32	Data appear Normal at 1% Significance Level											
33	Note GOF tests may be unreliable for small sample sizes											
34												
35	Assuming Normal Distribution											
36	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
37	95% Student's-t UCL					58.69	95% Adjusted-CLT UCL (Chen-1995)					54.92
38							95% Modified-t UCL (Johnson-1978)					58.48
39												
40	Gamma GOF Test											
41	A-D Test Statistic					0.311	Anderson-Darling Gamma GOF Test					
42	5% A-D Critical Value					0.656	Detected data appear Gamma Distributed at 5% Significance Level					
43	K-S Test Statistic					0.268	Kolmogorov-Smirnov Gamma GOF Test					
44	5% K-S Critical Value					0.394	Detected data appear Gamma Distributed at 5% Significance Level					
45	Detected data appear Gamma Distributed at 5% Significance Level											
46	Note GOF tests may be unreliable for small sample sizes											
47												
48	Gamma Statistics											
49	k hat (MLE)					72.18	k star (bias corrected MLE)					18.21
50	Theta hat (MLE)					0.703	Theta star (bias corrected MLE)					2.787
51	nu hat (MLE)					577.4	nu star (bias corrected)					145.7
52	MLE Mean (bias corrected)					50.75	MLE Sd (bias corrected)					11.89
53							Approximate Chi Square Value (0.05)					118.8
54	Adjusted Level of Significance					N/A	Adjusted Chi Square Value					N/A
55												
56	Assuming Gamma Distribution											
57	95% Approximate Gamma UCL					62.24	95% Adjusted Gamma UCL					N/A
58												
59	Lognormal GOF Test											
60	Shapiro Wilk Test Statistic					0.925	Shapiro Wilk Lognormal GOF Test					
61	10% Shapiro Wilk Critical Value					0.792	Data appear Lognormal at 10% Significance Level					
62	Lilliefors Test Statistic					0.237	Lilliefors Lognormal GOF Test					
63	10% Lilliefors Critical Value					0.346	Data appear Lognormal at 10% Significance Level					
64	Data appear Lognormal at 10% Significance Level											
65	Note GOF tests may be unreliable for small sample sizes											
66												
67	Lognormal Statistics											
68	Minimum of Logged Data					3.738	Mean of logged Data					3.92
69	Maximum of Logged Data					4.043	SD of logged Data					0.138
70												
71	Assuming Lognormal Distribution											
72	95% H-UCL					61.1	90% Chebyshev (MVUE) UCL					61.22
73	95% Chebyshev (MVUE) UCL					65.96	97.5% Chebyshev (MVUE) UCL					72.54
74	99% Chebyshev (MVUE) UCL					85.46						
75												
76	Nonparametric Distribution Free UCL Statistics											
77	Data appear to follow a Discernible Distribution											
78												
79	Nonparametric Distribution Free UCLs											
80	95% CLT UCL					56.3	95% BCA Bootstrap UCL					N/A
81	95% Standard Bootstrap UCL					N/A	95% Bootstrap-t UCL					N/A
82	95% Hall's Bootstrap UCL					N/A	95% Percentile Bootstrap UCL					N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					60.88	95% Chebyshev(Mean, Sd) UCL					65.46
84	97.5% Chebyshev(Mean, Sd) UCL					71.83	99% Chebyshev(Mean, Sd) UCL					84.34
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					58.69						
88	**Recommended UCL exceeds the maximum observation**											
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												
94	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
95	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
96												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 5:01:02 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

GF-WRD-0.5-5

General Statistics

Total Number of Observations	4	Number of Distinct Observations	3
		Number of Missing Observations	0
Minimum	52	Mean	56
Maximum	62	Median	55
SD	4.243	Std. Error of Mean	2.121
Coefficient of Variation	0.0758	Skewness	1.309

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.875	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.343	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	60.99	95% Adjusted-CLT UCL (Chen-1995)	60.97
		95% Modified-t UCL (Johnson-1978)	61.22

Gamma GOF Test

A-D Test Statistic	0.442	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.351	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	239.3	k star (bias corrected MLE)	60
Theta hat (MLE)	0.234	Theta star (bias corrected MLE)	0.933
nu hat (MLE)	1915	nu star (bias corrected)	480
MLE Mean (bias corrected)	56	MLE Sd (bias corrected)	7.23
		Approximate Chi Square Value (0.05)	430.2
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	62.48	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.886	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.335	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	3.951	Mean of logged Data	4.023
Maximum of Logged Data	4.127	SD of logged Data	0.0741

Assuming Lognormal Distribution

95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	62.22
95% Chebyshev (MVUE) UCL	65.04	97.5% Chebyshev (MVUE) UCL	68.95
99% Chebyshev (MVUE) UCL	76.64		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	59.49	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83				90% Chebyshev(Mean, Sd) UCL		62.36				95% Chebyshev(Mean, Sd) UCL		65.25
84				97.5% Chebyshev(Mean, Sd) UCL		69.25				99% Chebyshev(Mean, Sd) UCL		77.11
85												
86						**Suggested UCL to Use**						
87				95% Student's-t UCL		60.99						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 5:02:22 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

GF-WRD-0.5-6

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	51	Mean	59
Maximum	80	Median	52.5
SD	14.02	Std. Error of Mean	7.012
Coefficient of Variation	0.238	Skewness	1.98

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.685	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.416	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	75.5	95% Adjusted-CLT UCL (Chen-1995)	77.95
		95% Modified-t UCL (Johnson-1978)	76.66

Gamma GOF Test

A-D Test Statistic	0.809	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.657	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.435	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	26.92	k star (bias corrected MLE)	6.896
Theta hat (MLE)	2.192	Theta star (bias corrected MLE)	8.556
nu hat (MLE)	215.3	nu star (bias corrected)	55.17
MLE Mean (bias corrected)	59	MLE Sd (bias corrected)	22.47
		Approximate Chi Square Value (0.05)	39.1
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	83.25	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.698	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.409	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.932	Mean of logged Data	4.059
Maximum of Logged Data	4.382	SD of logged Data	0.216

Assuming Lognormal Distribution

95% H-UCL	81.05	90% Chebyshev (MVUE) UCL	77.95
95% Chebyshev (MVUE) UCL	86.57	97.5% Chebyshev (MVUE) UCL	98.54
99% Chebyshev (MVUE) UCL	122		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	70.53	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
90% Chebyshev(Mean, Sd) UCL	80.04	95% Chebyshev(Mean, Sd) UCL	89.56
97.5% Chebyshev(Mean, Sd) UCL	102.8	99% Chebyshev(Mean, Sd) UCL	128.8

	A	B	C	D	E	F	G	H	I	J	K	L
83	**Suggested UCL to Use**											
84	Recommendation cannot be provided											
85												
86	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
87	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
88	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
89												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 4:57:11 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

GF-WRD-0.5-2

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	30	Mean	38.5
Maximum	44	Median	40
SD	6.191	Std. Error of Mean	3.096
Coefficient of Variation	0.161	Skewness	-1.138

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.921	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.218	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	45.79	95% Adjusted-CLT UCL (Chen-1995)	41.71
		95% Modified-t UCL (Johnson-1978)	45.49

Gamma GOF Test

A-D Test Statistic	0.354	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.656	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.245	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	47.8	k star (bias corrected MLE)	12.12
Theta hat (MLE)	0.806	Theta star (bias corrected MLE)	3.178
nu hat (MLE)	382.4	nu star (bias corrected)	96.93
MLE Mean (bias corrected)	38.5	MLE Sd (bias corrected)	11.06
		Approximate Chi Square Value (0.05)	75.22
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	49.61	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.897	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.244	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	3.401	Mean of logged Data	3.64
Maximum of Logged Data	3.784	SD of logged Data	0.171

Assuming Lognormal Distribution

95% H-UCL	48.89	90% Chebyshev (MVUE) UCL	48.35
95% Chebyshev (MVUE) UCL	52.81	97.5% Chebyshev (MVUE) UCL	58.99
99% Chebyshev (MVUE) UCL	71.14		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	43.59	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					47.79	95% Chebyshev(Mean, Sd) UCL					51.99
84	97.5% Chebyshev(Mean, Sd) UCL					57.83	99% Chebyshev(Mean, Sd) UCL					69.3
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					45.79						
88	**Recommended UCL exceeds the maximum observation**											
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												
94	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
95	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
96												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 4:24:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

LMM-TLA-0.5-1

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	3054	Mean	3873
Maximum	4841	Median	3926
SD	495.1	Std. Error of Mean	156.6
Coefficient of Variation	0.128	Skewness	0.273

Normal GOF Test

Shapiro Wilk Test Statistic	0.957	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.185	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	4160	95% Adjusted-CLT UCL (Chen-1995)	4145
		95% Modified-t UCL (Johnson-1978)	4162

Gamma GOF Test

A-D Test Statistic	0.297	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.724	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.165	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.266	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	68.02	k star (bias corrected MLE)	47.68
Theta hat (MLE)	56.94	Theta star (bias corrected MLE)	81.23
nu hat (MLE)	1360	nu star (bias corrected)	953.6
MLE Mean (bias corrected)	3873	MLE Sd (bias corrected)	560.9
		Approximate Chi Square Value (0.05)	882.9
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	871

Assuming Gamma Distribution

95% Approximate Gamma UCL	4183	95% Adjusted Gamma UCL	4240

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.962	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.172	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	8.024	Mean of logged Data	8.254
Maximum of Logged Data	8.485	SD of logged Data	0.128

Assuming Lognormal Distribution

95% H-UCL	4190	90% Chebyshev (MVUE) UCL	4345
95% Chebyshev (MVUE) UCL	4559	97.5% Chebyshev (MVUE) UCL	4855
99% Chebyshev (MVUE) UCL	5438		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	4131	95% BCA Bootstrap UCL	4125
95% Standard Bootstrap UCL	4118	95% Bootstrap-t UCL	4179
95% Hall's Bootstrap UCL	4207	95% Percentile Bootstrap UCL	4113
90% Chebyshev(Mean, Sd) UCL	4343	95% Chebyshev(Mean, Sd) UCL	4556
97.5% Chebyshev(Mean, Sd) UCL	4851	99% Chebyshev(Mean, Sd) UCL	5431

Suggested UCL to Use

95% Student's-t UCL	4160

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
83												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Uncensored Full Data Sets											
2												
3	User Selected Options											
4	Date/Time of Computation			ProUCL 5.2 10/28/2024 4:27:30 PM								
5	From File			WorkSheet.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	LMM-TLA-0.5-2											
12												
13	General Statistics											
14	Total Number of Observations					10	Number of Distinct Observations					10
15							Number of Missing Observations					0
16	Minimum					4263	Mean					8805
17	Maximum					17380	Median					8345
18	SD					3586	Std. Error of Mean					1134
19	Coefficient of Variation					0.407	Skewness					1.493
20												
21	Normal GOF Test											
22	Shapiro Wilk Test Statistic					0.878	Shapiro Wilk GOF Test					
23	1% Shapiro Wilk Critical Value					0.781	Data appear Normal at 1% Significance Level					
24	Lilliefors Test Statistic					0.225	Lilliefors GOF Test					
25	1% Lilliefors Critical Value					0.304	Data appear Normal at 1% Significance Level					
26	Data appear Normal at 1% Significance Level											
27												
28	Assuming Normal Distribution											
29	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
30	95% Student's-t UCL					10884	95% Adjusted-CLT UCL (Chen-1995)					11242
31							95% Modified-t UCL (Johnson-1978)					10973
32												
33	Gamma GOF Test											
34	A-D Test Statistic					0.28	Anderson-Darling Gamma GOF Test					
35	5% A-D Critical Value					0.727	Detected data appear Gamma Distributed at 5% Significance Level					
36	K-S Test Statistic					0.174	Kolmogorov-Smirnov Gamma GOF Test					
37	5% K-S Critical Value					0.267	Detected data appear Gamma Distributed at 5% Significance Level					
38	Detected data appear Gamma Distributed at 5% Significance Level											
39												
40	Gamma Statistics											
41	k hat (MLE)					7.612	k star (bias corrected MLE)					5.395
42	Theta hat (MLE)					1157	Theta star (bias corrected MLE)					1632
43	nu hat (MLE)					152.2	nu star (bias corrected)					107.9
44	MLE Mean (bias corrected)					8805	MLE Sd (bias corrected)					3791
45							Approximate Chi Square Value (0.05)					84.93
46	Adjusted Level of Significance					0.0267	Adjusted Chi Square Value					81.39
47												
48	Assuming Gamma Distribution											
49	95% Approximate Gamma UCL					11187	95% Adjusted Gamma UCL					11673
50												
51	Lognormal GOF Test											
52	Shapiro Wilk Test Statistic					0.97	Shapiro Wilk Lognormal GOF Test					
53	10% Shapiro Wilk Critical Value					0.869	Data appear Lognormal at 10% Significance Level					
54	Lilliefors Test Statistic					0.168	Lilliefors Lognormal GOF Test					
55	10% Lilliefors Critical Value					0.241	Data appear Lognormal at 10% Significance Level					
56	Data appear Lognormal at 10% Significance Level											
57												
58	Lognormal Statistics											
59	Minimum of Logged Data					8.358	Mean of logged Data					9.016
60	Maximum of Logged Data					9.763	SD of logged Data					0.382
61												
62	Assuming Lognormal Distribution											
63	95% H-UCL					11528	90% Chebyshev (MVUE) UCL					12012
64	95% Chebyshev (MVUE) UCL					13472	97.5% Chebyshev (MVUE) UCL					15498
65	99% Chebyshev (MVUE) UCL					19478						
66												
67	Nonparametric Distribution Free UCL Statistics											
68	Data appear to follow a Discernible Distribution											
69												
70	Nonparametric Distribution Free UCLs											
71	95% CLT UCL					10670	95% BCA Bootstrap UCL					11206
72	95% Standard Bootstrap UCL					10585	95% Bootstrap-t UCL					11658
73	95% Hall's Bootstrap UCL					20697	95% Percentile Bootstrap UCL					10662
74	90% Chebyshev(Mean, Sd) UCL					12207	95% Chebyshev(Mean, Sd) UCL					13748
75	97.5% Chebyshev(Mean, Sd) UCL					15887	99% Chebyshev(Mean, Sd) UCL					20088
76												
77	Suggested UCL to Use											
78	95% Student's-t UCL					10884						
79												
80	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
81	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
82	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											

	A	B	C	D	E	F	G	H	I	J	K	L
83												

UCL Statistics for Uncensored Full Data Sets		

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 4:31:16 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

LMM-TLA-0.5-3

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	10	Mean	11.5
Maximum	13	Median	11.5
SD	1.291	Std. Error of Mean	0.645
Coefficient of Variation	0.112	Skewness	0

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.994	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.151	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	13.02	95% Adjusted-CLT UCL (Chen-1995)	12.56
		95% Modified-t UCL (Johnson-1978)	13.02

Gamma GOF Test

A-D Test Statistic	0.202	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.182	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	105.1	k star (bias corrected MLE)	26.45
Theta hat (MLE)	0.109	Theta star (bias corrected MLE)	0.435
nu hat (MLE)	841.1	nu star (bias corrected)	211.6
MLE Mean (bias corrected)	11.5	MLE Sd (bias corrected)	2.236
		Approximate Chi Square Value (0.05)	179
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	13.6	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.993	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.162	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	2.303	Mean of logged Data	2.438
Maximum of Logged Data	2.565	SD of logged Data	0.113

Assuming Lognormal Distribution

95% H-UCL	13.34	90% Chebyshev (MVUE) UCL	13.45
95% Chebyshev (MVUE) UCL	14.33	97.5% Chebyshev (MVUE) UCL	15.55
99% Chebyshev (MVUE) UCL	17.96		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	12.56	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83					90% Chebyshev(Mean, Sd) UCL	13.44					95% Chebyshev(Mean, Sd) UCL	14.31
84					97.5% Chebyshev(Mean, Sd) UCL	15.53					99% Chebyshev(Mean, Sd) UCL	17.92
85												
86	**Suggested UCL to Use**											
87					95% Student's-t UCL	13.02						
88	**Recommended UCL exceeds the maximum observation**											
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 4:34:10 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

LMM-TLA-0.5-4

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	461	Mean	683.1
Maximum	1213	Median	562.5
SD	268.8	Std. Error of Mean	84.99
Coefficient of Variation	0.393	Skewness	1.311

Normal GOF Test

Shapiro Wilk Test Statistic	0.793	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.263	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	838.9	95% Adjusted-CLT UCL (Chen-1995)	860.5
		95% Modified-t UCL (Johnson-1978)	844.8

Gamma GOF Test

A-D Test Statistic	0.775	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.726	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.255	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.267	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	8.567	k star (bias corrected MLE)	6.063
Theta hat (MLE)	79.74	Theta star (bias corrected MLE)	112.7
nu hat (MLE)	171.3	nu star (bias corrected)	121.3
MLE Mean (bias corrected)	683.1	MLE Sd (bias corrected)	277.4
		Approximate Chi Square Value (0.05)	96.84
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	93.05

Assuming Gamma Distribution

95% Approximate Gamma UCL	855.4	95% Adjusted Gamma UCL	890.3

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.847	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.869	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.236	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level

Data appear Approximate Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	6.133	Mean of logged Data	6.467
Maximum of Logged Data	7.101	SD of logged Data	0.349

Assuming Lognormal Distribution

95% H-UCL	866.7	90% Chebyshev (MVUE) UCL	907.3
95% Chebyshev (MVUE) UCL	1010	97.5% Chebyshev (MVUE) UCL	1153
99% Chebyshev (MVUE) UCL	1434		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	822.9	95% BCA Bootstrap UCL	869
95% Standard Bootstrap UCL	815.6	95% Bootstrap-t UCL	1015
95% Hall's Bootstrap UCL	1046	95% Percentile Bootstrap UCL	822.6
90% Chebyshev(Mean, Sd) UCL	938.1	95% Chebyshev(Mean, Sd) UCL	1054
97.5% Chebyshev(Mean, Sd) UCL	1214	99% Chebyshev(Mean, Sd) UCL	1529

Suggested UCL to Use

95% Student's-t UCL	838.9

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
83												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 4:08:14 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

LMM-WRA-0.5-1

General Statistics			
Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	95	Mean	238.8
Maximum	423	Median	244
SD	87.9	Std. Error of Mean	27.8
Coefficient of Variation	0.368	Skewness	0.591
Normal GOF Test			
Shapiro Wilk Test Statistic	0.947	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.208	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	289.8	95% Adjusted-CLT UCL (Chen-1995)	290.1
		95% Modified-t UCL (Johnson-1978)	290.6
Gamma GOF Test			
A-D Test Statistic	0.304	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.727	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.173	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.267	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	7.698	k star (bias corrected MLE)	5.455
Theta hat (MLE)	31.02	Theta star (bias corrected MLE)	43.77
nu hat (MLE)	154	nu star (bias corrected)	109.1
MLE Mean (bias corrected)	238.8	MLE Sd (bias corrected)	102.2
		Approximate Chi Square Value (0.05)	86
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	82.44
Assuming Gamma Distribution			
95% Approximate Gamma UCL	303	95% Adjusted Gamma UCL	316.1
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.937	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.177	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	4.554	Mean of logged Data	5.409
Maximum of Logged Data	6.047	SD of logged Data	0.4
Assuming Lognormal Distribution			
95% H-UCL	319.7	90% Chebyshev (MVUE) UCL	332.1
95% Chebyshev (MVUE) UCL	373.8	97.5% Chebyshev (MVUE) UCL	431.7
99% Chebyshev (MVUE) UCL	545.5		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	284.5	95% BCA Bootstrap UCL	284.4
95% Standard Bootstrap UCL	281.4	95% Bootstrap-t UCL	293
95% Hall's Bootstrap UCL	305.7	95% Percentile Bootstrap UCL	281.9
90% Chebyshev(Mean, Sd) UCL	322.2	95% Chebyshev(Mean, Sd) UCL	360
97.5% Chebyshev(Mean, Sd) UCL	412.4	99% Chebyshev(Mean, Sd) UCL	515.4
Suggested UCL to Use			
95% Student's-t UCL	289.8		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
83												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Uncensored Full Data Sets											
2												
3	User Selected Options											
4	Date/Time of Computation			ProUCL 5.2 10/28/2024 4:11:12 PM								
5	From File			WorkSheet.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	LMM-WRA-0.5-2											
12												
13	General Statistics											
14	Total Number of Observations					10	Number of Distinct Observations					10
15							Number of Missing Observations					0
16	Minimum					209	Mean					320.5
17	Maximum					531	Median					308.5
18	SD					103.2	Std. Error of Mean					32.63
19	Coefficient of Variation					0.322	Skewness					1.09
20												
21	Normal GOF Test											
22	Shapiro Wilk Test Statistic					0.886	Shapiro Wilk GOF Test					
23	1% Shapiro Wilk Critical Value					0.781	Data appear Normal at 1% Significance Level					
24	Lilliefors Test Statistic					0.263	Lilliefors GOF Test					
25	1% Lilliefors Critical Value					0.304	Data appear Normal at 1% Significance Level					
26	Data appear Normal at 1% Significance Level											
27												
28	Assuming Normal Distribution											
29	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
30	95% Student's-t UCL					380.3	95% Adjusted-CLT UCL (Chen-1995)					386.2
31							95% Modified-t UCL (Johnson-1978)					382.2
32												
33	Gamma GOF Test											
34	A-D Test Statistic					0.374	Anderson-Darling Gamma GOF Test					
35	5% A-D Critical Value					0.725	Detected data appear Gamma Distributed at 5% Significance Level					
36	K-S Test Statistic					0.222	Kolmogorov-Smirnov Gamma GOF Test					
37	5% K-S Critical Value					0.267	Detected data appear Gamma Distributed at 5% Significance Level					
38	Detected data appear Gamma Distributed at 5% Significance Level											
39												
40	Gamma Statistics											
41	k hat (MLE)					11.88	k star (bias corrected MLE)					8.381
42	Theta hat (MLE)					26.98	Theta star (bias corrected MLE)					38.24
43	nu hat (MLE)					237.6	nu star (bias corrected)					167.6
44	MLE Mean (bias corrected)					320.5	MLE Sd (bias corrected)					110.7
45							Approximate Chi Square Value (0.05)					138.7
46	Adjusted Level of Significance					0.0267	Adjusted Chi Square Value					134.1
47												
48	Assuming Gamma Distribution											
49	95% Approximate Gamma UCL					387.4	95% Adjusted Gamma UCL					400.6
50												
51	Lognormal GOF Test											
52	Shapiro Wilk Test Statistic					0.936	Shapiro Wilk Lognormal GOF Test					
53	10% Shapiro Wilk Critical Value					0.869	Data appear Lognormal at 10% Significance Level					
54	Lilliefors Test Statistic					0.206	Lilliefors Lognormal GOF Test					
55	10% Lilliefors Critical Value					0.241	Data appear Lognormal at 10% Significance Level					
56	Data appear Lognormal at 10% Significance Level											
57												
58	Lognormal Statistics											
59	Minimum of Logged Data					5.342	Mean of logged Data					5.727
60	Maximum of Logged Data					6.275	SD of logged Data					0.302
61												
62	Assuming Lognormal Distribution											
63	95% H-UCL					392.5	90% Chebyshev (MVUE) UCL					412.4
64	95% Chebyshev (MVUE) UCL					454.3	97.5% Chebyshev (MVUE) UCL					512.4
65	99% Chebyshev (MVUE) UCL					626.6						
66												
67	Nonparametric Distribution Free UCL Statistics											
68	Data appear to follow a Discernible Distribution											
69												
70	Nonparametric Distribution Free UCLs											
71	95% CLT UCL					374.2	95% BCA Bootstrap UCL					383.9
72	95% Standard Bootstrap UCL					372.9	95% Bootstrap-t UCL					414
73	95% Hall's Bootstrap UCL					734.8	95% Percentile Bootstrap UCL					377.3
74	90% Chebyshev(Mean, Sd) UCL					418.4	95% Chebyshev(Mean, Sd) UCL					462.7
75	97.5% Chebyshev(Mean, Sd) UCL					524.3	99% Chebyshev(Mean, Sd) UCL					645.2
76												
77	Suggested UCL to Use											
78	95% Student's-t UCL					380.3						
79												
80	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
81	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
82	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											

	A	B	C	D	E	F	G	H	I	J	K	L
83												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 4:13:08 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

LMM-WRA-0.5-3

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	38	Mean	74.6
Maximum	134	Median	66
SD	31.94	Std. Error of Mean	10.1
Coefficient of Variation	0.428	Skewness	0.654

Normal GOF Test

Shapiro Wilk Test Statistic	0.912	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.189	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	93.12	95% Adjusted-CLT UCL (Chen-1995)	93.45
		95% Modified-t UCL (Johnson-1978)	93.46

Gamma GOF Test

A-D Test Statistic	0.38	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.728	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.202	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.267	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	6.292	k star (bias corrected MLE)	4.471
Theta hat (MLE)	11.86	Theta star (bias corrected MLE)	16.69
nu hat (MLE)	125.8	nu star (bias corrected)	89.42
MLE Mean (bias corrected)	74.6	MLE Sd (bias corrected)	35.28
		Approximate Chi Square Value (0.05)	68.62
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	65.46

Assuming Gamma Distribution

95% Approximate Gamma UCL	97.22	95% Adjusted Gamma UCL	101.9

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.939	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.187	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.638	Mean of logged Data	4.231
Maximum of Logged Data	4.898	SD of logged Data	0.425

Assuming Lognormal Distribution

95% H-UCL	101.7	90% Chebyshev (MVUE) UCL	105
95% Chebyshev (MVUE) UCL	118.8	97.5% Chebyshev (MVUE) UCL	138
99% Chebyshev (MVUE) UCL	175.7		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	91.21	95% BCA Bootstrap UCL	92.2
95% Standard Bootstrap UCL	90.24	95% Bootstrap-t UCL	96.52
95% Hall's Bootstrap UCL	92.02	95% Percentile Bootstrap UCL	90.5
90% Chebyshev(Mean, Sd) UCL	104.9	95% Chebyshev(Mean, Sd) UCL	118.6
97.5% Chebyshev(Mean, Sd) UCL	137.7	99% Chebyshev(Mean, Sd) UCL	175.1

Suggested UCL to Use

95% Student's-t UCL	93.12

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
83												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 4:15:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

LMM-WRA-0.5-3-DS

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	16	Mean	38.75
Maximum	50	Median	44.5
SD	15.52	Std. Error of Mean	7.761
Coefficient of Variation	0.401	Skewness	-1.739

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.811	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.333	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	57.01	95% Adjusted-CLT UCL (Chen-1995)	44.3
		95% Modified-t UCL (Johnson-1978)	55.89

Gamma GOF Test

A-D Test Statistic	0.64	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.659	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.381	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.396	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	5.778	k star (bias corrected MLE)	1.611
Theta hat (MLE)	6.706	Theta star (bias corrected MLE)	24.05
nu hat (MLE)	46.22	nu star (bias corrected)	12.89
MLE Mean (bias corrected)	38.75	MLE Sd (bias corrected)	30.53
		Approximate Chi Square Value (0.05)	5.818
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	85.84	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.748	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.374	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.773	Mean of logged Data	3.568
Maximum of Logged Data	3.912	SD of logged Data	0.535

Assuming Lognormal Distribution

95% H-UCL	134.2	90% Chebyshev (MVUE) UCL	70.33
95% Chebyshev (MVUE) UCL	84.35	97.5% Chebyshev (MVUE) UCL	103.8
99% Chebyshev (MVUE) UCL	142		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	51.52	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
90% Chebyshev(Mean, Sd) UCL	62.03	95% Chebyshev(Mean, Sd) UCL	72.58

	A	B	C	D	E	F	G	H	I	J	K	L
83	97.5% Chebyshev(Mean, Sd) UCL					87.22	99% Chebyshev(Mean, Sd) UCL					116
84												
85	**Suggested UCL to Use**											
86	95% Student's-t UCL					57.01						
87	**Recommended UCL exceeds the maximum observation**											
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												
93	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
94	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
95												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 4:21:58 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

LMM-WRA-0.5-4

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	697	Mean	1594
Maximum	2991	Median	1449
SD	764.4	Std. Error of Mean	241.7
Coefficient of Variation	0.48	Skewness	0.537

Normal GOF Test

Shapiro Wilk Test Statistic	0.929	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.173	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2037	95% Adjusted-CLT UCL (Chen-1995)	2035
		95% Modified-t UCL (Johnson-1978)	2044

Gamma GOF Test

A-D Test Statistic	0.339	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.729	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.175	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.268	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.676	k star (bias corrected MLE)	3.34
Theta hat (MLE)	340.8	Theta star (bias corrected MLE)	477.2
nu hat (MLE)	93.52	nu star (bias corrected)	66.79
MLE Mean (bias corrected)	1594	MLE Sd (bias corrected)	872.1
		Approximate Chi Square Value (0.05)	48.99
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	46.35

Assuming Gamma Distribution

95% Approximate Gamma UCL	2173	95% Adjusted Gamma UCL	2297

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.925	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.206	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	6.547	Mean of logged Data	7.263
Maximum of Logged Data	8.003	SD of logged Data	0.508

Assuming Lognormal Distribution

95% H-UCL	2369	90% Chebyshev (MVUE) UCL	2386
95% Chebyshev (MVUE) UCL	2742	97.5% Chebyshev (MVUE) UCL	3236
99% Chebyshev (MVUE) UCL	4206		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	1991	95% BCA Bootstrap UCL	2007
95% Standard Bootstrap UCL	1973	95% Bootstrap-t UCL	2124
95% Hall's Bootstrap UCL	2130	95% Percentile Bootstrap UCL	1971
90% Chebyshev(Mean, Sd) UCL	2319	95% Chebyshev(Mean, Sd) UCL	2647
97.5% Chebyshev(Mean, Sd) UCL	3103	99% Chebyshev(Mean, Sd) UCL	3999

Suggested UCL to Use

95% Student's-t UCL	2037

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
83												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 4:37:03 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

LMM-WRB-0.5-1

General Statistics			
Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	645	Mean	844.1
Maximum	978	Median	866.5
SD	108.3	Std. Error of Mean	34.25
Coefficient of Variation	0.128	Skewness	-0.612
Normal GOF Test			
Shapiro Wilk Test Statistic	0.94	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.173	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	906.9	95% Adjusted-CLT UCL (Chen-1995)	893.3
		95% Modified-t UCL (Johnson-1978)	905.8
Gamma GOF Test			
A-D Test Statistic	0.361	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.724	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.19	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.266	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	63.84	k star (bias corrected MLE)	44.76
Theta hat (MLE)	13.22	Theta star (bias corrected MLE)	18.86
nu hat (MLE)	1277	nu star (bias corrected)	895.1
MLE Mean (bias corrected)	844.1	MLE Sd (bias corrected)	126.2
		Approximate Chi Square Value (0.05)	826.7
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	815.2
Assuming Gamma Distribution			
95% Approximate Gamma UCL	914	95% Adjusted Gamma UCL	926.8
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.922	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.192	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	6.469	Mean of logged Data	6.73
Maximum of Logged Data	6.886	SD of logged Data	0.134
Assuming Lognormal Distribution			
95% H-UCL	917	90% Chebyshev (MVUE) UCL	951.9
95% Chebyshev (MVUE) UCL	1001	97.5% Chebyshev (MVUE) UCL	1068
99% Chebyshev (MVUE) UCL	1201		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	900.4	95% BCA Bootstrap UCL	895.4
95% Standard Bootstrap UCL	898.4	95% Bootstrap-t UCL	902.5
95% Hall's Bootstrap UCL	894.1	95% Percentile Bootstrap UCL	898.2
90% Chebyshev(Mean, Sd) UCL	946.8	95% Chebyshev(Mean, Sd) UCL	993.4
97.5% Chebyshev(Mean, Sd) UCL	1058	99% Chebyshev(Mean, Sd) UCL	1185
Suggested UCL to Use			
95% Student's-t UCL	906.9		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
83												
84	Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be											
85	reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.											
86												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 4:39:27 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

LMM-WRB-0.5-2

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	142	Mean	195.3
Maximum	284	Median	185
SD	42.31	Std. Error of Mean	13.38
Coefficient of Variation	0.217	Skewness	0.937

Normal GOF Test

Shapiro Wilk Test Statistic	0.929	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.193	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	219.8	95% Adjusted-CLT UCL (Chen-1995)	221.5
		95% Modified-t UCL (Johnson-1978)	220.5

Gamma GOF Test

A-D Test Statistic	0.285	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.725	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.17	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.266	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	25.23	k star (bias corrected MLE)	17.73
Theta hat (MLE)	7.741	Theta star (bias corrected MLE)	11.02
nu hat (MLE)	504.6	nu star (bias corrected)	354.5
MLE Mean (bias corrected)	195.3	MLE Sd (bias corrected)	46.39
		Approximate Chi Square Value (0.05)	311.9
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	304.9

Assuming Gamma Distribution

95% Approximate Gamma UCL	222	95% Adjusted Gamma UCL	227.1

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.96	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.155	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.956	Mean of logged Data	5.255
Maximum of Logged Data	5.649	SD of logged Data	0.208

Assuming Lognormal Distribution

95% H-UCL	223	90% Chebyshev (MVUE) UCL	233.9
95% Chebyshev (MVUE) UCL	251.4	97.5% Chebyshev (MVUE) UCL	275.7
99% Chebyshev (MVUE) UCL	323.5		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	217.3	95% BCA Bootstrap UCL	220.6
95% Standard Bootstrap UCL	216.3	95% Bootstrap-t UCL	228.4
95% Hall's Bootstrap UCL	241.4	95% Percentile Bootstrap UCL	216.4
90% Chebyshev(Mean, Sd) UCL	235.4	95% Chebyshev(Mean, Sd) UCL	253.6
97.5% Chebyshev(Mean, Sd) UCL	278.8	99% Chebyshev(Mean, Sd) UCL	328.4

Suggested UCL to Use

95% Student's-t UCL	219.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
83												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Uncensored Full Data Sets											
2												
3			User Selected Options									
4			Date/Time of Computation	ProUCL 5.2 10/28/2024 3:27:22 PM								
5			From File	WorkSheet.xls								
6			Full Precision	OFF								
7			Confidence Coefficient	95%								
8			Number of Bootstrap Operations	2000								
9												
10												
11	LMM-WRB-0.5-3-DS											
12												
13	General Statistics											
14					Total Number of Observations	4					Number of Distinct Observations	3
15											Number of Missing Observations	0
16					Minimum	14					Mean	17.5
17					Maximum	19					Median	18.5
18					SD	2.38					Std. Error of Mean	1.19
19					Coefficient of Variation	0.136					Skewness	-1.779
20												
21	Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,											
22	refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,											
23	but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).											
24	The Chebyshev UCL often results in gross overestimates of the mean.											
25	Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.											
26												
27	Normal GOF Test											
28					Shapiro Wilk Test Statistic	0.764	Shapiro Wilk GOF Test					
29					1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level					
30					Lilliefors Test Statistic	0.333	Lilliefors GOF Test					
31					1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level					
32	Data appear Normal at 1% Significance Level											
33	Note GOF tests may be unreliable for small sample sizes											
34												
35	Assuming Normal Distribution											
36	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
37					95% Student's-t UCL	20.3					95% Adjusted-CLT UCL (Chen-1995)	18.33
38											95% Modified-t UCL (Johnson-1978)	20.12
39												
40	Gamma GOF Test											
41					A-D Test Statistic	0.651	Anderson-Darling Gamma GOF Test					
42					5% A-D Critical Value	0.656	Detected data appear Gamma Distributed at 5% Significance Level					
43					K-S Test Statistic	0.357	Kolmogorov-Smirnov Gamma GOF Test					
44					5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level					
45	Detected data appear Gamma Distributed at 5% Significance Level											
46	Note GOF tests may be unreliable for small sample sizes											
47												
48	Gamma Statistics											
49					k hat (MLE)	65.75					k star (bias corrected MLE)	16.6
50					Theta hat (MLE)	0.266					Theta star (bias corrected MLE)	1.054
51					nu hat (MLE)	526					nu star (bias corrected)	132.8
52					MLE Mean (bias corrected)	17.5					MLE Sd (bias corrected)	4.295
53											Approximate Chi Square Value (0.05)	107.2
54					Adjusted Level of Significance	N/A					Adjusted Chi Square Value	N/A
55												
56	Assuming Gamma Distribution											
57					95% Approximate Gamma UCL	21.68					95% Adjusted Gamma UCL	N/A
58												
59	Lognormal GOF Test											
60					Shapiro Wilk Test Statistic	0.75	Shapiro Wilk Lognormal GOF Test					
61					10% Shapiro Wilk Critical Value	0.792	Data Not Lognormal at 10% Significance Level					
62					Lilliefors Test Statistic	0.347	Lilliefors Lognormal GOF Test					
63					10% Lilliefors Critical Value	0.346	Data Not Lognormal at 10% Significance Level					
64	Data Not Lognormal at 10% Significance Level											
65												
66	Lognormal Statistics											
67					Minimum of Logged Data	2.639					Mean of logged Data	2.855
68					Maximum of Logged Data	2.944					SD of logged Data	0.146
69												
70	Assuming Lognormal Distribution											
71					95% H-UCL	21.35					90% Chebyshev (MVUE) UCL	21.33
72					95% Chebyshev (MVUE) UCL	23.06					97.5% Chebyshev (MVUE) UCL	25.47
73					99% Chebyshev (MVUE) UCL	30.19						
74												
75	Nonparametric Distribution Free UCL Statistics											
76	Data appear to follow a Discernible Distribution											
77												
78	Nonparametric Distribution Free UCLs											
79					95% CLT UCL	19.46					95% BCA Bootstrap UCL	N/A
80					95% Standard Bootstrap UCL	N/A					95% Bootstrap-t UCL	N/A
81					95% Hall's Bootstrap UCL	N/A					95% Percentile Bootstrap UCL	N/A
82					90% Chebyshev(Mean, Sd) UCL	21.07					95% Chebyshev(Mean, Sd) UCL	22.69

	A	B	C	D	E	F	G	H	I	J	K	L
83	97.5% Chebyshev(Mean, Sd) UCL					24.93	99% Chebyshev(Mean, Sd) UCL					29.34
84												
85	**Suggested UCL to Use**											
86	95% Student's-t UCL					20.3						
87	**Recommended UCL exceeds the maximum observation**											
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												
93	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
94	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
95												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Uncensored Full Data Sets											
2												
3	User Selected Options											
4	Date/Time of Computation			ProUCL 5.2 10/28/2024 3:22:06 PM								
5	From File			WorkSheet.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	LMM-WRB-0.5-3											
12												
13	General Statistics											
14	Total Number of Observations					4	Number of Distinct Observations					4
15							Number of Missing Observations					0
16	Minimum					92	Mean					112.5
17	Maximum					149	Median					104.5
18	SD					25.77	Std. Error of Mean					12.89
19	Coefficient of Variation					0.229	Skewness					1.413
20												
21	Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,											
22	refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,											
23	but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).											
24	The Chebyshev UCL often results in gross overestimates of the mean.											
25	Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.											
26												
27	Normal GOF Test											
28	Shapiro Wilk Test Statistic					0.872	Shapiro Wilk GOF Test					
29	1% Shapiro Wilk Critical Value					0.687	Data appear Normal at 1% Significance Level					
30	Lilliefors Test Statistic					0.258	Lilliefors GOF Test					
31	1% Lilliefors Critical Value					0.413	Data appear Normal at 1% Significance Level					
32	Data appear Normal at 1% Significance Level											
33	Note GOF tests may be unreliable for small sample sizes											
34												
35	Assuming Normal Distribution											
36	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
37	95% Student's-t UCL					142.8	95% Adjusted-CLT UCL (Chen-1995)					143.4
38							95% Modified-t UCL (Johnson-1978)					144.3
39												
40	Gamma GOF Test											
41	A-D Test Statistic					0.376	Anderson-Darling Gamma GOF Test					
42	5% A-D Critical Value					0.657	Detected data appear Gamma Distributed at 5% Significance Level					
43	K-S Test Statistic					0.257	Kolmogorov-Smirnov Gamma GOF Test					
44	5% K-S Critical Value					0.394	Detected data appear Gamma Distributed at 5% Significance Level					
45	Detected data appear Gamma Distributed at 5% Significance Level											
46	Note GOF tests may be unreliable for small sample sizes											
47												
48	Gamma Statistics											
49	k hat (MLE)					27.61	k star (bias corrected MLE)					7.07
50	Theta hat (MLE)					4.074	Theta star (bias corrected MLE)					15.91
51	nu hat (MLE)					220.9	nu star (bias corrected)					56.56
52	MLE Mean (bias corrected)					112.5	MLE Sd (bias corrected)					42.31
53							Approximate Chi Square Value (0.05)					40.27
54	Adjusted Level of Significance					N/A	Adjusted Chi Square Value					N/A
55												
56	Assuming Gamma Distribution											
57	95% Approximate Gamma UCL					158	95% Adjusted Gamma UCL					N/A
58												
59	Lognormal GOF Test											
60	Shapiro Wilk Test Statistic					0.902	Shapiro Wilk Lognormal GOF Test					
61	10% Shapiro Wilk Critical Value					0.792	Data appear Lognormal at 10% Significance Level					
62	Lilliefors Test Statistic					0.226	Lilliefors Lognormal GOF Test					
63	10% Lilliefors Critical Value					0.346	Data appear Lognormal at 10% Significance Level					
64	Data appear Lognormal at 10% Significance Level											
65	Note GOF tests may be unreliable for small sample sizes											
66												
67	Lognormal Statistics											
68	Minimum of Logged Data					4.522	Mean of logged Data					4.705
69	Maximum of Logged Data					5.004	SD of logged Data					0.216
70												
71	Assuming Lognormal Distribution											
72	95% H-UCL					154.6	90% Chebyshev (MVUE) UCL					148.7
73	95% Chebyshev (MVUE) UCL					165.2	97.5% Chebyshev (MVUE) UCL					188
74	99% Chebyshev (MVUE) UCL					232.8						
75												
76	Nonparametric Distribution Free UCL Statistics											
77	Data appear to follow a Discernible Distribution											
78												
79	Nonparametric Distribution Free UCLs											
80	95% CLT UCL					133.7	95% BCA Bootstrap UCL					N/A
81	95% Standard Bootstrap UCL					N/A	95% Bootstrap-t UCL					N/A
82	95% Hall's Bootstrap UCL					N/A	95% Percentile Bootstrap UCL					N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83				90% Chebyshev(Mean, Sd) UCL		151.2				95% Chebyshev(Mean, Sd) UCL		168.7
84				97.5% Chebyshev(Mean, Sd) UCL		193				99% Chebyshev(Mean, Sd) UCL		240.7
85												
86						**Suggested UCL to Use**						
87				95% Student's-t UCL		142.8						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Uncensored Full Data Sets											
2												
3	User Selected Options											
4	Date/Time of Computation			ProUCL 5.2 10/31/2024 1:55:18 PM								
5	From File			ProUCL Input.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	SH-WRA-0.5-1											
12												
13	General Statistics											
14	Total Number of Observations					4	Number of Distinct Observations					3
15							Number of Missing Observations					0
16	Minimum					9	Mean					11.5
17	Maximum					13	Median					12
18	SD					1.732	Std. Error of Mean					0.866
19	Coefficient of Variation					0.151	Skewness					-1.54
20												
21	Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,											
22	refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,											
23	but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).											
24	The Chebyshev UCL often results in gross overestimates of the mean.											
25	Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.											
26												
27	Normal GOF Test											
28	Shapiro Wilk Test Statistic					0.84	Shapiro Wilk GOF Test					
29	1% Shapiro Wilk Critical Value					0.687	Data appear Normal at 1% Significance Level					
30	Lilliefors Test Statistic					0.364	Lilliefors GOF Test					
31	1% Lilliefors Critical Value					0.413	Data appear Normal at 1% Significance Level					
32	Data appear Normal at 1% Significance Level											
33	Note GOF tests may be unreliable for small sample sizes											
34												
35	Assuming Normal Distribution											
36	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
37	95% Student's-t UCL					13.54	95% Adjusted-CLT UCL (Chen-1995)					12.21
38							95% Modified-t UCL (Johnson-1978)					13.43
39												
40	Gamma GOF Test											
41	A-D Test Statistic					0.554	Anderson-Darling Gamma GOF Test					
42	5% A-D Critical Value					0.656	Detected data appear Gamma Distributed at 5% Significance Level					
43	K-S Test Statistic					0.39	Kolmogorov-Smirnov Gamma GOF Test					
44	5% K-S Critical Value					0.394	Detected data appear Gamma Distributed at 5% Significance Level					
45	Detected data appear Gamma Distributed at 5% Significance Level											
46	Note GOF tests may be unreliable for small sample sizes											
47												
48	Gamma Statistics											
49	k hat (MLE)					53.64	k star (bias corrected MLE)					13.58
50	Theta hat (MLE)					0.214	Theta star (bias corrected MLE)					0.847
51	nu hat (MLE)					429.1	nu star (bias corrected)					108.6
52	MLE Mean (bias corrected)					11.5	MLE Sd (bias corrected)					3.121
53							Approximate Chi Square Value (0.05)					85.56
54	Adjusted Level of Significance					N/A	Adjusted Chi Square Value					N/A
55												
56	Assuming Gamma Distribution											
57	95% Approximate Gamma UCL					14.6	95% Adjusted Gamma UCL					N/A
58												
59	Lognormal GOF Test											
60	Shapiro Wilk Test Statistic					0.815	Shapiro Wilk Lognormal GOF Test					
61	10% Shapiro Wilk Critical Value					0.792	Data appear Lognormal at 10% Significance Level					
62	Lilliefors Test Statistic					0.376	Lilliefors Lognormal GOF Test					
63	10% Lilliefors Critical Value					0.346	Data Not Lognormal at 10% Significance Level					
64	Data appear Approximate Lognormal at 10% Significance Level											
65	Note GOF tests may be unreliable for small sample sizes											
66												
67	Lognormal Statistics											
68	Minimum of Logged Data					2.197	Mean of logged Data					2.433
69	Maximum of Logged Data					2.565	SD of logged Data					0.162
70												
71	Assuming Lognormal Distribution											
72	95% H-UCL					14.39	90% Chebyshev (MVUE) UCL					14.29
73	95% Chebyshev (MVUE) UCL					15.55	97.5% Chebyshev (MVUE) UCL					17.3
74	99% Chebyshev (MVUE) UCL					20.74						
75												
76	Nonparametric Distribution Free UCL Statistics											
77	Data appear to follow a Discernible Distribution											
78												
79	Nonparametric Distribution Free UCLs											
80	95% CLT UCL					12.92	95% BCA Bootstrap UCL					N/A
81	95% Standard Bootstrap UCL					N/A	95% Bootstrap-t UCL					N/A
82	95% Hall's Bootstrap UCL					N/A	95% Percentile Bootstrap UCL					N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83			90% Chebyshev(Mean, Sd) UCL			14.1			95% Chebyshev(Mean, Sd) UCL			15.27
84			97.5% Chebyshev(Mean, Sd) UCL			16.91			99% Chebyshev(Mean, Sd) UCL			20.12
85												
86						**Suggested UCL to Use**						
87			95% Student's-t UCL			13.54						
88						**Recommended UCL exceeds the maximum observation**						
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												
94	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
95	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
96												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 1:56:58 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

SH-WRA-0.5-2

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	12	Mean	15.25
Maximum	21	Median	14
SD	4.031	Std. Error of Mean	2.016
Coefficient of Variation	0.264	Skewness	1.469

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.872	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.275	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	19.99	95% Adjusted-CLT UCL (Chen-1995)	20.15
		95% Modified-t UCL (Johnson-1978)	20.24

Gamma GOF Test

A-D Test Statistic	0.368	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.251	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	21.02	k star (bias corrected MLE)	5.422
Theta hat (MLE)	0.725	Theta star (bias corrected MLE)	2.812
nu hat (MLE)	168.2	nu star (bias corrected)	43.38
MLE Mean (bias corrected)	15.25	MLE Sd (bias corrected)	6.549
		Approximate Chi Square Value (0.05)	29.28
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	22.6	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.911	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.238	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	2.485	Mean of logged Data	2.701
Maximum of Logged Data	3.045	SD of logged Data	0.247

Assuming Lognormal Distribution

95% H-UCL	22.25	90% Chebyshev (MVUE) UCL	20.85
95% Chebyshev (MVUE) UCL	23.4	97.5% Chebyshev (MVUE) UCL	26.93
99% Chebyshev (MVUE) UCL	33.88		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	18.57	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					21.3	95% Chebyshev(Mean, Sd) UCL					24.04
84	97.5% Chebyshev(Mean, Sd) UCL					27.84	99% Chebyshev(Mean, Sd) UCL					35.3
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					19.99						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Uncensored Full Data Sets											
2												
3	User Selected Options											
4	Date/Time of Computation			ProUCL 5.2 10/31/2024 2:02:01 PM								
5	From File			ProUCL Input.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	SH-WRB-0.5-1											
12												
13	General Statistics											
14	Total Number of Observations					4	Number of Distinct Observations					4
15							Number of Missing Observations					0
16	Minimum					19	Mean					24.5
17	Maximum					30	Median					24.5
18	SD					4.655	Std. Error of Mean					2.327
19	Coefficient of Variation					0.19	Skewness					0
20												
21	Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,											
22	refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,											
23	but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).											
24	The Chebyshev UCL often results in gross overestimates of the mean.											
25	Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.											
26												
27	Normal GOF Test											
28	Shapiro Wilk Test Statistic					N/A	Shapiro Wilk GOF Test					
29	1% Shapiro Wilk Critical Value					0.687	Data Not Normal at 1% Significance Level					
30	Lilliefors Test Statistic					0.131	Lilliefors GOF Test					
31	1% Lilliefors Critical Value					0.413	Data appear Normal at 1% Significance Level					
32	Data appear Approximate Normal at 1% Significance Level											
33	Note GOF tests may be unreliable for small sample sizes											
34												
35	Assuming Normal Distribution											
36	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
37	95% Student's-t UCL					29.98	95% Adjusted-CLT UCL (Chen-1995)					28.33
38							95% Modified-t UCL (Johnson-1978)					29.98
39												
40	Gamma GOF Test											
41	A-D Test Statistic					0.194	Anderson-Darling Gamma GOF Test					
42	5% A-D Critical Value					0.656	Detected data appear Gamma Distributed at 5% Significance Level					
43	K-S Test Statistic					0.171	Kolmogorov-Smirnov Gamma GOF Test					
44	5% K-S Critical Value					0.394	Detected data appear Gamma Distributed at 5% Significance Level					
45	Detected data appear Gamma Distributed at 5% Significance Level											
46	Note GOF tests may be unreliable for small sample sizes											
47												
48	Gamma Statistics											
49	k hat (MLE)					36.22	k star (bias corrected MLE)					9.223
50	Theta hat (MLE)					0.676	Theta star (bias corrected MLE)					2.656
51	nu hat (MLE)					289.8	nu star (bias corrected)					73.78
52	MLE Mean (bias corrected)					24.5	MLE Sd (bias corrected)					8.067
53							Approximate Chi Square Value (0.05)					55
54	Adjusted Level of Significance					N/A	Adjusted Chi Square Value					N/A
55												
56	Assuming Gamma Distribution											
57	95% Approximate Gamma UCL					32.87	95% Adjusted Gamma UCL					N/A
58												
59	Lognormal GOF Test											
60	Shapiro Wilk Test Statistic					0.995	Shapiro Wilk Lognormal GOF Test					
61	10% Shapiro Wilk Critical Value					0.792	Data appear Lognormal at 10% Significance Level					
62	Lilliefors Test Statistic					0.149	Lilliefors Lognormal GOF Test					
63	10% Lilliefors Critical Value					0.346	Data appear Lognormal at 10% Significance Level					
64	Data appear Lognormal at 10% Significance Level											
65	Note GOF tests may be unreliable for small sample sizes											
66												
67	Lognormal Statistics											
68	Minimum of Logged Data					2.944	Mean of logged Data					3.185
69	Maximum of Logged Data					3.401	SD of logged Data					0.194
70												
71	Assuming Lognormal Distribution											
72	95% H-UCL					32.36	90% Chebyshev (MVUE) UCL					31.6
73	95% Chebyshev (MVUE) UCL					34.81	97.5% Chebyshev (MVUE) UCL					39.27
74	99% Chebyshev (MVUE) UCL					48.03						
75												
76	Nonparametric Distribution Free UCL Statistics											
77	Data appear to follow a Discernible Distribution											
78												
79	Nonparametric Distribution Free UCLs											
80	95% CLT UCL					28.33	95% BCA Bootstrap UCL					N/A
81	95% Standard Bootstrap UCL					N/A	95% Bootstrap-t UCL					N/A
82	95% Hall's Bootstrap UCL					N/A	95% Percentile Bootstrap UCL					N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83					90% Chebyshev(Mean, Sd) UCL	31.48					95% Chebyshev(Mean, Sd) UCL	34.64
84					97.5% Chebyshev(Mean, Sd) UCL	39.03					99% Chebyshev(Mean, Sd) UCL	47.66
85												
86						**Suggested UCL to Use**						
87					95% Student's-t UCL	29.98						
88												
89	When a data set follows an approximate distribution passing only one of the GOF tests,											
90	it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL											
91												
92	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
93	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
94	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
95												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 2:03:41 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

SH-WRB-0.5-2

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	59	Mean	63
Maximum	66	Median	63.5
SD	3.162	Std. Error of Mean	1.581
Coefficient of Variation	0.0502	Skewness	-0.632

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.941	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.236	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	66.72	95% Adjusted-CLT UCL (Chen-1995)	65.07
		95% Modified-t UCL (Johnson-1978)	66.64

Gamma GOF Test

A-D Test Statistic	0.295	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.268	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	523	k star (bias corrected MLE)	130.9
Theta hat (MLE)	0.12	Theta star (bias corrected MLE)	0.481
nu hat (MLE)	4184	nu star (bias corrected)	1047
MLE Mean (bias corrected)	63	MLE Sd (bias corrected)	5.506
		Approximate Chi Square Value (0.05)	973.3
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	67.8	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.938	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.238	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	4.078	Mean of logged Data	4.142
Maximum of Logged Data	4.19	SD of logged Data	0.0506

Assuming Lognormal Distribution

95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	67.79
95% Chebyshev (MVUE) UCL	69.95	97.5% Chebyshev (MVUE) UCL	72.96
99% Chebyshev (MVUE) UCL	78.87		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	65.6	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83			90% Chebyshev(Mean, Sd) UCL			67.74			95% Chebyshev(Mean, Sd) UCL			69.89
84			97.5% Chebyshev(Mean, Sd) UCL			72.87			99% Chebyshev(Mean, Sd) UCL			78.73
85												
86	**Suggested UCL to Use**											
87			95% Student's-t UCL			66.72						
88	**Recommended UCL exceeds the maximum observation**											
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												
94	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
95	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
96												

UCL Statistics for Uncensored Full Data Sets			
User Selected Options			
Date/Time of Computation	ProUCL 5.2 10/31/2024 2:05:52 PM		
From File	ProUCL Input.xls		
Full Precision	OFF		
Confidence Coefficient	95%		
Number of Bootstrap Operations	2000		
SH-WRC-0.5-1			
General Statistics			
Total Number of Observations	4	Number of Distinct Observations	3
		Number of Missing Observations	0
Minimum	12	Mean	17
Maximum	21	Median	17.5
SD	4.69	Std. Error of Mean	2.345
Coefficient of Variation	0.276	Skewness	-0.155
Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,			
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,			
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).			
The Chebyshev UCL often results in gross overestimates of the mean.			
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.			
Normal GOF Test			
Shapiro Wilk Test Statistic	0.82	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.303	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	22.52	95% Adjusted-CLT UCL (Chen-1995)	20.66
		95% Modified-t UCL (Johnson-1978)	22.49
Gamma GOF Test			
A-D Test Statistic	0.51	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.336	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Gamma Statistics			
k hat (MLE)	16.85	k star (bias corrected MLE)	4.38
Theta hat (MLE)	1.009	Theta star (bias corrected MLE)	3.881
nu hat (MLE)	134.8	nu star (bias corrected)	35.04
MLE Mean (bias corrected)	17	MLE Sd (bias corrected)	8.123
		Approximate Chi Square Value (0.05)	22.5
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A
Assuming Gamma Distribution			
95% Approximate Gamma UCL	26.48	95% Adjusted Gamma UCL	N/A
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.837	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.301	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Lognormal Statistics			
Minimum of Logged Data	2.485	Mean of logged Data	2.803
Maximum of Logged Data	3.045	SD of logged Data	0.286
Assuming Lognormal Distribution			
95% H-UCL	26.94	90% Chebyshev (MVUE) UCL	24.25
95% Chebyshev (MVUE) UCL	27.53	97.5% Chebyshev (MVUE) UCL	32.08
99% Chebyshev (MVUE) UCL	41.03		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	20.86	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					24.04	95% Chebyshev(Mean, Sd) UCL					27.22
84	97.5% Chebyshev(Mean, Sd) UCL					31.65	99% Chebyshev(Mean, Sd) UCL					40.33
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					22.52						
88	**Recommended UCL exceeds the maximum observation**											
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												
94	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
95	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
96												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Uncensored Full Data Sets											
2												
3	User Selected Options											
4	Date/Time of Computation			ProUCL 5.2 10/31/2024 2:10:09 PM								
5	From File			ProUCL Input.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	SH-WRC-0.5-2											
12												
13	General Statistics											
14	Total Number of Observations					4	Number of Distinct Observations					3
15							Number of Missing Observations					0
16	Minimum					14	Mean					18
17	Maximum					21	Median					18.5
18	SD					3.559	Std. Error of Mean					1.78
19	Coefficient of Variation					0.198	Skewness					-0.266
20												
21	Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,											
22	refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,											
23	but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).											
24	The Chebyshev UCL often results in gross overestimates of the mean.											
25	Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.											
26												
27	Normal GOF Test											
28	Shapiro Wilk Test Statistic					0.84	Shapiro Wilk GOF Test					
29	1% Shapiro Wilk Critical Value					0.687	Data appear Normal at 1% Significance Level					
30	Lilliefors Test Statistic					0.3	Lilliefors GOF Test					
31	1% Lilliefors Critical Value					0.413	Data appear Normal at 1% Significance Level					
32	Data appear Normal at 1% Significance Level											
33	Note GOF tests may be unreliable for small sample sizes											
34												
35	Assuming Normal Distribution											
36	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
37	95% Student's-t UCL					22.19	95% Adjusted-CLT UCL (Chen-1995)					20.67
38							95% Modified-t UCL (Johnson-1978)					22.15
39												
40	Gamma GOF Test											
41	A-D Test Statistic					0.477	Anderson-Darling Gamma GOF Test					
42	5% A-D Critical Value					0.657	Detected data appear Gamma Distributed at 5% Significance Level					
43	K-S Test Statistic					0.333	Kolmogorov-Smirnov Gamma GOF Test					
44	5% K-S Critical Value					0.394	Detected data appear Gamma Distributed at 5% Significance Level					
45	Detected data appear Gamma Distributed at 5% Significance Level											
46	Note GOF tests may be unreliable for small sample sizes											
47												
48	Gamma Statistics											
49	k hat (MLE)					33.06	k star (bias corrected MLE)					8.432
50	Theta hat (MLE)					0.544	Theta star (bias corrected MLE)					2.135
51	nu hat (MLE)					264.5	nu star (bias corrected)					67.46
52	MLE Mean (bias corrected)					18	MLE Sd (bias corrected)					6.199
53							Approximate Chi Square Value (0.05)					49.56
54	Adjusted Level of Significance					N/A	Adjusted Chi Square Value					N/A
55												
56	Assuming Gamma Distribution											
57	95% Approximate Gamma UCL					24.5	95% Adjusted Gamma UCL					N/A
58												
59	Lognormal GOF Test											
60	Shapiro Wilk Test Statistic					0.85	Shapiro Wilk Lognormal GOF Test					
61	10% Shapiro Wilk Critical Value					0.792	Data appear Lognormal at 10% Significance Level					
62	Lilliefors Test Statistic					0.298	Lilliefors Lognormal GOF Test					
63	10% Lilliefors Critical Value					0.346	Data appear Lognormal at 10% Significance Level					
64	Data appear Lognormal at 10% Significance Level											
65	Note GOF tests may be unreliable for small sample sizes											
66												
67	Lognormal Statistics											
68	Minimum of Logged Data					2.639	Mean of logged Data					2.875
69	Maximum of Logged Data					3.045	SD of logged Data					0.203
70												
71	Assuming Lognormal Distribution											
72	95% H-UCL					24.18	90% Chebyshev (MVUE) UCL					23.47
73	95% Chebyshev (MVUE) UCL					25.94	97.5% Chebyshev (MVUE) UCL					29.38
74	99% Chebyshev (MVUE) UCL					36.13						
75												
76	Nonparametric Distribution Free UCL Statistics											
77	Data appear to follow a Discernible Distribution											
78												
79	Nonparametric Distribution Free UCLs											
80	95% CLT UCL					20.93	95% BCA Bootstrap UCL					N/A
81	95% Standard Bootstrap UCL					N/A	95% Bootstrap-t UCL					N/A
82	95% Hall's Bootstrap UCL					N/A	95% Percentile Bootstrap UCL					N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					23.34	95% Chebyshev(Mean, Sd) UCL					25.76
84	97.5% Chebyshev(Mean, Sd) UCL					29.11	99% Chebyshev(Mean, Sd) UCL					35.71
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					22.19						
88	**Recommended UCL exceeds the maximum observation**											
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												
94	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
95	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
96												

	A-E	F	G-K	L
1	**UCL Statistics for Uncensored Full Data Sets**			
2				
3	User Selected Options			
4	Date/Time of Computation	ProUCL 5.2 10/31/2024 2:44:38 PM		
5	From File	ProUCL Input.xls		
6	Full Precision	OFF		
7	Confidence Coefficient	95%		
8	Number of Bootstrap Operations	2000		
9				
10				
11	TL-WRA-0.5-1			
12				
13	**General Statistics**			
14	Total Number of Observations	4	Number of Distinct Observations	4
15			Number of Missing Observations	0
16	Minimum	131	Mean	153.5
17	Maximum	176	Median	153.5
18	SD	18.41	Std. Error of Mean	9.206
19	Coefficient of Variation	0.12	Skewness	0
20				
21	**Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,**			
22	**refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,**			
23	**but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).**			
24	**The Chebyshev UCL often results in gross overestimates of the mean.**			
25	**Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.**			
26				
27	**Normal GOF Test**			
28	Shapiro Wilk Test Statistic	0.971	**Shapiro Wilk GOF Test**	
29	1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level	
30	Lilliefors Test Statistic	0.218	**Lilliefors GOF Test**	
31	1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level	
32	**Data appear Normal at 1% Significance Level**			
33	**Note GOF tests may be unreliable for small sample sizes**			
34				
35	**Assuming Normal Distribution**			
36	**95% Normal UCL**		**95% UCLs (Adjusted for Skewness)**	
37	95% Student's-t UCL	175.2	95% Adjusted-CLT UCL (Chen-1995)	168.6
38			95% Modified-t UCL (Johnson-1978)	175.2
39				
40	**Gamma GOF Test**			
41	A-D Test Statistic	0.268	**Anderson-Darling Gamma GOF Test**	
42	5% A-D Critical Value	0.656	Detected data appear Gamma Distributed at 5% Significance Level	
43	K-S Test Statistic	0.226	**Kolmogorov-Smirnov Gamma GOF Test**	
44	5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level	
45	**Detected data appear Gamma Distributed at 5% Significance Level**			
46	**Note GOF tests may be unreliable for small sample sizes**			
47				
48	**Gamma Statistics**			
49	k hat (MLE)	91.85	k star (bias corrected MLE)	23.13
50	Theta hat (MLE)	1.671	Theta star (bias corrected MLE)	6.637
51	nu hat (MLE)	734.8	nu star (bias corrected)	185
52	MLE Mean (bias corrected)	153.5	MLE Sd (bias corrected)	31.92
53			Approximate Chi Square Value (0.05)	154.6
54	Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A
55				
56	**Assuming Gamma Distribution**			
57	95% Approximate Gamma UCL	183.8	95% Adjusted Gamma UCL	N/A
58				
59	**Lognormal GOF Test**			
60	Shapiro Wilk Test Statistic	0.968	**Shapiro Wilk Lognormal GOF Test**	
61	10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level	
62	Lilliefors Test Statistic	0.236	**Lilliefors Lognormal GOF Test**	
63	10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level	
64	**Data appear Lognormal at 10% Significance Level**			
65	**Note GOF tests may be unreliable for small sample sizes**			
66				
67	**Lognormal Statistics**			
68	Minimum of Logged Data	4.875	Mean of logged Data	5.028
69	Maximum of Logged Data	5.17	SD of logged Data	0.121
70				
71	**Assuming Lognormal Distribution**			
72	95% H-UCL	180.2	90% Chebyshev (MVUE) UCL	181.3
73	95% Chebyshev (MVUE) UCL	193.9	97.5% Chebyshev (MVUE) UCL	211.4
74	99% Chebyshev (MVUE) UCL	245.8		
75				
76	**Nonparametric Distribution Free UCL Statistics**			
77	**Data appear to follow a Discernible Distribution**			
78				
79	**Nonparametric Distribution Free UCLs**			
80	95% CLT UCL	168.6	95% BCA Bootstrap UCL	N/A
81	95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
82	95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					181.1	95% Chebyshev(Mean, Sd) UCL					193.6
84	97.5% Chebyshev(Mean, Sd) UCL					211	99% Chebyshev(Mean, Sd) UCL					245.1
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					175.2						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 2:48:35 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

TL-WRA-0.5-1-DS

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	150	Mean	166.5
Maximum	185	Median	165.5
SD	16.3	Std. Error of Mean	8.15
Coefficient of Variation	0.0979	Skewness	0.2

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.931	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.24	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	185.7	95% Adjusted-CLT UCL (Chen-1995)	180.8
		95% Modified-t UCL (Johnson-1978)	185.8

Gamma GOF Test

A-D Test Statistic	0.32	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.268	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	139.6	k star (bias corrected MLE)	35.06
Theta hat (MLE)	1.193	Theta star (bias corrected MLE)	4.75
nu hat (MLE)	1116	nu star (bias corrected)	280.4
MLE Mean (bias corrected)	166.5	MLE Sd (bias corrected)	28.12
		Approximate Chi Square Value (0.05)	242.7
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	192.4	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.931	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.236	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	5.011	Mean of logged Data	5.111
Maximum of Logged Data	5.22	SD of logged Data	0.0977

Assuming Lognormal Distribution

95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	190.9
95% Chebyshev (MVUE) UCL	201.9	97.5% Chebyshev (MVUE) UCL	217.3
99% Chebyshev (MVUE) UCL	247.4		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	179.9	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					190.9	95% Chebyshev(Mean, Sd) UCL					202
84	97.5% Chebyshev(Mean, Sd) UCL					217.4	99% Chebyshev(Mean, Sd) UCL					247.6
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					185.7						
88	**Recommended UCL exceeds the maximum observation**											
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 2:50:44 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

TL-WRA-0.5-1-DS-2

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	161	Mean	175.3
Maximum	185	Median	177.5
SD	10.14	Std. Error of Mean	5.072
Coefficient of Variation	0.0579	Skewness	-1.239

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.899	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.318	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	187.2	95% Adjusted-CLT UCL (Chen-1995)	180.2
		95% Modified-t UCL (Johnson-1978)	186.7

Gamma GOF Test

A-D Test Statistic	0.412	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.334	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	387.7	k star (bias corrected MLE)	97.1
Theta hat (MLE)	0.452	Theta star (bias corrected MLE)	1.805
nu hat (MLE)	3102	nu star (bias corrected)	776.8
MLE Mean (bias corrected)	175.3	MLE Sd (bias corrected)	17.79
		Approximate Chi Square Value (0.05)	713.1
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	190.9	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.889	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.325	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	5.081	Mean of logged Data	5.165
Maximum of Logged Data	5.22	SD of logged Data	0.059

Assuming Lognormal Distribution

95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	190.8
95% Chebyshev (MVUE) UCL	197.8	97.5% Chebyshev (MVUE) UCL	207.6
99% Chebyshev (MVUE) UCL	226.7		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	183.6	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83			90% Chebyshev(Mean, Sd) UCL			190.5			95% Chebyshev(Mean, Sd) UCL			197.4
84			97.5% Chebyshev(Mean, Sd) UCL			206.9			99% Chebyshev(Mean, Sd) UCL			225.7
85												
86						**Suggested UCL to Use**						
87				95% Student's-t UCL		187.2						
88				**Recommended UCL exceeds the maximum observation**								
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												
94	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
95	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
96												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 2:46:21 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

TL-WRA-0.5-1-DUP

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	133	Mean	159
Maximum	181	Median	161
SD	20	Std. Error of Mean	10
Coefficient of Variation	0.126	Skewness	-0.56

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.982	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.21	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	182.5	95% Adjusted-CLT UCL (Chen-1995)	172.5
		95% Modified-t UCL (Johnson-1978)	182.1

Gamma GOF Test

A-D Test Statistic	0.245	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.656	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.219	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	81.54	k star (bias corrected MLE)	20.55
Theta hat (MLE)	1.95	Theta star (bias corrected MLE)	7.737
nu hat (MLE)	652.3	nu star (bias corrected)	164.4
MLE Mean (bias corrected)	159	MLE Sd (bias corrected)	35.07
		Approximate Chi Square Value (0.05)	135.8
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	192.6	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.968	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.23	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	4.89	Mean of logged Data	5.063
Maximum of Logged Data	5.198	SD of logged Data	0.129

Assuming Lognormal Distribution

95% H-UCL	189	90% Chebyshev (MVUE) UCL	189.8
95% Chebyshev (MVUE) UCL	203.7	97.5% Chebyshev (MVUE) UCL	223.1
99% Chebyshev (MVUE) UCL	261.1		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	175.4	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					189	95% Chebyshev(Mean, Sd) UCL					202.6
84	97.5% Chebyshev(Mean, Sd) UCL					221.4	99% Chebyshev(Mean, Sd) UCL					258.5
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					182.5						
88	**Recommended UCL exceeds the maximum observation**											
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												
94	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
95	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
96												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Uncensored Full Data Sets											
2												
3			User Selected Options									
4			Date/Time of Computation	ProUCL 5.2 10/31/2024 2:52:38 PM								
5			From File	ProUCL Input.xls								
6			Full Precision	OFF								
7			Confidence Coefficient	95%								
8			Number of Bootstrap Operations	2000								
9												
10												
11	TL-WRA-0.5-2											
12												
13	General Statistics											
14					Total Number of Observations	4					Number of Distinct Observations	3
15											Number of Missing Observations	0
16					Minimum	253					Mean	278
17					Maximum	299					Median	280
18					SD	24.47					Std. Error of Mean	12.23
19					Coefficient of Variation	0.088					Skewness	-0.0918
20												
21	Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,											
22	refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,											
23	but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).											
24	The Chebyshev UCL often results in gross overestimates of the mean.											
25	Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.											
26												
27	Normal GOF Test											
28					Shapiro Wilk Test Statistic	0.803	Shapiro Wilk GOF Test					
29					1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level					
30					Lilliefors Test Statistic	0.305	Lilliefors GOF Test					
31					1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level					
32	Data appear Normal at 1% Significance Level											
33	Note GOF tests may be unreliable for small sample sizes											
34												
35	Assuming Normal Distribution											
36	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
37					95% Student's-t UCL	306.8					95% Adjusted-CLT UCL (Chen-1995)	297.5
38											95% Modified-t UCL (Johnson-1978)	306.7
39												
40	Gamma GOF Test											
41					A-D Test Statistic	0.564	Anderson-Darling Gamma GOF Test					
42					5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level					
43					K-S Test Statistic	0.339	Kolmogorov-Smirnov Gamma GOF Test					
44					5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level					
45	Detected data appear Gamma Distributed at 5% Significance Level											
46	Note GOF tests may be unreliable for small sample sizes											
47												
48	Gamma Statistics											
49					k hat (MLE)	171.3					k star (bias corrected MLE)	42.99
50					Theta hat (MLE)	1.623					Theta star (bias corrected MLE)	6.467
51					nu hat (MLE)	1370					nu star (bias corrected)	343.9
52					MLE Mean (bias corrected)	278					MLE Sd (bias corrected)	42.4
53											Approximate Chi Square Value (0.05)	301.9
54					Adjusted Level of Significance	N/A					Adjusted Chi Square Value	N/A
55												
56	Assuming Gamma Distribution											
57					95% Approximate Gamma UCL	316.6					95% Adjusted Gamma UCL	N/A
58												
59	Lognormal GOF Test											
60					Shapiro Wilk Test Statistic	0.808	Shapiro Wilk Lognormal GOF Test					
61					10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level					
62					Lilliefors Test Statistic	0.304	Lilliefors Lognormal GOF Test					
63					10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level					
64	Data appear Lognormal at 10% Significance Level											
65	Note GOF tests may be unreliable for small sample sizes											
66												
67	Lognormal Statistics											
68					Minimum of Logged Data	5.533					Mean of logged Data	5.625
69					Maximum of Logged Data	5.7					SD of logged Data	0.0884
70												
71	Assuming Lognormal Distribution											
72					95% H-UCL	N/A					90% Chebyshev (MVUE) UCL	314.8
73					95% Chebyshev (MVUE) UCL	331.5					97.5% Chebyshev (MVUE) UCL	354.7
74					99% Chebyshev (MVUE) UCL	400.2						
75												
76	Nonparametric Distribution Free UCL Statistics											
77	Data appear to follow a Discernible Distribution											
78												
79	Nonparametric Distribution Free UCLs											
80					95% CLT UCL	298.1					95% BCA Bootstrap UCL	N/A
81					95% Standard Bootstrap UCL	N/A					95% Bootstrap-t UCL	N/A
82					95% Hall's Bootstrap UCL	N/A					95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					314.7	95% Chebyshev(Mean, Sd) UCL					331.3
84	97.5% Chebyshev(Mean, Sd) UCL					354.4	99% Chebyshev(Mean, Sd) UCL					399.7
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					306.8						
88	**Recommended UCL exceeds the maximum observation**											
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												
94	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
95	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
96												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 2:54:29 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

TL-WRA-0.5-3

General Statistics			
Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	321	Mean	371
Maximum	438	Median	369
SD	35.16	Std. Error of Mean	11.12
Coefficient of Variation	0.0948	Skewness	0.551
Normal GOF Test			
Shapiro Wilk Test Statistic	0.976	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.143	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	391.4	95% Adjusted-CLT UCL (Chen-1995)	391.4
		95% Modified-t UCL (Johnson-1978)	391.7
Gamma GOF Test			
A-D Test Statistic	0.146	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.724	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.128	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.266	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	126.2	k star (bias corrected MLE)	88.42
Theta hat (MLE)	2.939	Theta star (bias corrected MLE)	4.196
nu hat (MLE)	2524	nu star (bias corrected)	1768
MLE Mean (bias corrected)	371	MLE Sd (bias corrected)	39.45
		Approximate Chi Square Value (0.05)	1672
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	1655
Assuming Gamma Distribution			
95% Approximate Gamma UCL	392.5	95% Adjusted Gamma UCL	396.3
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.986	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.126	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	5.771	Mean of logged Data	5.912
Maximum of Logged Data	6.082	SD of logged Data	0.0935
Assuming Lognormal Distribution			
95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	403.9
95% Chebyshev (MVUE) UCL	418.8	97.5% Chebyshev (MVUE) UCL	439.5
99% Chebyshev (MVUE) UCL	480.2		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	389.3	95% BCA Bootstrap UCL	390.2
95% Standard Bootstrap UCL	388.3	95% Bootstrap-t UCL	394.5
95% Hall's Bootstrap UCL	395.2	95% Percentile Bootstrap UCL	388.6
90% Chebyshev(Mean, Sd) UCL	404.4	95% Chebyshev(Mean, Sd) UCL	419.5
97.5% Chebyshev(Mean, Sd) UCL	440.4	99% Chebyshev(Mean, Sd) UCL	481.6
Suggested UCL to Use			
95% Student's-t UCL	391.4		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
83												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 2:56:02 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

TL-WRA-0.5-4

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	125	Mean	159
Maximum	193	Median	159
SD	29.44	Std. Error of Mean	14.72
Coefficient of Variation	0.185	Skewness	0

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.991	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.158	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	193.6	95% Adjusted-CLT UCL (Chen-1995)	183.2
		95% Modified-t UCL (Johnson-1978)	193.6

Gamma GOF Test

A-D Test Statistic	0.208	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.656	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.195	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	38.25	k star (bias corrected MLE)	9.729
Theta hat (MLE)	4.157	Theta star (bias corrected MLE)	16.34
nu hat (MLE)	306	nu star (bias corrected)	77.83
MLE Mean (bias corrected)	159	MLE Sd (bias corrected)	50.98
		Approximate Chi Square Value (0.05)	58.51
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	211.5	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.988	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.176	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	4.828	Mean of logged Data	5.056
Maximum of Logged Data	5.263	SD of logged Data	0.188

Assuming Lognormal Distribution

95% H-UCL	208	90% Chebyshev (MVUE) UCL	203.8
95% Chebyshev (MVUE) UCL	224.1	97.5% Chebyshev (MVUE) UCL	252.2
99% Chebyshev (MVUE) UCL	307.5		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	183.2	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					203.2	95% Chebyshev(Mean, Sd) UCL					223.2
84	97.5% Chebyshev(Mean, Sd) UCL					250.9	99% Chebyshev(Mean, Sd) UCL					305.5
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					193.6						
88	**Recommended UCL exceeds the maximum observation**											
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 2:57:47 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

TL-WRB-0.5-1

General Statistics

Total Number of Observations	4	Number of Distinct Observations	3
		Number of Missing Observations	0
Minimum	67	Mean	69.75
Maximum	73	Median	69.5
SD	3.202	Std. Error of Mean	1.601
Coefficient of Variation	0.0459	Skewness	0.0838

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.801	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.305	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	73.52	95% Adjusted-CLT UCL (Chen-1995)	72.45
		95% Modified-t UCL (Johnson-1978)	73.53

Gamma GOF Test

A-D Test Statistic	0.579	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.339	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	633.3	k star (bias corrected MLE)	158.5
Theta hat (MLE)	0.11	Theta star (bias corrected MLE)	0.44
nu hat (MLE)	5066	nu star (bias corrected)	1268
MLE Mean (bias corrected)	69.75	MLE Sd (bias corrected)	5.54
		Approximate Chi Square Value (0.05)	1186
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	74.55	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.798	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.305	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	4.205	Mean of logged Data	4.244
Maximum of Logged Data	4.29	SD of logged Data	0.0459

Assuming Lognormal Distribution

95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	74.55
95% Chebyshev (MVUE) UCL	76.72	97.5% Chebyshev (MVUE) UCL	79.74
99% Chebyshev (MVUE) UCL	85.67		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	72.38	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					74.55	95% Chebyshev(Mean, Sd) UCL					76.73
84	97.5% Chebyshev(Mean, Sd) UCL					79.75	99% Chebyshev(Mean, Sd) UCL					85.68
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					73.52						
88	**Recommended UCL exceeds the maximum observation**											
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												

1	UCL Statistics for Uncensored Full Data Sets			
2				
3	User Selected Options			
4	Date/Time of Computation	ProUCL 5.2 10/31/2024 2:59:12 PM		
5	From File	ProUCL Input.xls		
6	Full Precision	OFF		
7	Confidence Coefficient	95%		
8	Number of Bootstrap Operations	2000		
9				
10				
11	TL-WRB-0.5-2			
12				
13	General Statistics			
14	Total Number of Observations	4	Number of Distinct Observations	4
15			Number of Missing Observations	0
16	Minimum	106	Mean	129.5
17	Maximum	157	Median	127.5
18	SD	20.98	Std. Error of Mean	10.49
19	Coefficient of Variation	0.162	Skewness	0.561
20				
21	**Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,**			
22	**refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,**			
23	**but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).**			
24	**The Chebyshev UCL often results in gross overestimates of the mean.**			
25	**Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.**			
26				
27	Normal GOF Test			
28	Shapiro Wilk Test Statistic	0.957	**Shapiro Wilk GOF Test**	
29	1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level	
30	Lilliefors Test Statistic	0.26	**Lilliefors GOF Test**	
31	1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level	
32	**Data appear Normal at 1% Significance Level**			
33	**Note GOF tests may be unreliable for small sample sizes**			
34				
35	Assuming Normal Distribution			
36	**95% Normal UCL**		**95% UCLs (Adjusted for Skewness)**	
37	95% Student's-t UCL	154.2	95% Adjusted-CLT UCL (Chen-1995)	149.9
38			95% Modified-t UCL (Johnson-1978)	154.7
39				
40	Gamma GOF Test			
41	A-D Test Statistic	0.279	**Anderson-Darling Gamma GOF Test**	
42	5% A-D Critical Value	0.656	Detected data appear Gamma Distributed at 5% Significance Level	
43	K-S Test Statistic	0.243	**Kolmogorov-Smirnov Gamma GOF Test**	
44	5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level	
45	**Detected data appear Gamma Distributed at 5% Significance Level**			
46	**Note GOF tests may be unreliable for small sample sizes**			
47				
48	Gamma Statistics			
49	k hat (MLE)	51.52	k star (bias corrected MLE)	13.05
50	Theta hat (MLE)	2.514	Theta star (bias corrected MLE)	9.926
51	nu hat (MLE)	412.2	nu star (bias corrected)	104.4
52	MLE Mean (bias corrected)	129.5	MLE Sd (bias corrected)	35.85
53			Approximate Chi Square Value (0.05)	81.8
54	Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A
55				
56	Assuming Gamma Distribution			
57	95% Approximate Gamma UCL	165.2	95% Adjusted Gamma UCL	N/A
58				
59	Lognormal GOF Test			
60	Shapiro Wilk Test Statistic	0.967	**Shapiro Wilk Lognormal GOF Test**	
61	10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level	
62	Lilliefors Test Statistic	0.235	**Lilliefors Lognormal GOF Test**	
63	10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level	
64	**Data appear Lognormal at 10% Significance Level**			
65	**Note GOF tests may be unreliable for small sample sizes**			
66				
67	Lognormal Statistics			
68	Minimum of Logged Data	4.663	Mean of logged Data	4.854
69	Maximum of Logged Data	5.056	SD of logged Data	0.161
70				
71	Assuming Lognormal Distribution			
72	95% H-UCL	161.7	90% Chebyshev (MVUE) UCL	160.7
73	95% Chebyshev (MVUE) UCL	174.8	97.5% Chebyshev (MVUE) UCL	194.4
74	99% Chebyshev (MVUE) UCL	232.9		
75				
76	**Nonparametric Distribution Free UCL Statistics**			
77	**Data appear to follow a Discernible Distribution**			
78				
79	Nonparametric Distribution Free UCLs			
80	95% CLT UCL	146.8	95% BCA Bootstrap UCL	N/A
81	95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
82	95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83				90% Chebyshev(Mean, Sd) UCL		161				95% Chebyshev(Mean, Sd) UCL		175.2
84				97.5% Chebyshev(Mean, Sd) UCL		195				99% Chebyshev(Mean, Sd) UCL		233.9
85												
86						**Suggested UCL to Use**						
87				95% Student's-t UCL		154.2						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 3:00:48 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

TL-WRB-0.5-3

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	113	Mean	124.5
Maximum	138	Median	123.5
SD	10.91	Std. Error of Mean	5.454
Coefficient of Variation	0.0876	Skewness	0.419

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.978	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.193	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level	

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	137.3	95% Adjusted-CLT UCL (Chen-1995)	134.7
		95% Modified-t UCL (Johnson-1978)	137.5

Gamma GOF Test

A-D Test Statistic	0.222	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.215	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	175.2	k star (bias corrected MLE)	43.96
Theta hat (MLE)	0.711	Theta star (bias corrected MLE)	2.832
nu hat (MLE)	1401	nu star (bias corrected)	351.7
MLE Mean (bias corrected)	124.5	MLE Sd (bias corrected)	18.78
		Approximate Chi Square Value (0.05)	309.2
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	141.6	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.983	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.186	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level	

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	4.727	Mean of logged Data	4.821
Maximum of Logged Data	4.927	SD of logged Data	0.0871

Assuming Lognormal Distribution

95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	140.8
95% Chebyshev (MVUE) UCL	148.1	97.5% Chebyshev (MVUE) UCL	158.3
99% Chebyshev (MVUE) UCL	178.4		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	133.5	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					140.9	95% Chebyshev(Mean, Sd) UCL					148.3
84	97.5% Chebyshev(Mean, Sd) UCL					158.6	99% Chebyshev(Mean, Sd) UCL					178.8
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					137.3						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

UCL Statistics for Uncensored Full Data Sets			
User Selected Options			
Date/Time of Computation	ProUCL 5.2 10/31/2024 3:02:31 PM		
From File	ProUCL Input.xls		
Full Precision	OFF		
Confidence Coefficient	95%		
Number of Bootstrap Operations	2000		
TL-WRB-0.5-4			
General Statistics			
Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	105	Mean	153.1
Maximum	184	Median	165.5
SD	32.11	Std. Error of Mean	11.35
Coefficient of Variation	0.21	Skewness	-0.637
Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,			
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,			
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).			
The Chebyshev UCL often results in gross overestimates of the mean.			
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.			
Normal GOF Test			
Shapiro Wilk Test Statistic	0.854	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.749	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.222	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.333	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	174.6	95% Adjusted-CLT UCL (Chen-1995)	169.1
		95% Modified-t UCL (Johnson-1978)	174.2
Gamma GOF Test			
A-D Test Statistic	0.624	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.716	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.248	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.294	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Gamma Statistics			
k hat (MLE)	23.7	k star (bias corrected MLE)	14.9
Theta hat (MLE)	6.461	Theta star (bias corrected MLE)	10.28
nu hat (MLE)	379.2	nu star (bias corrected)	238.3
MLE Mean (bias corrected)	153.1	MLE Sd (bias corrected)	39.67
		Approximate Chi Square Value (0.05)	203.6
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	195.5
Assuming Gamma Distribution			
95% Approximate Gamma UCL	179.3	95% Adjusted Gamma UCL	186.7
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.841	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.851	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.249	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.265	Data appear Lognormal at 10% Significance Level	
Data appear Approximate Lognormal at 10% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Lognormal Statistics			
Minimum of Logged Data	4.654	Mean of logged Data	5.01
Maximum of Logged Data	5.215	SD of logged Data	0.226
Assuming Lognormal Distribution			
95% H-UCL	181.9	90% Chebyshev (MVUE) UCL	190.1
95% Chebyshev (MVUE) UCL	206.7	97.5% Chebyshev (MVUE) UCL	229.9
99% Chebyshev (MVUE) UCL	275.3		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	171.8	95% BCA Bootstrap UCL	168.4
95% Standard Bootstrap UCL	170.1	95% Bootstrap-t UCL	171.1
95% Hall's Bootstrap UCL	166.8	95% Percentile Bootstrap UCL	169.8

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					187.2	95% Chebyshev(Mean, Sd) UCL					202.6
84	97.5% Chebyshev(Mean, Sd) UCL					224	99% Chebyshev(Mean, Sd) UCL					266.1
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					174.6						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												
93	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
94	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
95												

Row				
1	UCL Statistics for Uncensored Full Data Sets			
2				
3	User Selected Options			
4	Date/Time of Computation	ProUCL 5.2 10/31/2024 3:03:54 PM		
5	From File	ProUCL Input.xls		
6	Full Precision	OFF		
7	Confidence Coefficient	95%		
8	Number of Bootstrap Operations	2000		
9				
10				
11	**TL-WRC-0.5-1**			
12				
13	**General Statistics**			
14	Total Number of Observations	4	Number of Distinct Observations	3
15			Number of Missing Observations	0
16	Minimum	99	Mean	132.8
17	Maximum	145	Median	143.5
18	SD	22.54	Std. Error of Mean	11.27
19	Coefficient of Variation	0.17	Skewness	-1.977
20				
21	**Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,**			
22	**refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,**			
23	**but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).**			
24	**The Chebyshev UCL often results in gross overestimates of the mean.**			
25	**Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.**			
26				
27	**Normal GOF Test**			
28	Shapiro Wilk Test Statistic	0.676	**Shapiro Wilk GOF Test**	
29	1% Shapiro Wilk Critical Value	0.687	Data Not Normal at 1% Significance Level	
30	Lilliefors Test Statistic	0.409	**Lilliefors GOF Test**	
31	1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level	
32	**Data appear Approximate Normal at 1% Significance Level**			
33	**Note GOF tests may be unreliable for small sample sizes**			
34				
35	**Assuming Normal Distribution**			
36	**95% Normal UCL**		**95% UCLs (Adjusted for Skewness)**	
37	95% Student's-t UCL	159.3	95% Adjusted-CLT UCL (Chen-1995)	139.4
38			95% Modified-t UCL (Johnson-1978)	157.4
39				
40	**Gamma GOF Test**			
41	A-D Test Statistic	0.852	**Anderson-Darling Gamma GOF Test**	
42	5% A-D Critical Value	0.656	Data Not Gamma Distributed at 5% Significance Level	
43	K-S Test Statistic	0.437	**Kolmogorov-Smirnov Gamma GOF Test**	
44	5% K-S Critical Value	0.394	Data Not Gamma Distributed at 5% Significance Level	
45	**Data Not Gamma Distributed at 5% Significance Level**			
46				
47	**Gamma Statistics**			
48	k hat (MLE)	40.61	k star (bias corrected MLE)	10.32
49	Theta hat (MLE)	3.269	Theta star (bias corrected MLE)	12.87
50	nu hat (MLE)	324.8	nu star (bias corrected)	82.54
51	MLE Mean (bias corrected)	132.8	MLE Sd (bias corrected)	41.33
52			Approximate Chi Square Value (0.05)	62.61
53	Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A
54				
55	**Assuming Gamma Distribution**			
56	95% Approximate Gamma UCL	175	95% Adjusted Gamma UCL	N/A
57				
58	**Lognormal GOF Test**			
59	Shapiro Wilk Test Statistic	0.669	**Shapiro Wilk Lognormal GOF Test**	
60	10% Shapiro Wilk Critical Value	0.792	Data Not Lognormal at 10% Significance Level	
61	Lilliefors Test Statistic	0.415	**Lilliefors Lognormal GOF Test**	
62	10% Lilliefors Critical Value	0.346	Data Not Lognormal at 10% Significance Level	
63	**Data Not Lognormal at 10% Significance Level**			
64				
65	**Lognormal Statistics**			
66	Minimum of Logged Data	4.595	Mean of logged Data	4.876
67	Maximum of Logged Data	4.977	SD of logged Data	0.188
68				
69	**Assuming Lognormal Distribution**			
70	95% H-UCL	173.6	90% Chebyshev (MVUE) UCL	170.1
71	95% Chebyshev (MVUE) UCL	187	97.5% Chebyshev (MVUE) UCL	210.5
72	99% Chebyshev (MVUE) UCL	256.5		
73				
74	**Nonparametric Distribution Free UCL Statistics**			
75	**Data appear to follow a Discernible Distribution**			
76				
77	**Nonparametric Distribution Free UCLs**			
78	95% CLT UCL	151.3	95% BCA Bootstrap UCL	N/A
79	95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
80	95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
81	90% Chebyshev(Mean, Sd) UCL	166.6	95% Chebyshev(Mean, Sd) UCL	181.9
82	97.5% Chebyshev(Mean, Sd) UCL	203.1	99% Chebyshev(Mean, Sd) UCL	244.9

	A	B	C	D	E	F	G	H	I	J	K	L
83												
84	**Suggested UCL to Use**											
85				95% Student's-t UCL		159.3						
86	**Recommended UCL exceeds the maximum observation**											
87												
88	When a data set follows an approximate distribution passing only one of the GOF tests,											
89	it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL											
90												
91	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
92	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
93	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
94												
95	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
96	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
97												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 3:05:32 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

TL-WRC-0.5-2

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	188	Mean	200
Maximum	205	Median	203.5
SD	8.042	Std. Error of Mean	4.021
Coefficient of Variation	0.0402	Skewness	-1.938

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.724	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.395	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	209.5	95% Adjusted-CLT UCL (Chen-1995)	202.4
		95% Modified-t UCL (Johnson-1978)	208.8

Gamma GOF Test

A-D Test Statistic	0.744	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.657	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.418	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	802.9	k star (bias corrected MLE)	200.9
Theta hat (MLE)	0.249	Theta star (bias corrected MLE)	0.996
nu hat (MLE)	6423	nu star (bias corrected)	1607
MLE Mean (bias corrected)	200	MLE Sd (bias corrected)	14.11
		Approximate Chi Square Value (0.05)	1515
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	212.2	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.72	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.397	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.236	Mean of logged Data	5.298
Maximum of Logged Data	5.323	SD of logged Data	0.041

Assuming Lognormal Distribution

95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	212.3
95% Chebyshev (MVUE) UCL	217.9	97.5% Chebyshev (MVUE) UCL	225.6
99% Chebyshev (MVUE) UCL	240.8		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	206.6	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
90% Chebyshev(Mean, Sd) UCL	212.1	95% Chebyshev(Mean, Sd) UCL	217.5
97.5% Chebyshev(Mean, Sd) UCL	225.1	99% Chebyshev(Mean, Sd) UCL	240

	A	B	C	D	E	F	G	H	I	J	K	L
83												
84	**Suggested UCL to Use**											
85				95% Student's-t UCL		209.5						
86	**Recommended UCL exceeds the maximum observation**											
87												
88	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
89	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
90	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
91												
92	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
93	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
94												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 12:04:58 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

UMM-TLA-0.5-1

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	53	Mean	84
Maximum	104	Median	95
SD	21.04	Std. Error of Mean	9.407
Coefficient of Variation	0.25	Skewness	-0.916

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.89	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.686	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.299	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.396	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	104.1	95% Adjusted-CLT UCL (Chen-1995)	95.36
		95% Modified-t UCL (Johnson-1978)	103.4

Gamma GOF Test

A-D Test Statistic	0.454	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.679	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.327	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	17.46	k star (bias corrected MLE)	7.119
Theta hat (MLE)	4.81	Theta star (bias corrected MLE)	11.8
nu hat (MLE)	174.6	nu star (bias corrected)	71.19
MLE Mean (bias corrected)	84	MLE Sd (bias corrected)	31.48
		Approximate Chi Square Value (0.05)	52.77
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	45.9

Assuming Gamma Distribution

95% Approximate Gamma UCL	113.3	95% Adjusted Gamma UCL	130.3

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.863	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.806	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.307	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.319	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	3.97	Mean of logged Data	4.402
Maximum of Logged Data	4.644	SD of logged Data	0.279

Assuming Lognormal Distribution

95% H-UCL	117.8	90% Chebyshev (MVUE) UCL	115.5
95% Chebyshev (MVUE) UCL	129.7	97.5% Chebyshev (MVUE) UCL	149.5
99% Chebyshev (MVUE) UCL	188.2		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	99.47	95% BCA Bootstrap UCL	96
95% Standard Bootstrap UCL	97.86	95% Bootstrap-t UCL	100.1
95% Hall's Bootstrap UCL	93.81	95% Percentile Bootstrap UCL	97.6

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					112.2	95% Chebyshev(Mean, Sd) UCL					125
84	97.5% Chebyshev(Mean, Sd) UCL					142.7	99% Chebyshev(Mean, Sd) UCL					177.6
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					104.1						
88	**Recommended UCL exceeds the maximum observation**											
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												
94	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
95	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
96												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 12:53:47 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

UMM-TLA-0.5-2

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	316	Mean	335.8
Maximum	388	Median	319.5
SD	34.93	Std. Error of Mean	17.47
Coefficient of Variation	0.104	Skewness	1.967

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.692	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.403	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	376.9	95% Adjusted-CLT UCL (Chen-1995)	382.8
		95% Modified-t UCL (Johnson-1978)	379.7

Gamma GOF Test

A-D Test Statistic	0.795	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.657	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.422	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	131.2	k star (bias corrected MLE)	32.96
Theta hat (MLE)	2.56	Theta star (bias corrected MLE)	10.19
nu hat (MLE)	1049	nu star (bias corrected)	263.7
MLE Mean (bias corrected)	335.8	MLE Sd (bias corrected)	58.48
		Approximate Chi Square Value (0.05)	227.1
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	389.9	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.698	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.399	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.756	Mean of logged Data	5.813
Maximum of Logged Data	5.961	SD of logged Data	0.0993

Assuming Lognormal Distribution

95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	385.7
95% Chebyshev (MVUE) UCL	408.3	97.5% Chebyshev (MVUE) UCL	439.7
99% Chebyshev (MVUE) UCL	501.4		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	364.5	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
90% Chebyshev(Mean, Sd) UCL	388.1	95% Chebyshev(Mean, Sd) UCL	411.9
97.5% Chebyshev(Mean, Sd) UCL	444.8	99% Chebyshev(Mean, Sd) UCL	509.5

	A	B	C	D	E	F	G	H	I	J	K	L
83												
84	**Suggested UCL to Use**											
85				95% Student's-t UCL		376.9						
86												
87	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
88	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
89	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
90												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 12:56:07 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

UMM-TLA-0.5-3

General Statistics

Total Number of Observations	10	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	11	Mean	80.2
Maximum	152	Median	81.5
SD	57.15	Std. Error of Mean	18.07
Coefficient of Variation	0.713	Skewness	-0.00761

Normal GOF Test

Shapiro Wilk Test Statistic	0.877	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.18	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	113.3	95% Adjusted-CLT UCL (Chen-1995)	109.9
		95% Modified-t UCL (Johnson-1978)	113.3

Gamma GOF Test

A-D Test Statistic	0.694	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.741	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.213	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.272	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.415	k star (bias corrected MLE)	1.057
Theta hat (MLE)	56.69	Theta star (bias corrected MLE)	75.88
nu hat (MLE)	28.29	nu star (bias corrected)	21.14
MLE Mean (bias corrected)	80.2	MLE Sd (bias corrected)	78.01
		Approximate Chi Square Value (0.05)	11.7
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	10.49

Assuming Gamma Distribution

95% Approximate Gamma UCL	145	95% Adjusted Gamma UCL	161.6

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.813	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.869	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.216	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level

Data appear Approximate Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.398	Mean of logged Data	3.991
Maximum of Logged Data	5.024	SD of logged Data	1.078

Assuming Lognormal Distribution

95% H-UCL	312.7	90% Chebyshev (MVUE) UCL	185.3
95% Chebyshev (MVUE) UCL	228.8	97.5% Chebyshev (MVUE) UCL	289.1
99% Chebyshev (MVUE) UCL	407.7		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	109.9	95% BCA Bootstrap UCL	107.7
95% Standard Bootstrap UCL	108.4	95% Bootstrap-t UCL	113.4
95% Hall's Bootstrap UCL	106.4	95% Percentile Bootstrap UCL	107.3
90% Chebyshev(Mean, Sd) UCL	134.4	95% Chebyshev(Mean, Sd) UCL	159
97.5% Chebyshev(Mean, Sd) UCL	193.1	99% Chebyshev(Mean, Sd) UCL	260

Suggested UCL to Use

95% Student's-t UCL	113.3

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
83												
84	Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be											
85	reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.											
86												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 12:57:45 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

UMM-TLA-0.5-4

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	59	Mean	75.5
Maximum	86	Median	78.5
SD	12.71	Std. Error of Mean	6.357
Coefficient of Variation	0.168	Skewness	-0.817

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.886	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.273	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	90.46	95% Adjusted-CLT UCL (Chen-1995)	83.18
		95% Modified-t UCL (Johnson-1978)	90.03

Gamma GOF Test

A-D Test Statistic	0.395	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.656	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.304	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	44.29	k star (bias corrected MLE)	11.24
Theta hat (MLE)	1.705	Theta star (bias corrected MLE)	6.718
nu hat (MLE)	354.3	nu star (bias corrected)	89.91
MLE Mean (bias corrected)	75.5	MLE Sd (bias corrected)	22.52
		Approximate Chi Square Value (0.05)	69.05
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	98.31	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.879	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.269	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	4.078	Mean of logged Data	4.313
Maximum of Logged Data	4.454	SD of logged Data	0.177

Assuming Lognormal Distribution

95% H-UCL	96.84	90% Chebyshev (MVUE) UCL	95.48
95% Chebyshev (MVUE) UCL	104.5	97.5% Chebyshev (MVUE) UCL	117.1
99% Chebyshev (MVUE) UCL	141.7		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	85.96	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					94.57	95% Chebyshev(Mean, Sd) UCL					103.2
84	97.5% Chebyshev(Mean, Sd) UCL					115.2	99% Chebyshev(Mean, Sd) UCL					138.8
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					90.46						
88	**Recommended UCL exceeds the maximum observation**											
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												
94	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
95	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
96												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 12:59:36 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

UMM-TLA-0.5-4-DUP

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	64	Mean	72.5
Maximum	81	Median	72.5
SD	6.952	Std. Error of Mean	3.476
Coefficient of Variation	0.0959	Skewness	0

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7). The Chebyshev UCL often results in gross overestimates of the mean. Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.968	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.221	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	80.68	95% Adjusted-CLT UCL (Chen-1995)	78.22
		95% Modified-t UCL (Johnson-1978)	80.68

Gamma GOF Test

A-D Test Statistic	0.274	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.228	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	144.2	k star (bias corrected MLE)	36.21
Theta hat (MLE)	0.503	Theta star (bias corrected MLE)	2.002
nu hat (MLE)	1153	nu star (bias corrected)	289.7
MLE Mean (bias corrected)	72.5	MLE Sd (bias corrected)	12.05
		Approximate Chi Square Value (0.05)	251.3
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	83.59	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.967	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.236	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	4.159	Mean of logged Data	4.28
Maximum of Logged Data	4.394	SD of logged Data	0.0964

Assuming Lognormal Distribution

95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	82.98
95% Chebyshev (MVUE) UCL	87.73	97.5% Chebyshev (MVUE) UCL	94.31
99% Chebyshev (MVUE) UCL	107.3		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	78.22	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					82.93	95% Chebyshev(Mean, Sd) UCL					87.65
84	97.5% Chebyshev(Mean, Sd) UCL					94.21	99% Chebyshev(Mean, Sd) UCL					107.1
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					80.68						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 1:03:38 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

UMM-TLA-0.5-5

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	31	Mean	38.5
Maximum	46	Median	38.5
SD	6.137	Std. Error of Mean	3.069
Coefficient of Variation	0.159	Skewness	0

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.971	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.218	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	45.72	95% Adjusted-CLT UCL (Chen-1995)	43.55
		95% Modified-t UCL (Johnson-1978)	45.72

Gamma GOF Test

A-D Test Statistic	0.27	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.656	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.231	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	51.64	k star (bias corrected MLE)	13.08
Theta hat (MLE)	0.746	Theta star (bias corrected MLE)	2.944
nu hat (MLE)	413.1	nu star (bias corrected)	104.6
MLE Mean (bias corrected)	38.5	MLE Sd (bias corrected)	10.65
		Approximate Chi Square Value (0.05)	82.01
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	49.11	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.966	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.242	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	3.434	Mean of logged Data	3.641
Maximum of Logged Data	3.829	SD of logged Data	0.162

Assuming Lognormal Distribution

95% H-UCL	48.17	90% Chebyshev (MVUE) UCL	47.83
95% Chebyshev (MVUE) UCL	52.06	97.5% Chebyshev (MVUE) UCL	57.92
99% Chebyshev (MVUE) UCL	69.44		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	43.55	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					47.71	95% Chebyshev(Mean, Sd) UCL					51.88
84	97.5% Chebyshev(Mean, Sd) UCL					57.66	99% Chebyshev(Mean, Sd) UCL					69.03
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					45.72						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 1:05:33 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

UMM-TLA-0.5-5-DUP

General Statistics			
Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	33	Mean	39.75
Maximum	47	Median	39.5
SD	6.801	Std. Error of Mean	3.4
Coefficient of Variation	0.171	Skewness	0.0914

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test			
Shapiro Wilk Test Statistic	0.893	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.258	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	47.75	95% Adjusted-CLT UCL (Chen-1995)	45.51
		95% Modified-t UCL (Johnson-1978)	47.78
Gamma GOF Test			
A-D Test Statistic	0.396	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.656	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.285	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Gamma Statistics			
k hat (MLE)	45.37	k star (bias corrected MLE)	11.51
Theta hat (MLE)	0.876	Theta star (bias corrected MLE)	3.454
nu hat (MLE)	362.9	nu star (bias corrected)	92.07
MLE Mean (bias corrected)	39.75	MLE Sd (bias corrected)	11.72
		Approximate Chi Square Value (0.05)	70.94
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A
Assuming Gamma Distribution			
95% Approximate Gamma UCL	51.59	95% Adjusted Gamma UCL	N/A
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.892	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.25	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Lognormal Statistics			
Minimum of Logged Data	3.497	Mean of logged Data	3.672
Maximum of Logged Data	3.85	SD of logged Data	0.172
Assuming Lognormal Distribution			
95% H-UCL	50.57	90% Chebyshev (MVUE) UCL	49.98
95% Chebyshev (MVUE) UCL	54.62	97.5% Chebyshev (MVUE) UCL	61.05
99% Chebyshev (MVUE) UCL	73.68		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	45.34	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83			90% Chebyshev(Mean, Sd) UCL			49.95			95% Chebyshev(Mean, Sd) UCL			54.57
84			97.5% Chebyshev(Mean, Sd) UCL			60.99			99% Chebyshev(Mean, Sd) UCL			73.58
85												
86						**Suggested UCL to Use**						
87			95% Student's-t UCL			47.75						
88						**Recommended UCL exceeds the maximum observation**						
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												

	A-E	F	G-K	L
1	UCL Statistics for Uncensored Full Data Sets			
2				
3	User Selected Options			
4	Date/Time of Computation	ProUCL 5.2 10/31/2024 1:16:44 PM		
5	From File	ProUCL Input.xls		
6	Full Precision	OFF		
7	Confidence Coefficient	95%		
8	Number of Bootstrap Operations	2000		
9				
10				
11	UMM-TLA-0.5-6			
12				
13	General Statistics			
14	Total Number of Observations	10	Number of Distinct Observations	10
15			Number of Missing Observations	0
16	Minimum	2576	Mean	3074
17	Maximum	3402	Median	3083
18	SD	254.4	Std. Error of Mean	80.46
19	Coefficient of Variation	0.0828	Skewness	-0.618
20				
21	Normal GOF Test			
22	Shapiro Wilk Test Statistic	0.962	Shapiro Wilk GOF Test	
23	1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level	
24	Lilliefors Test Statistic	0.113	Lilliefors GOF Test	
25	1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level	
26	Data appear Normal at 1% Significance Level			
27				
28	Assuming Normal Distribution			
29	95% Normal UCL		95% UCLs (Adjusted for Skewness)	
30	95% Student's-t UCL	3221	95% Adjusted-CLT UCL (Chen-1995)	3190
31			95% Modified-t UCL (Johnson-1978)	3219
32				
33	Gamma GOF Test			
34	A-D Test Statistic	0.218	Anderson-Darling Gamma GOF Test	
35	5% A-D Critical Value	0.724	Detected data appear Gamma Distributed at 5% Significance Level	
36	K-S Test Statistic	0.12	Kolmogorov-Smirnov Gamma GOF Test	
37	5% K-S Critical Value	0.266	Detected data appear Gamma Distributed at 5% Significance Level	
38	Detected data appear Gamma Distributed at 5% Significance Level			
39				
40	Gamma Statistics			
41	k hat (MLE)	156.7	k star (bias corrected MLE)	109.8
42	Theta hat (MLE)	19.61	Theta star (bias corrected MLE)	28
43	nu hat (MLE)	3135	nu star (bias corrected)	2196
44	MLE Mean (bias corrected)	3074	MLE Sd (bias corrected)	293.4
45			Approximate Chi Square Value (0.05)	2088
46	Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	2069
47				
48	Assuming Gamma Distribution			
49	95% Approximate Gamma UCL	3233	95% Adjusted Gamma UCL	3261
50				
51	Lognormal GOF Test			
52	Shapiro Wilk Test Statistic	0.949	Shapiro Wilk Lognormal GOF Test	
53	10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level	
54	Lilliefors Test Statistic	0.129	Lilliefors Lognormal GOF Test	
55	10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level	
56	Data appear Lognormal at 10% Significance Level			
57				
58	Lognormal Statistics			
59	Minimum of Logged Data	7.854	Mean of logged Data	8.028
60	Maximum of Logged Data	8.132	SD of logged Data	0.085
61				
62	Assuming Lognormal Distribution			
63	95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	3322
64	95% Chebyshev (MVUE) UCL	3435	97.5% Chebyshev (MVUE) UCL	3591
65	99% Chebyshev (MVUE) UCL	3897		
66				
67	Nonparametric Distribution Free UCL Statistics			
68	Data appear to follow a Discernible Distribution			
69				
70	Nonparametric Distribution Free UCLs			
71	95% CLT UCL	3206	95% BCA Bootstrap UCL	3187
72	95% Standard Bootstrap UCL	3199	95% Bootstrap-t UCL	3204
73	95% Hall's Bootstrap UCL	3195	95% Percentile Bootstrap UCL	3196
74	90% Chebyshev(Mean, Sd) UCL	3315	95% Chebyshev(Mean, Sd) UCL	3425
75	97.5% Chebyshev(Mean, Sd) UCL	3576	99% Chebyshev(Mean, Sd) UCL	3875
76				
77	Suggested UCL to Use			
78	95% Student's-t UCL	3221		
79				
80	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
81	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.			
82	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			

	A	B	C	D	E	F	G	H	I	J	K	L
83												
84	Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be											
85	reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.											
86												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Uncensored Full Data Sets											
2												
3	User Selected Options											
4	Date/Time of Computation			ProUCL 5.2 10/31/2024 1:20:34 PM								
5	From File			ProUCL Input.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	UMM-TLB-0.5-1											
12												
13	General Statistics											
14	Total Number of Observations					10	Number of Distinct Observations					10
15							Number of Missing Observations					0
16	Minimum					2731	Mean					3120
17	Maximum					3822	Median					3002
18	SD					381.3	Std. Error of Mean					120.6
19	Coefficient of Variation					0.122	Skewness					0.827
20												
21	Normal GOF Test											
22	Shapiro Wilk Test Statistic					0.889	Shapiro Wilk GOF Test					
23	1% Shapiro Wilk Critical Value					0.781	Data appear Normal at 1% Significance Level					
24	Lilliefors Test Statistic					0.227	Lilliefors GOF Test					
25	1% Lilliefors Critical Value					0.304	Data appear Normal at 1% Significance Level					
26	Data appear Normal at 1% Significance Level											
27												
28	Assuming Normal Distribution											
29	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
30	95% Student's-t UCL					3341	95% Adjusted-CLT UCL (Chen-1995)					3352
31							95% Modified-t UCL (Johnson-1978)					3346
32												
33	Gamma GOF Test											
34	A-D Test Statistic					0.485	Anderson-Darling Gamma GOF Test					
35	5% A-D Critical Value					0.724	Detected data appear Gamma Distributed at 5% Significance Level					
36	K-S Test Statistic					0.236	Kolmogorov-Smirnov Gamma GOF Test					
37	5% K-S Critical Value					0.266	Detected data appear Gamma Distributed at 5% Significance Level					
38	Detected data appear Gamma Distributed at 5% Significance Level											
39												
40	Gamma Statistics											
41	k hat (MLE)					77.73	k star (bias corrected MLE)					54.48
42	Theta hat (MLE)					40.14	Theta star (bias corrected MLE)					57.27
43	nu hat (MLE)					1555	nu star (bias corrected)					1090
44	MLE Mean (bias corrected)					3120	MLE Sd (bias corrected)					422.7
45							Approximate Chi Square Value (0.05)					1014
46	Adjusted Level of Significance					0.0267	Adjusted Chi Square Value					1001
47												
48	Assuming Gamma Distribution											
49	95% Approximate Gamma UCL					3353	95% Adjusted Gamma UCL					3395
50												
51	Lognormal GOF Test											
52	Shapiro Wilk Test Statistic					0.9	Shapiro Wilk Lognormal GOF Test					
53	10% Shapiro Wilk Critical Value					0.869	Data appear Lognormal at 10% Significance Level					
54	Lilliefors Test Statistic					0.224	Lilliefors Lognormal GOF Test					
55	10% Lilliefors Critical Value					0.241	Data appear Lognormal at 10% Significance Level					
56	Data appear Lognormal at 10% Significance Level											
57												
58	Lognormal Statistics											
59	Minimum of Logged Data					7.912	Mean of logged Data					8.039
60	Maximum of Logged Data					8.249	SD of logged Data					0.118
61												
62	Assuming Lognormal Distribution											
63	95% H-UCL					3354	90% Chebyshev (MVUE) UCL					3470
64	95% Chebyshev (MVUE) UCL					3629	97.5% Chebyshev (MVUE) UCL					3850
65	99% Chebyshev (MVUE) UCL					4283						
66												
67	Nonparametric Distribution Free UCL Statistics											
68	Data appear to follow a Discernible Distribution											
69												
70	Nonparametric Distribution Free UCLs											
71	95% CLT UCL					3318	95% BCA Bootstrap UCL					3338
72	95% Standard Bootstrap UCL					3310	95% Bootstrap-t UCL					3414
73	95% Hall's Bootstrap UCL					3361	95% Percentile Bootstrap UCL					3316
74	90% Chebyshev(Mean, Sd) UCL					3482	95% Chebyshev(Mean, Sd) UCL					3645
75	97.5% Chebyshev(Mean, Sd) UCL					3873	99% Chebyshev(Mean, Sd) UCL					4320
76												
77	Suggested UCL to Use											
78	95% Student's-t UCL					3341						
79												
80	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
81	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
82	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											

	A	B	C	D	E	F	G	H	I	J	K	L
83												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 1:27:32 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

UMM-TLB-0.5-2

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	221	Mean	1034
Maximum	2865	Median	562.5
SD	945.7	Std. Error of Mean	299.1
Coefficient of Variation	0.915	Skewness	1.152

Normal GOF Test

Shapiro Wilk Test Statistic	0.775	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.781	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.347	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.304	Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1582	95% Adjusted-CLT UCL (Chen-1995)	1642
		95% Modified-t UCL (Johnson-1978)	1600

Gamma GOF Test

A-D Test Statistic	0.747	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.739	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.284	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.271	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.537	k star (bias corrected MLE)	1.143
Theta hat (MLE)	672.6	Theta star (bias corrected MLE)	904.8
nu hat (MLE)	30.74	nu star (bias corrected)	22.85
MLE Mean (bias corrected)	1034	MLE Sd (bias corrected)	967.1
		Approximate Chi Square Value (0.05)	12.98
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	11.7

Assuming Gamma Distribution

95% Approximate Gamma UCL	1820	95% Adjusted Gamma UCL	2018

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.899	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.23	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.398	Mean of logged Data	6.582
Maximum of Logged Data	7.96	SD of logged Data	0.882

Assuming Lognormal Distribution

95% H-UCL	2473	90% Chebyshev (MVUE) UCL	1897
95% Chebyshev (MVUE) UCL	2298	97.5% Chebyshev (MVUE) UCL	2854
99% Chebyshev (MVUE) UCL	3945		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	1526	95% BCA Bootstrap UCL	1585
95% Standard Bootstrap UCL	1492	95% Bootstrap-t UCL	1784
95% Hall's Bootstrap UCL	1411	95% Percentile Bootstrap UCL	1519
90% Chebyshev(Mean, Sd) UCL	1931	95% Chebyshev(Mean, Sd) UCL	2337
97.5% Chebyshev(Mean, Sd) UCL	2901	99% Chebyshev(Mean, Sd) UCL	4009

Suggested UCL to Use

95% H-UCL	2473

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
83												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 1:32:39 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

UMM-TLB-0.5-3

General Statistics			
Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	367	Mean	629.1
Maximum	1143	Median	515
SD	285.1	Std. Error of Mean	90.17
Coefficient of Variation	0.453	Skewness	1.121
Normal GOF Test			
Shapiro Wilk Test Statistic	0.829	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.241	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	794.4	95% Adjusted-CLT UCL (Chen-1995)	811.6
		95% Modified-t UCL (Johnson-1978)	799.7
Gamma GOF Test			
A-D Test Statistic	0.535	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.728	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.218	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.267	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	6.262	k star (bias corrected MLE)	4.45
Theta hat (MLE)	100.5	Theta star (bias corrected MLE)	141.4
nu hat (MLE)	125.2	nu star (bias corrected)	89
MLE Mean (bias corrected)	629.1	MLE Sd (bias corrected)	298.2
		Approximate Chi Square Value (0.05)	68.25
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	65.1
Assuming Gamma Distribution			
95% Approximate Gamma UCL	820.4	95% Adjusted Gamma UCL	860.1
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.897	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.193	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	5.905	Mean of logged Data	6.362
Maximum of Logged Data	7.041	SD of logged Data	0.415
Assuming Lognormal Distribution			
95% H-UCL	845.1	90% Chebyshev (MVUE) UCL	875.2
95% Chebyshev (MVUE) UCL	988.1	97.5% Chebyshev (MVUE) UCL	1145
99% Chebyshev (MVUE) UCL	1453		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	777.4	95% BCA Bootstrap UCL	814.1
95% Standard Bootstrap UCL	774.5	95% Bootstrap-t UCL	912.7
95% Hall's Bootstrap UCL	944.5	95% Percentile Bootstrap UCL	787.4
90% Chebyshev(Mean, Sd) UCL	899.6	95% Chebyshev(Mean, Sd) UCL	1022
97.5% Chebyshev(Mean, Sd) UCL	1192	99% Chebyshev(Mean, Sd) UCL	1526
Suggested UCL to Use			
95% Student's-t UCL	794.4		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
83												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 1:37:00 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

UMM-TLB-0.5-4

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	1127	Mean	1475
Maximum	2033	Median	1364
SD	289.5	Std. Error of Mean	91.54
Coefficient of Variation	0.196	Skewness	0.798

Normal GOF Test

Shapiro Wilk Test Statistic	0.924	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.236	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1642	95% Adjusted-CLT UCL (Chen-1995)	1650
		95% Modified-t UCL (Johnson-1978)	1646

Gamma GOF Test

A-D Test Statistic	0.342	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.724	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.227	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.266	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	30.49	k star (bias corrected MLE)	21.41
Theta hat (MLE)	48.36	Theta star (bias corrected MLE)	68.87
nu hat (MLE)	609.8	nu star (bias corrected)	428.2
MLE Mean (bias corrected)	1475	MLE Sd (bias corrected)	318.7
		Approximate Chi Square Value (0.05)	381.3
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	373.5

Assuming Gamma Distribution

95% Approximate Gamma UCL	1656	95% Adjusted Gamma UCL	1690

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.948	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.213	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	7.027	Mean of logged Data	7.28
Maximum of Logged Data	7.617	SD of logged Data	0.189

Assuming Lognormal Distribution

95% H-UCL	1662	90% Chebyshev (MVUE) UCL	1739
95% Chebyshev (MVUE) UCL	1859	97.5% Chebyshev (MVUE) UCL	2026
99% Chebyshev (MVUE) UCL	2354		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	1625	95% BCA Bootstrap UCL	1646
95% Standard Bootstrap UCL	1621	95% Bootstrap-t UCL	1716
95% Hall's Bootstrap UCL	1660	95% Percentile Bootstrap UCL	1628
90% Chebyshev(Mean, Sd) UCL	1749	95% Chebyshev(Mean, Sd) UCL	1874
97.5% Chebyshev(Mean, Sd) UCL	2046	99% Chebyshev(Mean, Sd) UCL	2385

Suggested UCL to Use

95% Student's-t UCL	1642		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
83												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 1:39:34 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

UMM-TLC-0.5-1

General Statistics			
Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	410	Mean	1073
Maximum	1969	Median	973.5
SD	454	Std. Error of Mean	143.6
Coefficient of Variation	0.423	Skewness	0.577
Normal GOF Test			
Shapiro Wilk Test Statistic	0.959	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.175	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1336	95% Adjusted-CLT UCL (Chen-1995)	1337
		95% Modified-t UCL (Johnson-1978)	1340
Gamma GOF Test			
A-D Test Statistic	0.207	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.729	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.161	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.267	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	5.938	k star (bias corrected MLE)	4.223
Theta hat (MLE)	180.7	Theta star (bias corrected MLE)	254
nu hat (MLE)	118.8	nu star (bias corrected)	84.46
MLE Mean (bias corrected)	1073	MLE Sd (bias corrected)	522
		Approximate Chi Square Value (0.05)	64.28
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	61.23
Assuming Gamma Distribution			
95% Approximate Gamma UCL	1410	95% Adjusted Gamma UCL	1480
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.969	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.156	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	6.016	Mean of logged Data	6.891
Maximum of Logged Data	7.585	SD of logged Data	0.453
Assuming Lognormal Distribution			
95% H-UCL	1510	90% Chebyshev (MVUE) UCL	1548
95% Chebyshev (MVUE) UCL	1761	97.5% Chebyshev (MVUE) UCL	2057
99% Chebyshev (MVUE) UCL	2638		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	1309	95% BCA Bootstrap UCL	1331
95% Standard Bootstrap UCL	1301	95% Bootstrap-t UCL	1375
95% Hall's Bootstrap UCL	1387	95% Percentile Bootstrap UCL	1313
90% Chebyshev(Mean, Sd) UCL	1504	95% Chebyshev(Mean, Sd) UCL	1699
97.5% Chebyshev(Mean, Sd) UCL	1969	99% Chebyshev(Mean, Sd) UCL	2501
Suggested UCL to Use			
95% Student's-t UCL	1336		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
83												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/31/2024 1:42:31 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

UMM-TLC-0.5-2

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	1794	Mean	2621
Maximum	3389	Median	2662
SD	440.6	Std. Error of Mean	139.3
Coefficient of Variation	0.168	Skewness	-0.312

Normal GOF Test

Shapiro Wilk Test Statistic	0.971	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.148	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	2877	95% Adjusted-CLT UCL (Chen-1995)	2836
		95% Modified-t UCL (Johnson-1978)	2874

Gamma GOF Test

A-D Test Statistic	0.306	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.724	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.169	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.266	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	36.94	k star (bias corrected MLE)	25.93
Theta hat (MLE)	70.95	Theta star (bias corrected MLE)	101.1
nu hat (MLE)	738.9	nu star (bias corrected)	518.5
MLE Mean (bias corrected)	2621	MLE Sd (bias corrected)	514.8
		Approximate Chi Square Value (0.05)	466.7
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	458.2

Assuming Gamma Distribution

95% Approximate Gamma UCL	2912	95% Adjusted Gamma UCL	2967

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.944	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.181	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	7.492	Mean of logged Data	7.858
Maximum of Logged Data	8.128	SD of logged Data	0.177

Assuming Lognormal Distribution

95% H-UCL	2932	90% Chebyshev (MVUE) UCL	3065
95% Chebyshev (MVUE) UCL	3265	97.5% Chebyshev (MVUE) UCL	3543
99% Chebyshev (MVUE) UCL	4089		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	2850	95% BCA Bootstrap UCL	2832
95% Standard Bootstrap UCL	2838	95% Bootstrap-t UCL	2851
95% Hall's Bootstrap UCL	2861	95% Percentile Bootstrap UCL	2836
90% Chebyshev(Mean, Sd) UCL	3039	95% Chebyshev(Mean, Sd) UCL	3228
97.5% Chebyshev(Mean, Sd) UCL	3491	99% Chebyshev(Mean, Sd) UCL	4007

Suggested UCL to Use

95% Student's-t UCL	2877

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
83												
84	Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be											
85	reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.											
86												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Uncensored Full Data Sets											
2												
3	User Selected Options											
4	Date/Time of Computation			ProUCL 5.2 10/28/2024 4:42:30 PM								
5	From File			WorkSheet.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	UMM-WRA-0.5-1											
12												
13	General Statistics											
14	Total Number of Observations					10	Number of Distinct Observations					10
15							Number of Missing Observations					0
16	Minimum					597	Mean					905.9
17	Maximum					1876	Median					692
18	SD					408.3	Std. Error of Mean					129.1
19	Coefficient of Variation					0.451	Skewness					1.737
20												
21	Normal GOF Test											
22	Shapiro Wilk Test Statistic					0.772	Shapiro Wilk GOF Test					
23	1% Shapiro Wilk Critical Value					0.781	Data Not Normal at 1% Significance Level					
24	Lilliefors Test Statistic					0.283	Lilliefors GOF Test					
25	1% Lilliefors Critical Value					0.304	Data appear Normal at 1% Significance Level					
26	Data appear Approximate Normal at 1% Significance Level											
27												
28	Assuming Normal Distribution											
29	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
30	95% Student's-t UCL					1143	95% Adjusted-CLT UCL (Chen-1995)					1194
31							95% Modified-t UCL (Johnson-1978)					1154
32												
33	Gamma GOF Test											
34	A-D Test Statistic					0.793	Anderson-Darling Gamma GOF Test					
35	5% A-D Critical Value					0.728	Data Not Gamma Distributed at 5% Significance Level					
36	K-S Test Statistic					0.286	Kolmogorov-Smirnov Gamma GOF Test					
37	5% K-S Critical Value					0.267	Data Not Gamma Distributed at 5% Significance Level					
38	Data Not Gamma Distributed at 5% Significance Level											
39												
40	Gamma Statistics											
41	k hat (MLE)					7.013	k star (bias corrected MLE)					4.976
42	Theta hat (MLE)					129.2	Theta star (bias corrected MLE)					182.1
43	nu hat (MLE)					140.3	nu star (bias corrected)					99.52
44	MLE Mean (bias corrected)					905.9	MLE Sd (bias corrected)					406.1
45							Approximate Chi Square Value (0.05)					77.51
46	Adjusted Level of Significance					0.0267	Adjusted Chi Square Value					74.14
47												
48	Assuming Gamma Distribution											
49	95% Approximate Gamma UCL					1163	95% Adjusted Gamma UCL					1216
50												
51	Lognormal GOF Test											
52	Shapiro Wilk Test Statistic					0.844	Shapiro Wilk Lognormal GOF Test					
53	10% Shapiro Wilk Critical Value					0.869	Data Not Lognormal at 10% Significance Level					
54	Lilliefors Test Statistic					0.27	Lilliefors Lognormal GOF Test					
55	10% Lilliefors Critical Value					0.241	Data Not Lognormal at 10% Significance Level					
56	Data Not Lognormal at 10% Significance Level											
57												
58	Lognormal Statistics											
59	Minimum of Logged Data					6.392	Mean of logged Data					6.736
60	Maximum of Logged Data					7.537	SD of logged Data					0.382
61												
62	Assuming Lognormal Distribution											
63	95% H-UCL					1178	90% Chebyshev (MVUE) UCL					1228
64	95% Chebyshev (MVUE) UCL					1377	97.5% Chebyshev (MVUE) UCL					1584
65	99% Chebyshev (MVUE) UCL					1990						
66												
67	Nonparametric Distribution Free UCL Statistics											
68	Data appear to follow a Discernible Distribution											
69												
70	Nonparametric Distribution Free UCLs											
71	95% CLT UCL					1118	95% BCA Bootstrap UCL					1192
72	95% Standard Bootstrap UCL					1107	95% Bootstrap-t UCL					1347
73	95% Hall's Bootstrap UCL					1282	95% Percentile Bootstrap UCL					1119
74	90% Chebyshev(Mean, Sd) UCL					1293	95% Chebyshev(Mean, Sd) UCL					1469
75	97.5% Chebyshev(Mean, Sd) UCL					1712	99% Chebyshev(Mean, Sd) UCL					2191
76												
77	Suggested UCL to Use											
78	95% Student's-t UCL					1143						
79												
80	When a data set follows an approximate distribution passing only one of the GOF tests,											
81	it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL											
82												

	A	B	C	D	E	F	G	H	I	J	K	L
83	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
84	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
85	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
86												

UCL Statistics for Uncensored Full Data Sets			
User Selected Options			
Date/Time of Computation	ProUCL 5.2 10/28/2024 4:46:10 PM		
From File	WorkSheet.xls		
Full Precision	OFF		
Confidence Coefficient	95%		
Number of Bootstrap Operations	2000		
UMM-WRA-0.5-1-DS			
General Statistics			
Total Number of Observations	7	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	30	Mean	52
Maximum	75	Median	45
SD	15.49	Std. Error of Mean	5.855
Coefficient of Variation	0.298	Skewness	0.193
Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,			
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,			
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).			
The Chebyshev UCL often results in gross overestimates of the mean.			
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.			
Normal GOF Test			
Shapiro Wilk Test Statistic	0.94	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.73	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.246	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.35	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	63.38	95% Adjusted-CLT UCL (Chen-1995)	62.09
		95% Modified-t UCL (Johnson-1978)	63.45
Gamma GOF Test			
A-D Test Statistic	0.344	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.708	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.23	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.312	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Gamma Statistics			
k hat (MLE)	12.68	k star (bias corrected MLE)	7.339
Theta hat (MLE)	4.102	Theta star (bias corrected MLE)	7.085
nu hat (MLE)	177.5	nu star (bias corrected)	102.7
MLE Mean (bias corrected)	52	MLE Sd (bias corrected)	19.19
		Approximate Chi Square Value (0.05)	80.36
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	74.4

	A-E	F	G-K	L
56	**Assuming Gamma Distribution**			
57	95% Approximate Gamma UCL	66.49	95% Adjusted Gamma UCL	71.82
58				
59	**Lognormal GOF Test**			
60	Shapiro Wilk Test Statistic	0.936	**Shapiro Wilk Lognormal GOF Test**	
61	10% Shapiro Wilk Critical Value	0.838	Data appear Lognormal at 10% Significance Level	
62	Lilliefors Test Statistic	0.203	**Lilliefors Lognormal GOF Test**	
63	10% Lilliefors Critical Value	0.28	Data appear Lognormal at 10% Significance Level	
64	**Data appear Lognormal at 10% Significance Level**			
65	**Note GOF tests may be unreliable for small sample sizes**			
66				
67	**Lognormal Statistics**			
68	Minimum of Logged Data	3.401	Mean of logged Data	3.911
69	Maximum of Logged Data	4.317	SD of logged Data	0.31
70				
71	**Assuming Lognormal Distribution**			
72	95% H-UCL	69.53	90% Chebyshev (MVUE) UCL	70.41
73	95% Chebyshev (MVUE) UCL	78.72	97.5% Chebyshev (MVUE) UCL	90.26
74	99% Chebyshev (MVUE) UCL	112.9		
75				
76	**Nonparametric Distribution Free UCL Statistics**			
77	**Data appear to follow a Discernible Distribution**			
78				
79	**Nonparametric Distribution Free UCLs**			
80	95% CLT UCL	61.63	95% BCA Bootstrap UCL	61.29
81	95% Standard Bootstrap UCL	61.08	95% Bootstrap-t UCL	64.82
82	95% Hall's Bootstrap UCL	63.84	95% Percentile Bootstrap UCL	61
83	90% Chebyshev(Mean, Sd) UCL	69.57	95% Chebyshev(Mean, Sd) UCL	77.52
84	97.5% Chebyshev(Mean, Sd) UCL	88.57	99% Chebyshev(Mean, Sd) UCL	110.3
85				
86	**Suggested UCL to Use**			
87	95% Student's-t UCL	63.38		
88				
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.			
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			
92				

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 4:48:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

UMM-WRA-0.5-2

General Statistics

Total Number of Observations	10	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	252	Mean	395.1
Maximum	768	Median	354.5
SD	150.9	Std. Error of Mean	47.71
Coefficient of Variation	0.382	Skewness	1.916

Normal GOF Test

Shapiro Wilk Test Statistic	0.805	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.263	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	482.6	95% Adjusted-CLT UCL (Chen-1995)	504.5
		95% Modified-t UCL (Johnson-1978)	487.4

Gamma GOF Test

A-D Test Statistic	0.493	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.725	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.215	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.267	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	9.677	k star (bias corrected MLE)	6.841
Theta hat (MLE)	40.83	Theta star (bias corrected MLE)	57.76
nu hat (MLE)	193.5	nu star (bias corrected)	136.8
MLE Mean (bias corrected)	395.1	MLE Sd (bias corrected)	151.1
		Approximate Chi Square Value (0.05)	110.8
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	106.7

Assuming Gamma Distribution

95% Approximate Gamma UCL	487.9	95% Adjusted Gamma UCL	506.5

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.917	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.194	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.529	Mean of logged Data	5.927
Maximum of Logged Data	6.644	SD of logged Data	0.325

Assuming Lognormal Distribution

95% H-UCL	491.1	90% Chebyshev (MVUE) UCL	515.3
95% Chebyshev (MVUE) UCL	570.7	97.5% Chebyshev (MVUE) UCL	647.6
99% Chebyshev (MVUE) UCL	798.5		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	473.6	95% BCA Bootstrap UCL	510.6
95% Standard Bootstrap UCL	471.2	95% Bootstrap-t UCL	574.9
95% Hall's Bootstrap UCL	868.1	95% Percentile Bootstrap UCL	477.6
90% Chebyshev(Mean, Sd) UCL	538.2	95% Chebyshev(Mean, Sd) UCL	603.1
97.5% Chebyshev(Mean, Sd) UCL	693	99% Chebyshev(Mean, Sd) UCL	869.8

Suggested UCL to Use

95% Student's-t UCL	482.6

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
83												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 4:51:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

UMM-WRA-0.5-2-DS

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	51	Mean	57.25
Maximum	68	Median	55
SD	7.805	Std. Error of Mean	3.902
Coefficient of Variation	0.136	Skewness	1.197

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.881	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.249	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	66.43	95% Adjusted-CLT UCL (Chen-1995)	66.17
		95% Modified-t UCL (Johnson-1978)	66.82

Gamma GOF Test

A-D Test Statistic	0.379	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.656	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.283	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	75.1	k star (bias corrected MLE)	18.94
Theta hat (MLE)	0.762	Theta star (bias corrected MLE)	3.022
nu hat (MLE)	600.8	nu star (bias corrected)	151.5
MLE Mean (bias corrected)	57.25	MLE Sd (bias corrected)	13.15
		Approximate Chi Square Value (0.05)	124.1
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	69.92	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.894	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.251	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	3.932	Mean of logged Data	4.041
Maximum of Logged Data	4.22	SD of logged Data	0.132

Assuming Lognormal Distribution

95% H-UCL	68.3	90% Chebyshev (MVUE) UCL	68.55
95% Chebyshev (MVUE) UCL	73.68	97.5% Chebyshev (MVUE) UCL	80.79
99% Chebyshev (MVUE) UCL	94.76		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	63.67	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83				90% Chebyshev(Mean, Sd) UCL		68.96				95% Chebyshev(Mean, Sd) UCL		74.26
84				97.5% Chebyshev(Mean, Sd) UCL		81.62				99% Chebyshev(Mean, Sd) UCL		96.08
85												
86						Suggested UCL to Use						
87				95% Student's-t UCL		66.43						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 4:57:34 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

UMM-WRA-0.5-4

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	246	Mean	282
Maximum	320	Median	278
SD	32.47	Std. Error of Mean	14.52
Coefficient of Variation	0.115	Skewness	0.153

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.918	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.686	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.206	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.396	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	313	95% Adjusted-CLT UCL (Chen-1995)	306.9
		95% Modified-t UCL (Johnson-1978)	313.1

Gamma GOF Test

A-D Test Statistic	0.321	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.678	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.234	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	94.46	k star (bias corrected MLE)	37.92
Theta hat (MLE)	2.985	Theta star (bias corrected MLE)	7.437
nu hat (MLE)	944.6	nu star (bias corrected)	379.2
MLE Mean (bias corrected)	282	MLE Sd (bias corrected)	45.8
		Approximate Chi Square Value (0.05)	335.1
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	316.7

Assuming Gamma Distribution

95% Approximate Gamma UCL	319.1	95% Adjusted Gamma UCL	337.6

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.921	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.806	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.207	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.319	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	5.505	Mean of logged Data	5.637
Maximum of Logged Data	5.768	SD of logged Data	0.115

Assuming Lognormal Distribution

95% H-UCL	317.9	90% Chebyshev (MVUE) UCL	325.5
95% Chebyshev (MVUE) UCL	345.3	97.5% Chebyshev (MVUE) UCL	372.6
99% Chebyshev (MVUE) UCL	426.4		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	305.9	95% BCA Bootstrap UCL	305.2
95% Standard Bootstrap UCL	303.8	95% Bootstrap-t UCL	325.1
95% Hall's Bootstrap UCL	315.7	95% Percentile Bootstrap UCL	305.2

	A	B	C	D	E	F	G	H	I	J	K	L
83					90% Chebyshev(Mean, Sd) UCL	325.6					95% Chebyshev(Mean, Sd) UCL	345.3
84					97.5% Chebyshev(Mean, Sd) UCL	372.7					99% Chebyshev(Mean, Sd) UCL	426.5
85												
86						**Suggested UCL to Use**						
87					95% Student's-t UCL	313						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Uncensored Full Data Sets											
2												
3	User Selected Options											
4	Date/Time of Computation			ProUCL 5.2 10/28/2024 4:55:41 PM								
5	From File			WorkSheet.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	UMM-WRA-0.5-4-DS											
12												
13	General Statistics											
14	Total Number of Observations					4	Number of Distinct Observations					4
15							Number of Missing Observations					0
16	Minimum					53	Mean					57
17	Maximum					60	Median					57.5
18	SD					2.944	Std. Error of Mean					1.472
19	Coefficient of Variation					0.0516	Skewness					-0.941
20												
21	Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,											
22	refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,											
23	but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).											
24	The Chebyshev UCL often results in gross overestimates of the mean.											
25	Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.											
26												
27	Normal GOF Test											
28	Shapiro Wilk Test Statistic					0.953	Shapiro Wilk GOF Test					
29	1% Shapiro Wilk Critical Value					0.687	Data appear Normal at 1% Significance Level					
30	Lilliefors Test Statistic					0.25	Lilliefors GOF Test					
31	1% Lilliefors Critical Value					0.413	Data appear Normal at 1% Significance Level					
32	Data appear Normal at 1% Significance Level											
33	Note GOF tests may be unreliable for small sample sizes											
34												
35	Assuming Normal Distribution											
36	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
37	95% Student's-t UCL					60.46	95% Adjusted-CLT UCL (Chen-1995)					58.68
38							95% Modified-t UCL (Johnson-1978)					60.35
39												
40	Gamma GOF Test											
41	A-D Test Statistic					0.291	Anderson-Darling Gamma GOF Test					
42	5% A-D Critical Value					0.657	Detected data appear Gamma Distributed at 5% Significance Level					
43	K-S Test Statistic					0.256	Kolmogorov-Smirnov Gamma GOF Test					
44	5% K-S Critical Value					0.394	Detected data appear Gamma Distributed at 5% Significance Level					
45	Detected data appear Gamma Distributed at 5% Significance Level											
46	Note GOF tests may be unreliable for small sample sizes											
47												
48	Gamma Statistics											
49	k hat (MLE)					491	k star (bias corrected MLE)					122.9
50	Theta hat (MLE)					0.116	Theta star (bias corrected MLE)					0.464
51	nu hat (MLE)					3928	nu star (bias corrected)					983.4
52	MLE Mean (bias corrected)					57	MLE Sd (bias corrected)					5.141
53							Approximate Chi Square Value (0.05)					911.6
54	Adjusted Level of Significance					N/A	Adjusted Chi Square Value					N/A
55												
56	Assuming Gamma Distribution											
57	95% Approximate Gamma UCL					61.49	95% Adjusted Gamma UCL					N/A
58												
59	Lognormal GOF Test											
60	Shapiro Wilk Test Statistic					0.945	Shapiro Wilk Lognormal GOF Test					
61	10% Shapiro Wilk Critical Value					0.792	Data appear Lognormal at 10% Significance Level					
62	Lilliefors Test Statistic					0.258	Lilliefors Lognormal GOF Test					
63	10% Lilliefors Critical Value					0.346	Data appear Lognormal at 10% Significance Level					
64	Data appear Lognormal at 10% Significance Level											
65	Note GOF tests may be unreliable for small sample sizes											
66												
67	Lognormal Statistics											
68	Minimum of Logged Data					3.97	Mean of logged Data					4.042
69	Maximum of Logged Data					4.094	SD of logged Data					0.0524
70												
71	Assuming Lognormal Distribution											
72	95% H-UCL					N/A	90% Chebyshev (MVUE) UCL					61.48
73	95% Chebyshev (MVUE) UCL					63.5	97.5% Chebyshev (MVUE) UCL					66.32
74	99% Chebyshev (MVUE) UCL					71.84						
75												
76	Nonparametric Distribution Free UCL Statistics											
77	Data appear to follow a Discernible Distribution											
78												
79	Nonparametric Distribution Free UCLs											
80	95% CLT UCL					59.42	95% BCA Bootstrap UCL					N/A
81	95% Standard Bootstrap UCL					N/A	95% Bootstrap-t UCL					N/A
82	95% Hall's Bootstrap UCL					N/A	95% Percentile Bootstrap UCL					N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83					90% Chebyshev(Mean, Sd) UCL	61.42					95% Chebyshev(Mean, Sd) UCL	63.42
84					97.5% Chebyshev(Mean, Sd) UCL	66.19					99% Chebyshev(Mean, Sd) UCL	71.65
85												
86	**Suggested UCL to Use**											
87					95% Student's-t UCL	60.46						
88	**Recommended UCL exceeds the maximum observation**											
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
92	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
93												
94	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
95	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
96												

UCL Statistics for Uncensored Full Data Sets											
User Selected Options											
Date/Time of Computation			ProUCL 5.2 10/28/2024 8:40:49 PM								
From File			ProUCL Input.xls								
Full Precision			OFF								
Confidence Coefficient			95%								
Number of Bootstrap Operations			2000								

UMM-WRA-0.5-6

General Statistics			
Total Number of Observations	10	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	304	Mean	671.2
Maximum	1119	Median	663
SD	248.1	Std. Error of Mean	78.44
Coefficient of Variation	0.37	Skewness	0.384
Normal GOF Test			
Shapiro Wilk Test Statistic	0.966	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.187	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	815	95% Adjusted-CLT UCL (Chen-1995)	810.4
		95% Modified-t UCL (Johnson-1978)	816.6
Gamma GOF Test			
A-D Test Statistic	0.2	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.727	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.14	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.267	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	7.779	k star (bias corrected MLE)	5.512
Theta hat (MLE)	86.28	Theta star (bias corrected MLE)	121.8
nu hat (MLE)	155.6	nu star (bias corrected)	110.2
MLE Mean (bias corrected)	671.2	MLE Sd (bias corrected)	285.9
		Approximate Chi Square Value (0.05)	87.01
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	83.43
Assuming Gamma Distribution			
95% Approximate Gamma UCL	850.4	95% Adjusted Gamma UCL	887
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.97	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.145	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	5.717	Mean of logged Data	6.443
Maximum of Logged Data	7.02	SD of logged Data	0.392
Assuming Lognormal Distribution			
95% H-UCL	890.3	90% Chebyshev (MVUE) UCL	926.2
95% Chebyshev (MVUE) UCL	1041	97.5% Chebyshev (MVUE) UCL	1200
99% Chebyshev (MVUE) UCL	1512		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	800.2	95% BCA Bootstrap UCL	806.2
95% Standard Bootstrap UCL	793.7	95% Bootstrap-t UCL	840.9
95% Hall's Bootstrap UCL	838.3	95% Percentile Bootstrap UCL	797.7
90% Chebyshev(Mean, Sd) UCL	906.5	95% Chebyshev(Mean, Sd) UCL	1013
97.5% Chebyshev(Mean, Sd) UCL	1161	99% Chebyshev(Mean, Sd) UCL	1452
Suggested UCL to Use			
95% Student's-t UCL	815		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
83												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 8:43:14 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

UMM-WRA-0.5-7

General Statistics			
Total Number of Observations	10	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	326	Mean	528
Maximum	975	Median	498
SD	175.6	Std. Error of Mean	55.53
Coefficient of Variation	0.333	Skewness	2.027
Normal GOF Test			
Shapiro Wilk Test Statistic	0.795	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.25	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	629.8	95% Adjusted-CLT UCL (Chen-1995)	657.4
		95% Modified-t UCL (Johnson-1978)	635.7
Gamma GOF Test			
A-D Test Statistic	0.568	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.725	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.222	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.267	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	12.52	k star (bias corrected MLE)	8.829
Theta hat (MLE)	42.18	Theta star (bias corrected MLE)	59.81
nu hat (MLE)	250.3	nu star (bias corrected)	176.6
MLE Mean (bias corrected)	528	MLE Sd (bias corrected)	177.7
		Approximate Chi Square Value (0.05)	146.8
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	142.1
Assuming Gamma Distribution			
95% Approximate Gamma UCL	634.9	95% Adjusted Gamma UCL	656
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.91	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.203	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	5.787	Mean of logged Data	6.229
Maximum of Logged Data	6.882	SD of logged Data	0.287
Assuming Lognormal Distribution			
95% H-UCL	637.7	90% Chebyshev (MVUE) UCL	670.5
95% Chebyshev (MVUE) UCL	735.9	97.5% Chebyshev (MVUE) UCL	826.6
99% Chebyshev (MVUE) UCL	1005		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	619.3	95% BCA Bootstrap UCL	663.6
95% Standard Bootstrap UCL	615.4	95% Bootstrap-t UCL	714.1
95% Hall's Bootstrap UCL	1078	95% Percentile Bootstrap UCL	630.5
90% Chebyshev(Mean, Sd) UCL	694.6	95% Chebyshev(Mean, Sd) UCL	770
97.5% Chebyshev(Mean, Sd) UCL	874.8	99% Chebyshev(Mean, Sd) UCL	1080
Suggested UCL to Use			
95% Student's-t UCL	629.8		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
83												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 8:45:25 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

UMM-WRA-0.5-8

General Statistics			
Total Number of Observations	10	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	532	Mean	645.6
Maximum	873	Median	601.5
SD	110.7	Std. Error of Mean	35
Coefficient of Variation	0.171	Skewness	1.347
Normal GOF Test			
Shapiro Wilk Test Statistic	0.83	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.253	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	709.8	95% Adjusted-CLT UCL (Chen-1995)	719.1
		95% Modified-t UCL (Johnson-1978)	712.2
Gamma GOF Test			
A-D Test Statistic	0.728	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.724	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.253	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.266	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data follow Appr. Gamma Distribution at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	41.75	k star (bias corrected MLE)	29.29
Theta hat (MLE)	15.47	Theta star (bias corrected MLE)	22.04
nu hat (MLE)	834.9	nu star (bias corrected)	585.8
MLE Mean (bias corrected)	645.6	MLE Sd (bias corrected)	119.3
		Approximate Chi Square Value (0.05)	530.6
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	521.5
Assuming Gamma Distribution			
95% Approximate Gamma UCL	712.7	95% Adjusted Gamma UCL	725.2
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.867	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.869	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.242	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.241	Data Not Lognormal at 10% Significance Level	
Data Not Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	6.277	Mean of logged Data	6.458
Maximum of Logged Data	6.772	SD of logged Data	0.16
Assuming Lognormal Distribution			
95% H-UCL	712.8	90% Chebyshev (MVUE) UCL	743.2
95% Chebyshev (MVUE) UCL	787.6	97.5% Chebyshev (MVUE) UCL	849.1
99% Chebyshev (MVUE) UCL	970.1		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	703.2	95% BCA Bootstrap UCL	714.7
95% Standard Bootstrap UCL	699.2	95% Bootstrap-t UCL	786.3
95% Hall's Bootstrap UCL	1077	95% Percentile Bootstrap UCL	701.6
90% Chebyshev(Mean, Sd) UCL	750.6	95% Chebyshev(Mean, Sd) UCL	798.2
97.5% Chebyshev(Mean, Sd) UCL	864.2	99% Chebyshev(Mean, Sd) UCL	993.8
Suggested UCL to Use			
95% Student's-t UCL	709.8		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
83												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 9:12:15 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

UMM-WRB-0.5-1

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	8550	Mean	12512
Maximum	16800	Median	13085
SD	2811	Std. Error of Mean	889
Coefficient of Variation	0.225	Skewness	0.0189

Normal GOF Test

Shapiro Wilk Test Statistic	0.947	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.144	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	14142	95% Adjusted-CLT UCL (Chen-1995)	13980
		95% Modified-t UCL (Johnson-1978)	14142

Gamma GOF Test

A-D Test Statistic	0.303	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.725	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.172	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.266	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	21.3	k star (bias corrected MLE)	14.98
Theta hat (MLE)	587.4	Theta star (bias corrected MLE)	835.4
nu hat (MLE)	426	nu star (bias corrected)	299.5
MLE Mean (bias corrected)	12512	MLE Sd (bias corrected)	3233
		Approximate Chi Square Value (0.05)	260.4
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	254.1

Assuming Gamma Distribution

95% Approximate Gamma UCL	14390	95% Adjusted Gamma UCL	14749

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.94	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.172	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	9.054	Mean of logged Data	9.411
Maximum of Logged Data	9.729	SD of logged Data	0.232

Assuming Lognormal Distribution

95% H-UCL	14550	90% Chebyshev (MVUE) UCL	15284
95% Chebyshev (MVUE) UCL	16537	97.5% Chebyshev (MVUE) UCL	18276
99% Chebyshev (MVUE) UCL	21692		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	13974	95% BCA Bootstrap UCL	13868
95% Standard Bootstrap UCL	13917	95% Bootstrap-t UCL	14133
95% Hall's Bootstrap UCL	13945	95% Percentile Bootstrap UCL	13931
90% Chebyshev(Mean, Sd) UCL	15179	95% Chebyshev(Mean, Sd) UCL	16387
97.5% Chebyshev(Mean, Sd) UCL	18064	99% Chebyshev(Mean, Sd) UCL	21357

Suggested UCL to Use

95% Student's-t UCL	14142

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
83												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 9:15:09 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

UMM-WRB-0.5-2

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	1326	Mean	1756
Maximum	2565	Median	1718
SD	386.5	Std. Error of Mean	122.2
Coefficient of Variation	0.22	Skewness	1.001

Normal GOF Test

Shapiro Wilk Test Statistic	0.914	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.167	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1980	95% Adjusted-CLT UCL (Chen-1995)	1998
		95% Modified-t UCL (Johnson-1978)	1986

Gamma GOF Test

A-D Test Statistic	0.306	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.725	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.182	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.266	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	24.76	k star (bias corrected MLE)	17.4
Theta hat (MLE)	70.93	Theta star (bias corrected MLE)	100.9
nu hat (MLE)	495.1	nu star (bias corrected)	347.9
MLE Mean (bias corrected)	1756	MLE Sd (bias corrected)	421
		Approximate Chi Square Value (0.05)	305.7
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	298.8

Assuming Gamma Distribution

95% Approximate Gamma UCL	1998	95% Adjusted Gamma UCL	2044

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.945	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.17	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	7.19	Mean of logged Data	7.45
Maximum of Logged Data	7.85	SD of logged Data	0.209

Assuming Lognormal Distribution

95% H-UCL	2006	90% Chebyshev (MVUE) UCL	2104
95% Chebyshev (MVUE) UCL	2263	97.5% Chebyshev (MVUE) UCL	2483
99% Chebyshev (MVUE) UCL	2914		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	1957	95% BCA Bootstrap UCL	1997
95% Standard Bootstrap UCL	1949	95% Bootstrap-t UCL	2054
95% Hall's Bootstrap UCL	2103	95% Percentile Bootstrap UCL	1959
90% Chebyshev(Mean, Sd) UCL	2123	95% Chebyshev(Mean, Sd) UCL	2289
97.5% Chebyshev(Mean, Sd) UCL	2519	99% Chebyshev(Mean, Sd) UCL	2972

Suggested UCL to Use

95% Student's-t UCL	1980

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
83												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 9:16:40 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

UMM-WRB-0.5-2-DS

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	65	Mean	69
Maximum	78	Median	66.5
SD	6.055	Std. Error of Mean	3.028
Coefficient of Variation	0.0878	Skewness	1.892

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.753	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.379	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	76.13	95% Adjusted-CLT UCL (Chen-1995)	77.04
		95% Modified-t UCL (Johnson-1978)	76.6

Gamma GOF Test

A-D Test Statistic	0.659	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.657	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.394	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	182.3	k star (bias corrected MLE)	45.74
Theta hat (MLE)	0.379	Theta star (bias corrected MLE)	1.509
nu hat (MLE)	1458	nu star (bias corrected)	365.9
MLE Mean (bias corrected)	69	MLE Sd (bias corrected)	10.2
		Approximate Chi Square Value (0.05)	322.6
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	78.27	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.763	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.374	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.174	Mean of logged Data	4.231
Maximum of Logged Data	4.357	SD of logged Data	0.0845

Assuming Lognormal Distribution

95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	77.73
95% Chebyshev (MVUE) UCL	81.69	97.5% Chebyshev (MVUE) UCL	87.18
99% Chebyshev (MVUE) UCL	97.98		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	73.98	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
90% Chebyshev(Mean, Sd) UCL	78.08	95% Chebyshev(Mean, Sd) UCL	82.2
97.5% Chebyshev(Mean, Sd) UCL	87.91	99% Chebyshev(Mean, Sd) UCL	99.12

	A	B	C	D	E	F	G	H	I	J	K	L
83												
84	**Suggested UCL to Use**											
85				95% Student's-t UCL		76.13						
86												
87	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
88	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
89	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
90												

UCL Statistics for Uncensored Full Data Sets	
User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/30/2024 9:26:54 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

UMM-WRB-0.5-3

General Statistics			
Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	683	Mean	878.5
Maximum	1206	Median	860.5
SD	162.4	Std. Error of Mean	51.36
Coefficient of Variation	0.185	Skewness	0.764
Normal GOF Test			
Shapiro Wilk Test Statistic	0.938	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.158	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	972.7	95% Adjusted-CLT UCL (Chen-1995)	976.2
		95% Modified-t UCL (Johnson-1978)	974.7
Gamma GOF Test			
A-D Test Statistic	0.251	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.724	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.168	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.266	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	34.07	k star (bias corrected MLE)	23.92
Theta hat (MLE)	25.79	Theta star (bias corrected MLE)	36.73
nu hat (MLE)	681.4	nu star (bias corrected)	478.3
MLE Mean (bias corrected)	878.5	MLE Sd (bias corrected)	179.6
		Approximate Chi Square Value (0.05)	428.6
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	420.4
Assuming Gamma Distribution			
95% Approximate Gamma UCL	980.4	95% Adjusted Gamma UCL	999.5
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.959	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.155	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	6.526	Mean of logged Data	6.763
Maximum of Logged Data	7.095	SD of logged Data	0.179
Assuming Lognormal Distribution			
95% H-UCL	983.4	90% Chebyshev (MVUE) UCL	1028
95% Chebyshev (MVUE) UCL	1096	97.5% Chebyshev (MVUE) UCL	1190
99% Chebyshev (MVUE) UCL	1375		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	963	95% BCA Bootstrap UCL	968.1
95% Standard Bootstrap UCL	958.9	95% Bootstrap-t UCL	993.2
95% Hall's Bootstrap UCL	983.7	95% Percentile Bootstrap UCL	962.9
90% Chebyshev(Mean, Sd) UCL	1033	95% Chebyshev(Mean, Sd) UCL	1102
97.5% Chebyshev(Mean, Sd) UCL	1199	99% Chebyshev(Mean, Sd) UCL	1390
Suggested UCL to Use			
95% Student's-t UCL	972.7		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
83												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/30/2024 9:29:03 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

UMM-WRB-0.5-4

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	453	Mean	660.3
Maximum	891	Median	664.5
SD	139.3	Std. Error of Mean	44.05
Coefficient of Variation	0.211	Skewness	0.156

Normal GOF Test

Shapiro Wilk Test Statistic	0.977	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.123	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level	

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	741.1	95% Adjusted-CLT UCL (Chen-1995)	735.1
		95% Modified-t UCL (Johnson-1978)	741.4

Gamma GOF Test

A-D Test Statistic	0.173	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.725	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.135	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.266	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	24.58	k star (bias corrected MLE)	17.27
Theta hat (MLE)	26.86	Theta star (bias corrected MLE)	38.23
nu hat (MLE)	491.6	nu star (bias corrected)	345.5
MLE Mean (bias corrected)	660.3	MLE Sd (bias corrected)	158.9
		Approximate Chi Square Value (0.05)	303.4
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	296.5

Assuming Gamma Distribution

95% Approximate Gamma UCL	751.9	95% Adjusted Gamma UCL	769.2

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.976	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.121	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level	

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	6.116	Mean of logged Data	6.472
Maximum of Logged Data	6.792	SD of logged Data	0.215

Assuming Lognormal Distribution

95% H-UCL	758.2	90% Chebyshev (MVUE) UCL	795.6
95% Chebyshev (MVUE) UCL	856.8	97.5% Chebyshev (MVUE) UCL	941.7
99% Chebyshev (MVUE) UCL	1109		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	732.8	95% BCA Bootstrap UCL	728.9
95% Standard Bootstrap UCL	728	95% Bootstrap-t UCL	741
95% Hall's Bootstrap UCL	733.5	95% Percentile Bootstrap UCL	727.7
90% Chebyshev(Mean, Sd) UCL	792.5	95% Chebyshev(Mean, Sd) UCL	852.3
97.5% Chebyshev(Mean, Sd) UCL	935.4	99% Chebyshev(Mean, Sd) UCL	1099

Suggested UCL to Use

95% Student's-t UCL	741.1		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
83												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 8:47:57 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

UUMM-WRA-0.5-1

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	911	Mean	1102
Maximum	1270	Median	1119
SD	117.8	Std. Error of Mean	37.24
Coefficient of Variation	0.107	Skewness	-0.27

Normal GOF Test

Shapiro Wilk Test Statistic	0.962	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.148	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1170	95% Adjusted-CLT UCL (Chen-1995)	1160
		95% Modified-t UCL (Johnson-1978)	1170

Gamma GOF Test

A-D Test Statistic	0.259	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.724	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.16	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.266	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	95.06	k star (bias corrected MLE)	66.61
Theta hat (MLE)	11.59	Theta star (bias corrected MLE)	16.55
nu hat (MLE)	1901	nu star (bias corrected)	1332
MLE Mean (bias corrected)	1102	MLE Sd (bias corrected)	135
		Approximate Chi Square Value (0.05)	1248
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	1234

Assuming Gamma Distribution

95% Approximate Gamma UCL	1176	95% Adjusted Gamma UCL	1190

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.953	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.158	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	6.815	Mean of logged Data	7
Maximum of Logged Data	7.147	SD of logged Data	0.109

Assuming Lognormal Distribution

95% H-UCL	1178	90% Chebyshev (MVUE) UCL	1216
95% Chebyshev (MVUE) UCL	1268	97.5% Chebyshev (MVUE) UCL	1340
99% Chebyshev (MVUE) UCL	1480		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	1163	95% BCA Bootstrap UCL	1162
95% Standard Bootstrap UCL	1160	95% Bootstrap-t UCL	1168
95% Hall's Bootstrap UCL	1160	95% Percentile Bootstrap UCL	1161
90% Chebyshev(Mean, Sd) UCL	1214	95% Chebyshev(Mean, Sd) UCL	1265
97.5% Chebyshev(Mean, Sd) UCL	1335	99% Chebyshev(Mean, Sd) UCL	1473

Suggested UCL to Use

95% Student's-t UCL	1170

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
83												
84	Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be											
85	reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.											
86												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 8:50:02 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

UUMM-WRA-0.5-2

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	1447	Mean	2111
Maximum	3092	Median	2062
SD	559.4	Std. Error of Mean	176.9
Coefficient of Variation	0.265	Skewness	0.549

Normal GOF Test

Shapiro Wilk Test Statistic	0.912	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.224	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2435	95% Adjusted-CLT UCL (Chen-1995)	2435
		95% Modified-t UCL (Johnson-1978)	2440

Gamma GOF Test

A-D Test Statistic	0.4	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.725	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.193	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.266	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	16.33	k star (bias corrected MLE)	11.5
Theta hat (MLE)	129.3	Theta star (bias corrected MLE)	183.6
nu hat (MLE)	326.6	nu star (bias corrected)	230
MLE Mean (bias corrected)	2111	MLE Sd (bias corrected)	622.5
		Approximate Chi Square Value (0.05)	195.9
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	190.4

Assuming Gamma Distribution

95% Approximate Gamma UCL	2478	95% Adjusted Gamma UCL	2550

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.927	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.177	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	7.277	Mean of logged Data	7.624
Maximum of Logged Data	8.037	SD of logged Data	0.261

Assuming Lognormal Distribution

95% H-UCL	2507	90% Chebyshev (MVUE) UCL	2636
95% Chebyshev (MVUE) UCL	2874	97.5% Chebyshev (MVUE) UCL	3204
99% Chebyshev (MVUE) UCL	3853		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	2402	95% BCA Bootstrap UCL	2393
95% Standard Bootstrap UCL	2388	95% Bootstrap-t UCL	2475
95% Hall's Bootstrap UCL	2420	95% Percentile Bootstrap UCL	2382
90% Chebyshev(Mean, Sd) UCL	2642	95% Chebyshev(Mean, Sd) UCL	2882
97.5% Chebyshev(Mean, Sd) UCL	3216	99% Chebyshev(Mean, Sd) UCL	3871

Suggested UCL to Use

95% Student's-t UCL	2435

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
83												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 8:52:14 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

UUMM-WRA-0.5-3

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	1382	Mean	1584
Maximum	1937	Median	1524
SD	194.9	Std. Error of Mean	61.64
Coefficient of Variation	0.123	Skewness	0.697

Normal GOF Test

Shapiro Wilk Test Statistic	0.899	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.185	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1697	95% Adjusted-CLT UCL (Chen-1995)	1700
		95% Modified-t UCL (Johnson-1978)	1699

Gamma GOF Test

A-D Test Statistic	0.448	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.724	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.187	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.266	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	76.07	k star (bias corrected MLE)	53.31
Theta hat (MLE)	20.82	Theta star (bias corrected MLE)	29.71
nu hat (MLE)	1521	nu star (bias corrected)	1066
MLE Mean (bias corrected)	1584	MLE Sd (bias corrected)	216.9
		Approximate Chi Square Value (0.05)	991.5
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	978.9

Assuming Gamma Distribution

95% Approximate Gamma UCL	1703	95% Adjusted Gamma UCL	1725

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.907	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.175	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	7.231	Mean of logged Data	7.361
Maximum of Logged Data	7.569	SD of logged Data	0.12

Assuming Lognormal Distribution

95% H-UCL	1704	90% Chebyshev (MVUE) UCL	1764
95% Chebyshev (MVUE) UCL	1846	97.5% Chebyshev (MVUE) UCL	1959
99% Chebyshev (MVUE) UCL	2182		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	1685	95% BCA Bootstrap UCL	1698
95% Standard Bootstrap UCL	1682	95% Bootstrap-t UCL	1718
95% Hall's Bootstrap UCL	1686	95% Percentile Bootstrap UCL	1685
90% Chebyshev(Mean, Sd) UCL	1769	95% Chebyshev(Mean, Sd) UCL	1852
97.5% Chebyshev(Mean, Sd) UCL	1969	99% Chebyshev(Mean, Sd) UCL	2197

Suggested UCL to Use

95% Student's-t UCL	1697

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
83												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 8:55:20 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

UUMM-WRA-0.5-3-DS

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	19	Mean	24.25
Maximum	35	Median	21.5
SD	7.274	Std. Error of Mean	3.637
Coefficient of Variation	0.3	Skewness	1.822

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.785	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.371	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	32.81	95% Adjusted-CLT UCL (Chen-1995)	33.77
		95% Modified-t UCL (Johnson-1978)	33.36

Gamma GOF Test

A-D Test Statistic	0.555	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.373	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	17.07	k star (bias corrected MLE)	4.434
Theta hat (MLE)	1.421	Theta star (bias corrected MLE)	5.469
nu hat (MLE)	136.6	nu star (bias corrected)	35.47
MLE Mean (bias corrected)	24.25	MLE Sd (bias corrected)	11.52
		Approximate Chi Square Value (0.05)	22.84
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	37.66	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.828	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.349	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data Not Lognormal at 10% Significance Level

Data appear Approximate Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	2.944	Mean of logged Data	3.159
Maximum of Logged Data	3.555	SD of logged Data	0.271

Assuming Lognormal Distribution

95% H-UCL	37.17	90% Chebyshev (MVUE) UCL	33.99
95% Chebyshev (MVUE) UCL	38.43	97.5% Chebyshev (MVUE) UCL	44.59
99% Chebyshev (MVUE) UCL	56.68		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	30.23	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83			90% Chebyshev(Mean, Sd) UCL			35.16			95% Chebyshev(Mean, Sd) UCL			40.1
84			97.5% Chebyshev(Mean, Sd) UCL			46.96			99% Chebyshev(Mean, Sd) UCL			60.44
85												
86						**Suggested UCL to Use**						
87			95% Student's-t UCL			32.81						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 8:58:28 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

UUMM-WRB-0.5-1

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	96	Mean	137.8
Maximum	202	Median	129
SD	37.42	Std. Error of Mean	11.83
Coefficient of Variation	0.272	Skewness	0.618

Normal GOF Test

Shapiro Wilk Test Statistic	0.908	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.179	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	159.5	95% Adjusted-CLT UCL (Chen-1995)	159.7
		95% Modified-t UCL (Johnson-1978)	159.9

Gamma GOF Test

A-D Test Statistic	0.383	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.725	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.191	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.266	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	15.8	k star (bias corrected MLE)	11.13
Theta hat (MLE)	8.721	Theta star (bias corrected MLE)	12.38
nu hat (MLE)	316	nu star (bias corrected)	222.5
MLE Mean (bias corrected)	137.8	MLE Sd (bias corrected)	41.31
		Approximate Chi Square Value (0.05)	189
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	183.6

Assuming Gamma Distribution

95% Approximate Gamma UCL	162.2	95% Adjusted Gamma UCL	167

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.927	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.178	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.564	Mean of logged Data	4.894
Maximum of Logged Data	5.308	SD of logged Data	0.264

Assuming Lognormal Distribution

95% H-UCL	164	90% Chebyshev (MVUE) UCL	172.4
95% Chebyshev (MVUE) UCL	188.1	97.5% Chebyshev (MVUE) UCL	209.9
99% Chebyshev (MVUE) UCL	252.8		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	157.3	95% BCA Bootstrap UCL	159.1
95% Standard Bootstrap UCL	156.7	95% Bootstrap-t UCL	164.5
95% Hall's Bootstrap UCL	157.5	95% Percentile Bootstrap UCL	157.1
90% Chebyshev(Mean, Sd) UCL	173.3	95% Chebyshev(Mean, Sd) UCL	189.4
97.5% Chebyshev(Mean, Sd) UCL	211.7	99% Chebyshev(Mean, Sd) UCL	255.6

Suggested UCL to Use

95% Student's-t UCL	159.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
83												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 9:00:19 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

UUMM-WRC-0.5-1

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	16	Mean	17.75
Maximum	20	Median	17.5
SD	1.708	Std. Error of Mean	0.854
Coefficient of Variation	0.0962	Skewness	0.753

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.972	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.192	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	19.76	95% Adjusted-CLT UCL (Chen-1995)	19.5
		95% Modified-t UCL (Johnson-1978)	19.81

Gamma GOF Test

A-D Test Statistic	0.227	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.189	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	146.8	k star (bias corrected MLE)	36.88
Theta hat (MLE)	0.121	Theta star (bias corrected MLE)	0.481
nu hat (MLE)	1175	nu star (bias corrected)	295
MLE Mean (bias corrected)	17.75	MLE Sd (bias corrected)	2.923
		Approximate Chi Square Value (0.05)	256.2
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	20.44	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.982	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.177	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	2.773	Mean of logged Data	2.873
Maximum of Logged Data	2.996	SD of logged Data	0.0949

Assuming Lognormal Distribution

95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	20.27
95% Chebyshev (MVUE) UCL	21.42	97.5% Chebyshev (MVUE) UCL	23.01
99% Chebyshev (MVUE) UCL	26.13		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	19.15	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83	90% Chebyshev(Mean, Sd) UCL					20.31	95% Chebyshev(Mean, Sd) UCL					21.47
84	97.5% Chebyshev(Mean, Sd) UCL					23.08	99% Chebyshev(Mean, Sd) UCL					26.25
85												
86	**Suggested UCL to Use**											
87	95% Student's-t UCL					19.76						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 9:02:59 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

UUMM-WRD-0.5-1

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	269	Mean	291
Maximum	334	Median	280.5
SD	29.2	Std. Error of Mean	14.6
Coefficient of Variation	0.1	Skewness	1.778

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.798	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.371	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	325.4	95% Adjusted-CLT UCL (Chen-1995)	328.9
		95% Modified-t UCL (Johnson-1978)	327.5

Gamma GOF Test

A-D Test Statistic	0.571	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.384	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	139.8	k star (bias corrected MLE)	35.12
Theta hat (MLE)	2.081	Theta star (bias corrected MLE)	8.286
nu hat (MLE)	1119	nu star (bias corrected)	281
MLE Mean (bias corrected)	291	MLE Sd (bias corrected)	49.1
		Approximate Chi Square Value (0.05)	243.1
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	336.3	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.813	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.364	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data Not Lognormal at 10% Significance Level

Data appear Approximate Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	5.595	Mean of logged Data	5.67
Maximum of Logged Data	5.811	SD of logged Data	0.0964

Assuming Lognormal Distribution

95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	333
95% Chebyshev (MVUE) UCL	352.1	97.5% Chebyshev (MVUE) UCL	378.5
99% Chebyshev (MVUE) UCL	430.4		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	315	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83				90% Chebyshev(Mean, Sd) UCL		334.8				95% Chebyshev(Mean, Sd) UCL		354.6
84				97.5% Chebyshev(Mean, Sd) UCL		382.2				99% Chebyshev(Mean, Sd) UCL		436.3
85												
86						**Suggested UCL to Use**						
87				95% Student's-t UCL		325.4						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 9:04:56 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

UUMM-WRE-0.5-1

General Statistics

Total Number of Observations	4	Number of Distinct Observations	3
		Number of Missing Observations	0
Minimum	24	Mean	24.75
Maximum	26	Median	24.5
SD	0.957	Std. Error of Mean	0.479
Coefficient of Variation	0.0387	Skewness	0.855

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.865	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.687	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.283	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.413	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	25.88	95% Adjusted-CLT UCL (Chen-1995)	25.76
		95% Modified-t UCL (Johnson-1978)	25.91

Gamma GOF Test

A-D Test Statistic	0.427	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.318	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	900.3	k star (bias corrected MLE)	225.2
Theta hat (MLE)	0.0275	Theta star (bias corrected MLE)	0.11
nu hat (MLE)	7202	nu star (bias corrected)	1802
MLE Mean (bias corrected)	24.75	MLE Sd (bias corrected)	1.649
		Approximate Chi Square Value (0.05)	1704
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL	26.17	95% Adjusted Gamma UCL	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.865	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.792	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.284	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.346	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	3.178	Mean of logged Data	3.208
Maximum of Logged Data	3.258	SD of logged Data	0.0384

Assuming Lognormal Distribution

95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	26.17
95% Chebyshev (MVUE) UCL	26.82	97.5% Chebyshev (MVUE) UCL	27.72
99% Chebyshev (MVUE) UCL	29.48		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	25.54	95% BCA Bootstrap UCL	N/A
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A

	A	B	C	D	E	F	G	H	I	J	K	L
83			90% Chebyshev(Mean, Sd) UCL			26.19			95% Chebyshev(Mean, Sd) UCL			26.84
84			97.5% Chebyshev(Mean, Sd) UCL			27.74			99% Chebyshev(Mean, Sd) UCL			29.51
85												
86						**Suggested UCL to Use**						
87			95% Student's-t UCL			25.88						
88												
89	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
90	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
91	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
92												

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/28/2024 9:09:19 PM
From File	ProUCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

UUMM-WRF-0.5-1

General Statistics			
Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	290	Mean	509.4
Maximum	786	Median	501
SD	140.5	Std. Error of Mean	44.42
Coefficient of Variation	0.276	Skewness	0.491
Normal GOF Test			
Shapiro Wilk Test Statistic	0.98	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.136	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	590.8	95% Adjusted-CLT UCL (Chen-1995)	589.8
		95% Modified-t UCL (Johnson-1978)	592
Gamma GOF Test			
A-D Test Statistic	0.143	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.725	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.106	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.266	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	14.5	k star (bias corrected MLE)	10.22
Theta hat (MLE)	35.13	Theta star (bias corrected MLE)	49.86
nu hat (MLE)	290	nu star (bias corrected)	204.3
MLE Mean (bias corrected)	509.4	MLE Sd (bias corrected)	159.4
		Approximate Chi Square Value (0.05)	172.3
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	167.1
Assuming Gamma Distribution			
95% Approximate Gamma UCL	604.3	95% Adjusted Gamma UCL	622.8
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.988	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.116	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	5.67	Mean of logged Data	6.198
Maximum of Logged Data	6.667	SD of logged Data	0.282
Assuming Lognormal Distribution			
95% H-UCL	615.1	90% Chebyshev (MVUE) UCL	646.8
95% Chebyshev (MVUE) UCL	708.9	97.5% Chebyshev (MVUE) UCL	795.1
99% Chebyshev (MVUE) UCL	964.3		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	582.5	95% BCA Bootstrap UCL	589.2
95% Standard Bootstrap UCL	579.6	95% Bootstrap-t UCL	602.8
95% Hall's Bootstrap UCL	612.7	95% Percentile Bootstrap UCL	580.1
90% Chebyshev(Mean, Sd) UCL	642.6	95% Chebyshev(Mean, Sd) UCL	703
97.5% Chebyshev(Mean, Sd) UCL	786.8	99% Chebyshev(Mean, Sd) UCL	951.3
Suggested UCL to Use			
95% Student's-t UCL	590.8		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
83												

Appendix C

Laboratory Analytical Reports

October 23, 2024 Service Request No:K2410639

Don Malkemus
Terraphase Engineering Inc.
610 SW Broadway, Suite 405
Portland, OR 97205

Laboratory Results for: Upper Granite Creek Mines

Dear Don,

Enclosed are the results of the sample(s) submitted to our laboratory October 08, 2024
For your reference, these analyses have been assigned our service request number **K2410639.**

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please contact me if you have any questions. My extension is 3376. You may also contact me via email at Mark.Harris@alsglobal.com.

Respectfully submitted,

ALS Group USA, Corp. dba ALS Environmental

Mark Harris
Project Manager

ADDRESS 1317 S. 13th Avenue, Kelso, WA 98626
PHONE +1 360 577 7222 | FAX +1 360 636 1068
ALS Group USA, Corp.
dba ALS Environmental

Narrative Documents

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

Client: Terraphase Engineering Inc.
Project: Upper Granite Creek Mines
Sample Matrix: Soil

Service Request: K2410639
Date Received: 10/08/2024

CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples for the Tier II level requested by the client.

Sample Receipt:

Twenty soil samples were received for analysis at ALS Environmental on 10/08/2024. Any discrepancies upon initial sample inspection are annotated on the sample receipt and preservation form included within this report. The samples were stored at minimum in accordance with the analytical method requirements.

Metals:

Method 6020B, 10/22/2024: The Relative Percent Difference (RPD) for the replicate analysis of Total Lead in sample UUMM-WRA-0.5-2 was outside the normal ALS control limits. The variability in the results was attributed to the heterogeneous character of the sample. Standard mixing techniques were used, but were not sufficient for complete homogenization of this sample.

Method 7471B, 10/15/2024: The Relative Percent Difference (RPD) for the replicate analysis of Mercury in sample UMM-WRB-0.5-1 was outside the normal ALS control limits. The variability in the results was attributed to the heterogeneous character of the sample. Standard mixing techniques were used, but were not sufficient for complete homogenization of this sample.

Approved by ______________________ Date 10/23/2024

SAMPLE DETECTION SUMMARY

This form includes only detections above the reporting levels. For a full listing of sample results, continue to the Sample Results section of this Report.

CLIENT ID: LMM-WRB-0.5-3-DS — **Lab ID: K2410639-001**

Analyte	Results	Flag	MDL	MRL	Units	Method
Arsenic	29.1		0.05	0.41	mg/Kg	6020B
Solids, Total	95.4				Percent	160.3 Modified

CLIENT ID: UUMM-WRA-0.5-2 — **Lab ID: K2410639-002**

Analyte	Results	Flag	MDL	MRL	Units	Method
Arsenic	1940		1.1	8.8	mg/Kg	6020B
Solids, Total	95.2				Percent	160.3 Modified

CLIENT ID: UUMM-WRF-0.5-1 — **Lab ID: K2410639-003**

Analyte	Results	Flag	MDL	MRL	Units	Method
Arsenic	715		0.05	0.44	mg/Kg	6020B
Solids, Total	95.8				Percent	160.3 Modified

CLIENT ID: UUMM-WRD-0.5-1 — **Lab ID: K2410639-004**

Analyte	Results	Flag	MDL	MRL	Units	Method
Arsenic	269		0.05	0.45	mg/Kg	6020B
Solids, Total	96.4				Percent	160.3 Modified

CLIENT ID: UUMM-WRA-0.5-3 — **Lab ID: K2410639-005**

Analyte	Results	Flag	MDL	MRL	Units	Method
Arsenic	1710		1.1	9.1	mg/Kg	6020B
Arsenic	3440		0.6	4.9	mg/Kg	6020B
Arsenic	176		0.2	1.9	mg/Kg	6020B
Lead	12.6		0.08	0.19	mg/Kg	6020B
Lead	340		0.20	0.49	mg/Kg	6020B
Solids, Total	94.9				Percent	160.3 Modified

CLIENT ID: UUMM-WRA-0.5-3-DUP — **Lab ID: K2410639-006**

Analyte	Results	Flag	MDL	MRL	Units	Method
Arsenic	162		0.2	2.0	mg/Kg	6020B
Arsenic	1470		1.0	8.0	mg/Kg	6020B
Arsenic	3280		0.6	5.0	mg/Kg	6020B
Lead	340		0.20	0.50	mg/Kg	6020B
Lead	7.14		0.08	0.20	mg/Kg	6020B
Solids, Total	94.6				Percent	160.3 Modified

CLIENT ID: UUMM-WRA-0.5-3-DS — **Lab ID: K2410639-007**

Analyte	Results	Flag	MDL	MRL	Units	Method
Arsenic	16.0		0.05	0.44	mg/Kg	6020B
Solids, Total	89.4				Percent	160.3 Modified

CLIENT ID: UMM-WRB-0.5-2 — **Lab ID: K2410639-008**

Analyte	Results	Flag	MDL	MRL	Units	Method
Arsenic	1800		1.0	8.2	mg/Kg	6020B

SAMPLE DETECTION SUMMARY

This form includes only detections above the reporting levels. For a full listing of sample results, continue to the Sample Results section of this Report.

CLIENT ID: UMM-WRB-0.5-2 — **Lab ID: K2410639-008**

Analyte	Results	Flag	MDL	MRL	Units	Method
Solids, Total	95.4				Percent	160.3 Modified

CLIENT ID: UMM-WRB-0.5-2-DS — **Lab ID: K2410639-009**

Analyte	Results	Flag	MDL	MRL	Units	Method
Arsenic	79.2		0.05	0.45	mg/Kg	6020B
Solids, Total	80.9				Percent	160.3 Modified

CLIENT ID: LMM-WRB-0.5-1 — **Lab ID: K2410639-010**

Analyte	Results	Flag	MDL	MRL	Units	Method
Arsenic	1090		0.05	0.42	mg/Kg	6020B
Solids, Total	96.1				Percent	160.3 Modified

CLIENT ID: LMM-WRB-0.5-1-DUP — **Lab ID: K2410639-011**

Analyte	Results	Flag	MDL	MRL	Units	Method
Arsenic	802		0.05	0.42	mg/Kg	6020B
Solids, Total	96.6				Percent	160.3 Modified

CLIENT ID: CM-WRC-0.5-4 — **Lab ID: K2410639-012**

Analyte	Results	Flag	MDL	MRL	Units	Method
Arsenic	650		0.6	4.9	mg/Kg	6020B
Arsenic	292		0.05	0.42	mg/Kg	6020B
Arsenic	33.1		0.2	1.9	mg/Kg	6020B
Lead	2.95		0.08	0.19	mg/Kg	6020B
Lead	10.3		0.20	0.49	mg/Kg	6020B
Solids, Total	95.6				Percent	160.3 Modified

CLIENT ID: UMM-WRA-0.5-1 — **Lab ID: K2410639-013**

Analyte	Results	Flag	MDL	MRL	Units	Method
Arsenic	1300		1.0	8.4	mg/Kg	6020B
Arsenic	1590		0.6	4.9	mg/Kg	6020B
Arsenic	12.7		0.2	2.0	mg/Kg	6020B
Lead	66.0		0.08	0.20	mg/Kg	6020B
Lead	249		0.19	0.49	mg/Kg	6020B
Solids, Total	95.2				Percent	160.3 Modified

CLIENT ID: UMM-WRA-0.5-3 — **Lab ID: K2410639-014**

Analyte	Results	Flag	MDL	MRL	Units	Method
Arsenic	1210		0.05	0.45	mg/Kg	6020B
Solids, Total	91.5				Percent	160.3 Modified

CLIENT ID: UMM-WRA-0.5-1-DS — **Lab ID: K2410639-015**

Analyte	Results	Flag	MDL	MRL	Units	Method
Arsenic	37.5		0.05	0.41	mg/Kg	6020B
Solids, Total	94.4				Percent	160.3 Modified

SAMPLE DETECTION SUMMARY

This form includes only detections above the reporting levels. For a full listing of sample results, continue to the Sample Results section of this Report.

CLIENT ID: UMM-WRA-0.5-1-DS			Lab ID: K2410639-015			
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**

CLIENT ID: LMM-WRA-0.5-3			Lab ID: K2410639-016			
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Arsenic	16.6		0.2	2.0	mg/Kg	6020B
Arsenic	125		0.05	0.44	mg/Kg	6020B
Arsenic	328		0.6	4.9	mg/Kg	6020B
Lead	10.8		0.08	0.20	mg/Kg	6020B
Lead	32.0		0.19	0.49	mg/Kg	6020B
Solids, Total	91.0				Percent	160.3 Modified

CLIENT ID: LMM-WRA-0.5-3-DS			Lab ID: K2410639-017			
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Arsenic	21.6		0.05	0.44	mg/Kg	6020B
Solids, Total	92.2				Percent	160.3 Modified

CLIENT ID: LMM-WRA-0.5-4			Lab ID: K2410639-018			
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Arsenic	2290		1.1	8.8	mg/Kg	6020B
Solids, Total	93.8				Percent	160.3 Modified

CLIENT ID: LMM-WRA-0.5-4-DUP			Lab ID: K2410639-019			
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Arsenic	2570		1.0	8.5	mg/Kg	6020B
Solids, Total	93.7				Percent	160.3 Modified

CLIENT ID: UMM-WRB-0.5-1			Lab ID: K2410639-020			
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Arsenic	14000		5	41	mg/Kg	6020B
Lead	5210		1.6	4.1	mg/Kg	6020B
Mercury	0.663		0.010	0.098	mg/Kg	7471B
Solids, Total	96.3				Percent	160.3 Modified

Sample Receipt Information

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

Client: Terraphase Engineering Inc. **Service Request:** K2410639
Project: Upper Granite Creek Mines/0031.005.001

SAMPLE CROSS-REFERENCE

SAMPLE #	CLIENT SAMPLE ID	DATE	TIME
K2410639-001	LMM-WRB-0.5-3-DS	10/3/2024	1050
K2410639-002	UUMM-WRA-0.5-2	10/2/2024	1330
K2410639-003	UUMM-WRF-0.5-1	10/2/2024	1400
K2410639-004	UUMM-WRD-0.5-1	10/2/2024	1350
K2410639-005	UUMM-WRA-0.5-3	10/2/2024	1345
K2410639-006	UUMM-WRA-0.5-3-DUP	10/2/2024	1344
K2410639-007	UUMM-WRA-0.5-3-DS	10/2/2024	1335
K2410639-008	UMM-WRB-0.5-2	10/2/2024	1320
K2410639-009	UMM-WRB-0.5-2-DS	10/2/2024	1325
K2410639-010	LMM-WRB-0.5-1	10/3/2024	1035
K2410639-011	LMM-WRB-0.5-1-DUP	10/3/2024	1036
K2410639-012	CM-WRC-0.5-4	10/3/2024	1627
K2410639-013	UMM-WRA-0.5-1	10/2/2024	1215
K2410639-014	UMM-WRA-0.5-3	10/2/2024	1150
K2410639-015	UMM-WRA-0.5-1-DS	10/2/2024	1205
K2410639-016	LMM-WRA-0.5-3	10/3/2024	0930
K2410639-017	LMM-WRA-0.5-3-DS	10/3/2024	0925
K2410639-018	LMM-WRA-0.5-4	10/3/2024	0945
K2410639-019	LMM-WRA-0.5-4-DUP	10/3/2024	0946
K2410639-020	UMM-WRB-0.5-1	10/2/2024	1310

140510

CHAIN OF CUSTODY

140510

001, 002, 003

SR#___________

COC Set 1 of 8

COC#___________

1317 South 13th Ave, Kelso, WA 98626 Phone (360) 577-7222 / 800-695-7222 / FAX (360) 636-1068
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K2410639

Project Name	Upper Granite Creek Mines
Project Number	0031.005.001
Project Manager	Don Malkemus
Company	Terraphase Engineering Inc.
Address, City, State	610 SW Broadway Suite 405
Phone #	(503) 943-0384
email	don.malkemus@terraphase.com
Sampler Signature	[signature]
Sampler Printed Name	Don Malkemus

CLIENT SAMPLE ID	LABID	SAMPLING Date	Time	State	Matrix	NUMBER OF CONTAINERS	28D: 7470A / Hg T	28D: 7471B / Hg	180D: 6020B / IVBA (Sieved Total)	180D: 6020B / IVBA Extract	180D: 6020B / Metals T	999D: Grind / GrindSub	999D: SM 2340 B / Hardness Calc	1	2	3	4	5	Remarks
LMM-WRB-0.5-3-DS		10/3	1056		Soil	2					X								+ bag
UVMM-WRA-0.5-2		10/2	1330		Soil	2					X								
UVMM-WRF-0.5-1		10/2	1400		Soil	2					X								
UVMM-WRE-0.5-1		10/2	1355		Soil	2													+ bag HOLD
UVMM-WRD-0.5-1		10/2	1350		Soil	2					X								+ bag
UVMM-WRA-0.5-3		10/2	1345		Soil	2			X	X	X								+ bag
UVMM-WRA-0.5-3-DUP		10/2	1344		Soil	2			X	X	X								+ bag
UVMM-WRB-0.5-1		10/2	1320		Soil	2													HOLD
UVMM-WRA-0.5-3-DS		10/2	1335		Soil	2					X								+ bag
UVMM-TLB-0.5-3		10/2	1640		Soil	2													+ bag HOLD

Report Requirements

- __ I. Routine Report: Method Blank, Surrogate, as required
- __ II. Report Dup., MS, MSD as required
- __ III. CLP Like Summary (no raw data)
- __ IV. Data Validation Report
- __ V. EDD

Invoice Information

P.O.#__________

Bill To: ap@terraphase.com

Turnaround Requirements

- __ 24 hr.
- __ 48 hr.
- __ 5 Day
- X Standard

Requested Report Date

Circle which metals are to be analyzed

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Special Instructions/Comments:

*Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other____ (Circle One)

	Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature	[signature]	Franklin LaBiche	[signature]	Naomi Redlefsen		
Printed Name	Don Malkemus	Franklin LaBiche	Franklin LaBiche	AG		
Firm	TEI	ALS	ALS	10/8/24 1445		
Date/Time	10/8 1306	10/08/24 1306	10/08/24 1445			

140510

CHAIN OF CUSTODY

140510

001, 002, 003

SR#
COC Set 2 of 8
COC#

1317 South 13th Ave, Kelso, WA 98626 Phone (360) 577-7222 / 800-695-7222 / FAX (360) 636-1068
www.alsglobal.com

K2410639

Project Name: Upper Bank Creek Mines
Project Number: 0831.005.001
Project Manager: Dan Malkemus
Company: Terraphase Engineering Inc.
Address, City, State: 610 SW Broadway Suite 405
Phone #: (503) 946-0384
email: dan.malkemus@terraphase.com
Sampler Signature:
Sampler Printed Name: Dan Malkemus

Analysis columns: 28D: 7470A / Hg T; 7471B / Hg. 180D: 6020B / IVBA (Sieved Total); 6020B / IVBA Extract; 6020B / Metals T. 999D: Grind / GrindSub; SM 2340 B / Hardness Calc; 1; 2; 3; 4; 5

CLIENT SAMPLE ID	LABID	Date	Time	Matrix	NUMBER OF CONTAINERS	7470A / Hg T	7471B / Hg	6020B / IVBA (Sieved Total)	6020B / IVBA Extract	6020B / Metals T	Grind / GrindSub	SM 2340 B / Hardness Calc	1	2	3	4	5	Remarks
1. EB-20241003		10/5	0830	H_2O	1					X								
2. EB-20241004		10/4	0800	H_2O	1					X								
3. EB-20241005		10/5	0830	H_2O	1					X								
4. UMM-WRB-0.5-4		10/2	1335	Soil	2													+ bag HOLD
5. UMM-WRB-0.5-2		10/2	1320	Soil	2					X								~~HOLD~~
6. LMM-WRB-0.5-2		10/3	1045	Soil	2													+ bag HOLD
7. UMM-WRB-0.5-2-DS		10/2	1325	Soil	2					X								+ bag
8. LMM-WRB-0.5-1		10/3	1035	Soil	2					X								+ bag ~~HOLD~~
9. LMM-WRB-0.5-3		10/3	1055	Soil	2													+ bag HOLD
10. LMM-WRB-0.5-1-DUP		10/3	1036	Soil	2					X								

Report Requirements
- I. Routine Report: Method Blank, Surrogate, as required
- X II. Report Dup., MS, MSD as required
- III. CLP Like Summary (no raw data)
- IV. Data Validation Report
- V. EDD

Invoice Information
P.O.#
Bill To: ap@terraphase.com

Turnaround Requirements
- 24 hr.
- 48 hr.
- 5 Day
- X Standard

Requested Report Date

Circle which metals are to be analyzed

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Special Instructions/Comments:

*Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other____ (Circle One)

	Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature				Naomi Pedersen		
Printed Name	Dan Malkemus	Franklin LaBiche	Franklin LaBiche	ALS		
Firm	TEI	ALS	ALS	10/8/24 1445		
Date/Time	10/8 1300	10/08/24 1300	10/08/24 1445			

ALS Environmental

140510

CHAIN OF CUSTODY

140510

001, 002, 003

SR# ____

COC Set 3 of 8

COC# ____

1317 South 13th Ave, Kelso, WA 98626 Phone (360) 577-7222 / 800-695-7222 / FAX (360) 636-1068
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K2410639

Project Name: Upper Granite Creek Mines	Project Number: 0031-005.001
Project Manager: Don Malkemus	
Company: Teraphase Engineering	
Address, City, State: 616 SW Broadway Suite 405	
Phone #: (503) 943-0384	email: don.malkemus@teraphase.com
Sampler Signature: [signature]	Sampler Printed Name: Don Malkemus

CLIENT SAMPLE ID	LABID	SAMPLING Date	Time	State	Matrix	NUMBER OF CONTAINERS	28D 7470A / Hg T	28D 7471B / Hg	180D 6020B / IVBA (Sieved Total)	180D 6020B / IVBA Extract	180D 6020B / Metals T	999D Grind / GrindSub	SM 2340 B / Hardness Calc	1	2	3	4	5	Remarks
1. CM-WRC-0.5-4		10/3	1627		Soil	2			X	X	X								+ bag
2. UMM-WRA-0.5-1		10/2	1215		Soil	2			X	X	X								+ bag
3. UMM-WRA-0.5-3		10/2	1150		Soil	2					X								
4. UMM-WRA-0.5-1-DS		10/2	1205		Soil	2					X								
5. LMM-WRA-0.5-3		10/3	0930		Soil	2			X	X	X								+ bag
6. LMM-WRA-0.5-3-DS		10/3	0925		Soil	2					X								
7. LMM-WRA-0.5-4		10/3	0945		Soil	2					X								
8. LMM-WRA-0.5-4-DUP		10/3	0946		Soil	2					X								
9. UMM-WRB-0.5-1		10/2	1310		Soil	2		X			X								+ bag *
10. UMM-WRB-0.5-3		10/2	1330		Soil	2													+ bag HOLD

Report Requirements

___ I. Routine Report: Method Blank, Surrogate, as required

X II. Report Dup., MS, MSD as required

___ III. CLP Like Summary (no raw data)

___ IV. Data Validation Report

___ V. EDD

Invoice Information

P.O.# ____

Bill To: ap@teraphase.com

Turnaround Requirements

___ 24 hr. ___ 48 hr.

___ 5 Day

X Standard

Requested Report Date

Circle which metals are to be analyzed

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

*Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other____ (Circle One)

Special Instructions/Comments:

* Also analyze Pb + Hg on sample 9 (UMM-WRB-0.5-1), note likely high As concentration on this sample (i.e. > 1%)

Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature: [signature]	Signature: [signature]	Signature: [signature]	Signature: Naomi Pedersen	Signature	Signature
Printed Name: Don Malkemus	Printed Name: Franklin LaBiche	Printed Name: Franklin LaBiche	Printed Name: ALS	Printed Name	Printed Name
Firm: TEI	Firm: ALS	Firm: ALS	Firm: 10/8/24 1445	Firm	Firm
Date/Time: 10/8 1306	Date/Time: 10/08/24 1306	Date/Time: 10/08/24 1445	Date/Time	Date/Time	Date/Time

140510

CHAIN OF CUSTODY

140510

001, 002, 003

SR#

COC Set 4 of 8

COC#

1317 South 13th Ave, Kelso, WA 98626 Phone (360) 577-7222 / 800-695-7222 / FAX (360) 636-1068
www.alsglobal.com

K2410639

Project Name: Upper Granite Creek Mines
Project Number: 0031.005.001
Project Manager: Don Malkemus
Company: Tellyphase Engineering Inc.
Address, City, State: 610 SW Broadway Suite 405
Phone #: (503) 993-0384
email: don.malkemus@terraphase.com
Sampler Signature:
Sampler Printed Name: Don Malkemus

CLIENT SAMPLE ID	LABID	SAMPLING Date	Time	State	Matrix	NUMBER OF CONTAINERS	28D 7470A / Hg T	28D 7471B / Hg	180D 6020B / IVBA (Sieved Total)	180D 6020B / IVBA Extract	180D 6020B / Metals T	999D Grind / GrindSub	999D SM 2340 B / Hardness Calc	1	2	3	4	5	Remarks
1. UMM-TLB-0.5-1		10/2	1630		Soil	2		X	X	X	X								+ bag*
2. UMM-TLA-0.5-3		10/2	1530		Soil	2													+ bag HOLD
3. UMM-TLB-0.5-4		10/2	1645		Soil	2					X								+ bag
4. UMM-TLA-0.5-4		10/2	1535		Soil	2													+ bag HOLD
5. UMM-TLC-0.5-1		10/2	1700		Soil	2					X								+ bag
6. UMM-TLC-0.5-2		10/2	1715		Soil	2					X								+ bag
7. UMM-TLB-0.5-2		10/2	1635		Soil	2													+ bag HOLD
8. UMM-TLA-0.5-5		10/2	1540		Soil	2													+ bag HOLD
9. UMM-TLA-0.5-6		10/2	1545		Soil	2		X	X	X	X								+ bag
10.																			

Report Requirements
- __ I. Routine Report: Method Blank, Surrogate, as required
- X II. Report Dup., MS, MSD as required
- __ III. CLP Like Summary (no raw data)
- __ IV. Data Validation Report
- __ V. EDD

Invoice Information
P.O.#
Bill To: ap@terraphase.com

Turnaround Requirements
__ 24 hr. __ 48 hr.
__ 5 Day
X Standard

Requested Report Date

Circle which metals are to be analyzed

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

*Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other____(Circle One)

Special Instructions/Comments:
*Also analyze Pb + Hg on sample 1 (UMM-TLB-0.5-1) and 9 (UMM-TLA-0.5-6)

Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature	Signature	Signature	Signature Naomi Pedersen	Signature	Signature
Printed Name Don Malkemus	Printed Name Franklin LaBiche	Printed Name Franklin LaBiche	Printed Name ALS	Printed Name	Printed Name
Firm TEI	Firm ALS	Firm ALS	Firm 10/8/24 1445	Firm	Firm
Date/Time 10/8 1306	Date/Time 10/08/24 1206	Date/Time 10/08/24 1445	Date/Time	Date/Time	Date/Time

140510

CHAIN OF CUSTODY

140510

001, 002, 003

SR#

COC Set 5 of 8

COC#

1317 South 13th Ave, Kelso, WA 98626 Phone (360) 577-7222 / 800-695-7222 / FAX (360) 636-1068
www.alsglobal.com

K2410639

Project Name: Upper Granite Creek Mines
Project Number: 0031.005.001
Project Manager: Don Malkemus
Company: Terraphase Engineering Inc.
Address, City, State: 610 SW Broadway Suite 405
Phone #: (503) 889-1067
email: don.malkemus@terraphase.com
Sampler Signature: [signature]
Sampler Printed Name: Don Malkemus

CLIENT SAMPLE ID	LABID	Date	Time	State	Matrix	NUMBER OF CONTAINERS	28D 7470A / Hg T	28D 7471B / Hg	180D 6020B / IVBA (Sieved Total)	180D 6020B / IVBA Extract	180D 6020B / Metals T	999D Grind / GrindSub	999D SM 2340 B / Hardness Calc	1	2	3	4	5	Remarks
1. CEM-WRA-0.5-4-DS		10/5	1230		Soil	2					X								
2. CEM-WRB-0.5-1		10/5	1300		Soil	2					X								
3. CEM-WRA-0.5-2		10/5	1205		Soil	2			X	X	X								+ bag
4. CEM-WRC-0.5-1		10/5	1240		Soil	2					X								
5. GF-WRA-0.5-1		10/5	0930		Soil	2					X								
6. GF-WRD-0.5-6		10/5	1110		Soil	2					X								
7. GF-WRD-0.5-4-DS		10/5	1105		Soil	2			X	X	X								+ bag
8. GF-DR-0.5-1		10/5	1035		Soil	2					X								
9. GCS-WRA-0.5-3		10/4	1615		Soil	2					X								
10. GCS-WRA-0.5-4		10/4	1554		Soil	2					X								

Report Requirements

- __ I. Routine Report: Method Blank, Surrogate, as required
- X II. Report Dup., MS, MSD as required
- __ III. CLP Like Summary (no raw data)
- __ IV. Data Validation Report
- __ V. EDD

Invoice Information

P.O.#
Bill To: ap@terraphase.com

Turnaround Requirements

__ 24 hr. __ 48 hr.
__ 5 Day
X Standard

Requested Report Date

Circle which metals are to be analyzed

Total Metals: Al (As) Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Special Instructions/Comments:

*Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other____ (Circle One)

	Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature	[signature]	[signature]	[signature]	Naomi Pedersen		
Printed Name	Don Malkemus	Franklin LaBiche	Franklin LaBiche	ALS		
Firm	TEI	ALS	ALS	10/8/24 1445		
Date/Time	10/8 1306	10/08/24 1306	10/08/24 1445			

ALS

140510

CHAIN OF CUSTODY

140510

001, 002, 003

SR#

COC Set 6 of 8

COC#

1317 South 13th Ave, Kelso, WA 98626 Phone (360) 577-7222 / 800-695-7222 / FAX (360) 636-1068
www.alsglobal.com

K2410639

Project Name	Upper Granit Creek Mines
Project Number	0031.005.001
Project Manager	Don Malkemus
Company	Terraphase Engineering Inc.
Address, City, State	610 SW Broadway Suite 405
Phone #	(503) 943-0384
email	don.malkemus@terraphase.com
Sampler Signature	[signature]
Sampler Printed Name	Don Malkemus

CLIENT SAMPLE ID	LABID	SAMPLING Date	Time	State	Matrix	NUMBER OF CONTAINERS	28D 7470A / Hg T	28D 7471B / Hg	180D 6020B / IVBA (Sieved Total)	180D 6020B / IVBA Extract	180D 6020B / Metals T	999D Grind / GrindSub	999D SM 2340 B / Hardness Calc	1	2	3	4	5	Remarks
1. GC5-WRA-0.5-4-DS		10/4	1555		Soil	2			X	X	X								+ bag
2. GC6-WRA-0.5-2		10/4	1400		Soil	2			X	X	X								+ bag
3. GC6-WRA-0.5-1		10/4	1045		Soil	2					X								
4. GC7-WRA-0.5-3		10/4	1150		Soil	2					X								
5. GC7-WRB-0.5-1		10/4	1115		Soil	2					X								
6. TL-WRA-0.5-3		10/4	1405		Soil	2					X								
7. TL-WRB-0.5-4		10/4	1425		Soil	2					X								
8. TL-WRA-0.5-1-DS-2		10/4	1400		Soil	2			X	X	X								+ bag
9. SH-WRB-0.5-2		10/4	1005		Soil	2					X								
10. SH-WRC-0.5-1		10/4	1015		Soil	2					X								

Report Requirements

- ___ I. Routine Report: Method Blank, Surrogate, as required
- X II. Report Dup., MS, MSD as required
- ___ III. CLP Like Summary (no raw data)
- ___ IV. Data Validation Report
- ___ V. EDD

Invoice Information

P.O.#

Bill To: ap@terraphase.com

Turnaround Requirements

___ 24 hr. ___ 48 hr.
___ 5 Day
X Standard

Requested Report Date

Circle which metals are to be analyzed

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Special Instructions/Comments:

*Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other____(Circle One)

	Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature	[signature]	[signature]	[signature]	Nacoma Pedersen		
Printed Name	Don Malkemus	Franklin LaBiche	Franklin LaBiche	ALS		
Firm	TEI	ALS	ALS	10/8/24 1445		
Date/Time	10/8 1306	10/08/24 1306	10/08/24 1445			

140510

CHAIN OF CUSTODY

140510

001, 002, 003

SR#______

COC Set 7 of 8

COC#______

Page 1 of 1

1317 South 13th Ave, Kelso, WA 98626 Phone (360) 577-7222 / 800-695-7222 / FAX (360) 636-1068
www.alsglobal.com

K2410639

Project Name: Upper Granite Creek Mines	Project Number: 0031.005.001
Project Manager: Don Malkemus	
Company: Terraphase Engineering Inc.	
Address, City, State: 610 SW Broadway Suite 405	
Phone #: (503) 943-0384	email: don.malkemus@terraphase.com
Sampler Signature: [signature]	Sampler Printed Name: Don Malkemus

CLIENT SAMPLE ID	LABID	Sampling Date	Time	State	Matrix	NUMBER OF CONTAINERS	28D 7470A / Hg T	28D 7471B / Hg	180D 6020B / IVBA (Sieved Total)	180D 6020B / IVBA Extract	180D 6020B / Metals T	999D Grind / GrindSub	999D SM 2340 B / Hardness Calc	1	2	3	4	5	Remarks
1. CS-SW-1		10/5	~~1035~~ 1004		H_2O	1	X				X		X						
2. CS-SW-2		10/3	1700		H_2O	1	X				X		X						
3. CS-SW-2-DUP		10/3	1701		H_2O	1	X				X		X						
4. CS-SW-3		10/3	1600		H_2O	1	X				X		X						
5. CS-SW-4		10/3	1419		H_2O	1	X				X		X						
6. CS-SW-5		10/4	0925		H_2O	1	X				X		X						
7. CS-SW-6		10/4	1523		H_2O	1	X				X		X						
8. CS-SW-7		10/4	1334		H_2O	1	X				X		X						
9. CS-SW-8		10/5	1035		H_2O	1	X				X		X						
10.																			

Report Requirements

___ I. Routine Report: Method Blank, Surrogate, as required

X II. Report Dup., MS, MSD as required

___ III. CLP Like Summary (no raw data)

___ IV. Data Validation Report

___ V. EDD

Invoice Information

P.O.#______

Bill To: ap@terraphase.com

Turnaround Requirements

___ 24 hr. ___ 48 hr.

___ 5 Day

X Standard

Requested Report Date

Circle which metals are to be analyzed

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Special Instructions/Comments:

*Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other_____(Circle One)

	Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature	[signature]	[signature]	[signature]	Naomi Pedersen		
Printed Name	Don Malkemus	Franklin LaBiche	Franklin LaBiche	ALS		
Firm	TEI	ALS	ALS	10/8/24 1445		
Date/Time	10/8 1306	10/08/24 1306	10/08/24 1445			

140510

CHAIN OF CUSTODY

140510

001, 002, 003

SR#

COC Set 8 of 8

COC#

ALS

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www.alsglobal.com

Page 1 of 1

K2410639

Project Name: Upper Granite Creek Mines | Project Number: 0031.005.001

Project Manager: Don Malkemus

Company: Terraphase Engineering Inc.

Address, City, State: 610 SW Broadway Suite 405

Phone #: (503) 943 0384 | email: don.malkemus@terraphase.com

Sampler Signature: [signature] | Sampler Printed Name: Don Malkemus

CLIENT SAMPLE ID	LABID	SAMPLING Date	Time	State	Matrix	NUMBER OF CONTAINERS	28D 7470A / Hg T	28D 7471B / Hg	180D 6020B / IVBA (Sieved Total)	180D 6020B / IVBA Extract	180D 6020B / Metals T	999D Grind / GrindSub	SM 2340 B / Hardness Calc	1	2	3	4	5	Remarks
1. CS-SD-1		10/5	1006		Soil	2		X			X								
2. CS-SD-2		10/3	1505		Soil	2		X			X								
3. CS-SD-3		10/3	0900		Soil	2		X			X								
4. CS-SD-4		10/3	1424		Soil	2		X			X								
5. CS-SD-5		10/4	0930		Soil	2		X			X								
6. CS-SD-6		10/4	1521		Soil	2		X			X								
7. CS-SD-7		10/4	1335		Soil	2		X			X								
8. CS-SD-7-DUP		10/4	1340		Soil	2		X			X								
9. CS-SD-8		10/5	1030		Soil	2		X			X								
10.																			

Report Requirements

___ I. Routine Report: Method Blank, Surrogate, as required

X II. Report Dup., MS, MSD as required

___ III. CLP Like Summary (no raw data)

___ IV. Data Validation Report

___ V. EDD

Invoice Information

P.O.#

Bill To: ap@terraphase.com

Turnaround Requirements

___ 24 hr. ___ 48 hr.

___ 5 Day

X Standard

Requested Report Date

Circle which metals are to be analyzed

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Special Instructions/Comments:

*Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other_____ (Circle One)

	Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature	[signature]	[signature]	[signature]	[signature]		
Printed Name	Don Malkemus	Franklin LaBiche	Franklin LaBiche	Naomi Pedersen		
Firm	TEI	ALS	ALS	ALS		
Date/Time	10/8 1306	10/08/24 1306	10/08/24 1445	10/8/24 1445		

PM MH

Cooler Receipt and Preservation Form

Client Terraphase Service Request K24 0639

Received: 10/8/24 Opened: 10/8/24 By: AP Unloaded: 10/8/24 By: AP

1. Samples were received via? *USPS* *Fed Ex* *UPS* *DHL* *PDX* *Courier* *Hand Delivered*
2. Samples were received in: (circle) *Cooler* *Box* *Envelope* *Other* ______ *NA*
3. Were custody seals on coolers? NA Y N If yes, how many and where? ______

If present, were custody seals intact? Y N If present, were they signed and dated? Y N

Temp Blank	Sample Temp	IR Gun	Cooler #/COC ID / NA	Out of temp Indicate with "X"	PM Notified If out of temp	Tracking Number NA	Filed
9.6	4.6	IR01	140510				
16.8	5.7						
6.0	4.4						
9.4	4.5						
18.3	4.5						

4. Was a Temperature Blank present in cooler? NA Y N If yes, notate the temperature in the appropriate column above:

If no, take the temperature of a representative sample bottle contained within the cooler; notate in the column "Sample Temp":

5. Were samples received within the method specified temperature ranges? NA Y N

If no, were they received on ice and same day as collected? If not, notate the cooler # above and notify the PM. NA Y N

If applicable, tissue samples were received: *Frozen* *Partially Thawed* *Thawed*

6. Packing material: *Inserts* *Baggies* *Bubble Wrap* *Gel Packs* *Wet Ice* *Dry Ice* *Sleeves* ______
7. Were custody papers properly filled out (ink, signed, etc.)? NA Y N
8. Were samples received in good condition (unbroken) NA Y N
9. Were all sample labels complete (ie, analysis, preservation, etc.)? NA Y N
10. Did all sample labels and tags agree with custody papers? NA Y N
11. Were appropriate bottles/containers and volumes received for the tests indicated? NA Y N
12. Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* NA Y N
13. Were VOA vials received without headspace? *Indicate in the table below.* NA Y N
14. Was Cl2/Res negative? NA Y N
15. Were samples received within the method specified time limit? If not, notate the error below and notify the PM NA Y N
16. Were 100ml sterile microbiology bottles filled exactly to the 100ml mark? NA Y N Underfilled Overfilled

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count Bottle Type	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies, Resolutions: ______

ALS

Cooler Receipt and Preservation Form

Client Terraphase Service Request K24 0639

Temp Blank	Sample Temp	IR Gun	Cooler #/COC ID / NA	Out of temp indicate with "X"	PM Notified If out of temp	Tracking Number NA	Filed
~~NA8.~~ 7.8	3.8	IR01					
12.2	5.5	↓					

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count Bottle Type	Out of Temp	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies & Resolutions: Ice was at top of coolers on top of samples. Temp blank was under the samples, not indicative of sample temp

Miscellaneous Forms

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

Inorganic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
E	The result is an estimate amount because the value exceeded the instrument calibration range.
J	The result is an estimated value.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.
H	The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

#	The control limit criteria is not applicable.
J	The result is an estimated value.
E	The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
M	The duplicate injection precision was not met.
N	The Matrix Spike sample recovery is not within control limits. See case narrative.
S	The reported value was determined by the Method of Standard Additions (MSA).
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
W	The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
+	The correlation coefficient for the MSA is less than 0.995.
Q	See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
A	A tentatively identified compound, a suspected aldol-condensation product.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
C	The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
D	The reported result is from a dilution.
E	The result is an estimated value over the calibration range.
J	The result is an estimated value between the MDL and the MRL.
N	The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
P	The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

F	The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
L	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
H	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
O	The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
Y	The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
Z	The chromatographic fingerprint does not resemble a petroleum product.

ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso
State Certifications, Accreditations, and Licenses

Agency	Web Site	Number
Alaska DEH	http://dec.alaska.gov/eh/lab/cs/csapproval.htm	UST-040
Arizona DHS	http://www.azdhs.gov/lab/license/env.htm	AZ0339
Arkansas - DEQ	http://www.adeq.state.ar.us/techsvs/labcert.htm	88-0637
California DHS (ELAP)	http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx	2795
DOD ELAP	http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm	L16-58-R4
Florida DOH	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E87412
Hawaii DOH	http://health.hawaii.gov/	-
ISO 17025	http://www.pjlabs.com/	L16-57
Louisiana DEQ	http://www.deq.louisiana.gov/page/la-lab-accreditation	03016
Maine DHS	http://www.maine.gov/dhhs/	WA01276
Minnesota DOH	http://www.health.state.mn.us/accreditation	053-999-457
Nevada DEP	http://ndep.nv.gov/bsdw/labservice.htm	WA01276
New Jersey DEP	http://www.nj.gov/dep/enforcement/oqa.html	WA005
New York - DOH	https://www.wadsworth.org/regulatory/elap	12060
North Carolina DEQ	https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/laboratory-certification-branch/non-field-lab-certification	605
Oklahoma DEQ	http://www.deq.state.ok.us/CSDnew/labcert.htm	9801
Oregon – DEQ (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	WA100010
South Carolina DHEC	http://www.scdhec.gov/environment/EnvironmentalLabCertification/	61002
Texas CEQ	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704427
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C544
Wyoming (EPA Region 8)	https://www.epa.gov/region8-waterops/epa-region-8-certified-drinking-water-	-
Kelso Laboratory Website	www.alsglobal.com	NA

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.ALSGlobal.com or at the accreditation bodies web site.
Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/anlayte is offered by that state.

Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LOD	Limit of Detection
LOQ	Limit of Quantitation
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

ALS Group USA, Corp.
dba ALS Environmental

Analyst Summary report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001		

Sample Name:	LMM-WRB-0.5-3-DS	**Date Collected:**	10/3/24
Lab Code:	K2410639-001	**Date Received:**	10/8/24
Sample Matrix:	Soil		

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN

Sample Name:	UUMM-WRA-0.5-2	**Date Collected:**	10/2/24
Lab Code:	K2410639-002	**Date Received:**	10/8/24
Sample Matrix:	Soil		

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN

Sample Name:	UUMM-WRF-0.5-1	**Date Collected:**	10/2/24
Lab Code:	K2410639-003	**Date Received:**	10/8/24
Sample Matrix:	Soil		

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN

Sample Name:	UUMM-WRD-0.5-1	**Date Collected:**	10/2/24
Lab Code:	K2410639-004	**Date Received:**	10/8/24
Sample Matrix:	Soil		

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN

Client: Terraphase Engineering Inc. **Service Request:** K2410639
Project: Upper Granite Creek Mines/0031.005.001

Sample Name: UUMM-WRA-0.5-3 **Date Collected:** 10/2/24
Lab Code: K2410639-005 **Date Received:** 10/8/24
Sample Matrix: Soil

Analysis Method	**Extracted/Digested By**	**Analyzed By**
160.3 Modified		ZBIBI
6020B	MSOLADEY	JCHAN
6020B	KLAWSON	JCHAN

Sample Name: UUMM-WRA-0.5-3-DUP **Date Collected:** 10/2/24
Lab Code: K2410639-006 **Date Received:** 10/8/24
Sample Matrix: Soil

Analysis Method	**Extracted/Digested By**	**Analyzed By**
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN
6020B	MSOLADEY	JCHAN

Sample Name: UUMM-WRA-0.5-3-DS **Date Collected:** 10/2/24
Lab Code: K2410639-007 **Date Received:** 10/8/24
Sample Matrix: Soil

Analysis Method	**Extracted/Digested By**	**Analyzed By**
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN

Sample Name: UMM-WRB-0.5-2 **Date Collected:** 10/2/24
Lab Code: K2410639-008 **Date Received:** 10/8/24
Sample Matrix: Soil

Analysis Method	**Extracted/Digested By**	**Analyzed By**
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN

Analyst Summary report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001		

Sample Name:	UMM-WRB-0.5-2-DS	**Date Collected:**	10/2/24
Lab Code:	K2410639-009	**Date Received:**	10/8/24
Sample Matrix:	Soil		

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN

Sample Name:	LMM-WRB-0.5-1	**Date Collected:**	10/3/24
Lab Code:	K2410639-010	**Date Received:**	10/8/24
Sample Matrix:	Soil		

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN

Sample Name:	LMM-WRB-0.5-1-DUP	**Date Collected:**	10/3/24
Lab Code:	K2410639-011	**Date Received:**	10/8/24
Sample Matrix:	Soil		

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN

Sample Name:	CM-WRC-0.5-4	**Date Collected:**	10/3/24
Lab Code:	K2410639-012	**Date Received:**	10/8/24
Sample Matrix:	Soil		

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	MSOLADEY	JCHAN
6020B	KLAWSON	JCHAN

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Analyst Summary report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001		

Sample Name:	UMM-WRA-0.5-1	**Date Collected:**	10/2/24
Lab Code:	K2410639-013	**Date Received:**	10/8/24
Sample Matrix:	Soil		

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	MSOLADEY	JCHAN
6020B	KLAWSON	JCHAN

Sample Name:	UMM-WRA-0.5-3	**Date Collected:**	10/2/24
Lab Code:	K2410639-014	**Date Received:**	10/8/24
Sample Matrix:	Soil		

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN

Sample Name:	UMM-WRA-0.5-1-DS	**Date Collected:**	10/2/24
Lab Code:	K2410639-015	**Date Received:**	10/8/24
Sample Matrix:	Soil		

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN

Sample Name:	LMM-WRA-0.5-3	**Date Collected:**	10/3/24
Lab Code:	K2410639-016	**Date Received:**	10/8/24
Sample Matrix:	Soil		

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN
6020B	MSOLADEY	JCHAN

Client: Terraphase Engineering Inc. **Service Request:** K2410639
Project: Upper Granite Creek Mines/0031.005.001

Sample Name: LMM-WRA-0.5-3-DS **Date Collected:** 10/3/24
Lab Code: K2410639-017 **Date Received:** 10/8/24
Sample Matrix: Soil

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN

Sample Name: LMM-WRA-0.5-4 **Date Collected:** 10/3/24
Lab Code: K2410639-018 **Date Received:** 10/8/24
Sample Matrix: Soil

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN

Sample Name: LMM-WRA-0.5-4-DUP **Date Collected:** 10/3/24
Lab Code: K2410639-019 **Date Received:** 10/8/24
Sample Matrix: Soil

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN

Sample Name: UMM-WRB-0.5-1 **Date Collected:** 10/2/24
Lab Code: K2410639-020 **Date Received:** 10/8/24
Sample Matrix: Soil

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN
7471B	KLINN	KLINN

Sample Results

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

Metals

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client:	Terraphase Engineering Inc.		**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001		**Date Collected:**	10/03/24 10:50
Sample Matrix:	Soil		**Date Received:**	10/08/24 14:45
Sample Name:	LMM-WRB-0.5-3-DS		**Basis:**	Dry
Lab Code:	K2410639-001			

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**29.1**	mg/Kg	0.41	0.05	5	10/22/24 09:54	10/10/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 13:30
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UUMM-WRA-0.5-2	**Basis:**	Dry
Lab Code:	K2410639-002		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**1940**	mg/Kg	8.8	1.1	100	10/22/24 10:47	10/10/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 14:00
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UUMM-WRF-0.5-1	**Basis:**	Dry
Lab Code:	K2410639-003		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**715**	mg/Kg	0.44	0.05	5	10/22/24 09:55	10/10/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 13:50
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UUMM-WRD-0.5-1	**Basis:**	Dry
Lab Code:	K2410639-004		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**269**	mg/Kg	0.45	0.05	5	10/22/24 09:57	10/10/24	

Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 13:45
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UUMM-WRA-0.5-3	**Basis:**	Dry
Lab Code:	K2410639-005		

Total Metals – IVBA Analysis

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**3440**	mg/Kg	4.9	0.6	50	10/22/24 16:04	10/17/24	
Lead	6020B	**340**	mg/Kg	0.49	0.20	50	10/22/24 16:04	10/17/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 13:45
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UUMM-WRA-0.5-3	**Basis:**	Dry
Lab Code:	K2410639-005		

IVBA Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**176**	mg/Kg	1.9	0.2	20	10/17/24 11:41	10/16/24	
Lead	6020B	**12.6**	mg/Kg	0.19	0.08	20	10/17/24 11:41	10/16/24	

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 13:45
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UUMM-WRA-0.5-3	**Basis:**	Dry
Lab Code:	K2410639-005		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**1710**	mg/Kg	9.1	1.1	100	10/22/24 10:54	10/10/24	

Client:	Terraphase Engineering Inc.		**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001		**Date Collected:**	10/02/24 13:44
Sample Matrix:	Soil		**Date Received:**	10/08/24 14:45
Sample Name:	UUMM-WRA-0.5-3-DUP		**Basis:**	Dry
Lab Code:	K2410639-006			

Total Metals – IVBA Analysis

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**3280**	mg/Kg	5.0	0.6	50	10/22/24 16:05	10/17/24	
Lead	6020B	**340**	mg/Kg	0.50	0.20	50	10/22/24 16:05	10/17/24	

Client:	Terraphase Engineering Inc.		**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001		**Date Collected:**	10/02/24 13:44
Sample Matrix:	Soil		**Date Received:**	10/08/24 14:45
Sample Name:	UUMM-WRA-0.5-3-DUP		**Basis:**	Dry
Lab Code:	K2410639-006			

IVBA Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**162**	mg/Kg	2.0	0.2	20	10/17/24 11:43	10/16/24	
Lead	6020B	**7.14**	mg/Kg	0.20	0.08	20	10/17/24 11:43	10/16/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 13:44
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UUMM-WRA-0.5-3-DUP	**Basis:**	Dry
Lab Code:	K2410639-006		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**1470**	mg/Kg	8.0	1.0	100	10/22/24 10:56	10/10/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 13:35
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UUMM-WRA-0.5-3-DS	**Basis:**	Dry
Lab Code:	K2410639-007		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**16.0**	mg/Kg	0.44	0.05	5	10/22/24 10:04	10/10/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 13:20
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UMM-WRB-0.5-2	**Basis:**	Dry
Lab Code:	K2410639-008		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**1800**	mg/Kg	8.2	1.0	100	10/22/24 10:57	10/10/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 13:25
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UMM-WRB-0.5-2-DS	**Basis:**	Dry
Lab Code:	K2410639-009		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**79.2**	mg/Kg	0.45	0.05	5	10/22/24 10:07	10/10/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 10:35
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	LMM-WRB-0.5-1	**Basis:**	Dry
Lab Code:	K2410639-010		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**1090**	mg/Kg	0.42	0.05	5	10/22/24 10:08	10/10/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 10:36
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	LMM-WRB-0.5-1-DUP	**Basis:**	Dry
Lab Code:	K2410639-011		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**802**	mg/Kg	0.42	0.05	5	10/22/24 10:09	10/10/24	

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 16:27
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	CM-WRC-0.5-4	**Basis:**	Dry
Lab Code:	K2410639-012		

Total Metals – IVBA Analysis

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**650**	mg/Kg	4.9	0.6	50	10/22/24 16:07	10/17/24	
Lead	6020B	**10.3**	mg/Kg	0.49	0.20	50	10/22/24 16:07	10/17/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 16:27
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	CM-WRC-0.5-4	**Basis:**	Dry
Lab Code:	K2410639-012		

IVBA Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**33.1**	mg/Kg	1.9	0.2	20	10/17/24 11:44	10/16/24	
Lead	6020B	**2.95**	mg/Kg	0.19	0.08	20	10/17/24 11:44	10/16/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 16:27
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	CM-WRC-0.5-4	**Basis:**	Dry
Lab Code:	K2410639-012		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**292**	mg/Kg	0.42	0.05	5	10/22/24 10:11	10/10/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 12:15
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UMM-WRA-0.5-1	**Basis:**	Dry
Lab Code:	K2410639-013		

Total Metals – IVBA Analysis

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**1590**	mg/Kg	4.9	0.6	50	10/22/24 16:08	10/17/24	
Lead	6020B	**249**	mg/Kg	0.49	0.19	50	10/22/24 16:08	10/17/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 12:15
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UMM-WRA-0.5-1	**Basis:**	Dry
Lab Code:	K2410639-013		

IVBA Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**12.7**	mg/Kg	2.0	0.2	20	10/17/24 11:46	10/16/24	
Lead	6020B	**66.0**	mg/Kg	0.20	0.08	20	10/17/24 11:46	10/16/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 12:15
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UMM-WRA-0.5-1	**Basis:**	Dry
Lab Code:	K2410639-013		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**1300**	mg/Kg	8.4	1.0	100	10/22/24 10:59	10/10/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 11:50
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UMM-WRA-0.5-3	**Basis:**	Dry
Lab Code:	K2410639-014		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**1210**	mg/Kg	0.45	0.05	5	10/22/24 10:17	10/10/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 12:05
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UMM-WRA-0.5-1-DS	**Basis:**	Dry
Lab Code:	K2410639-015		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**37.5**	mg/Kg	0.41	0.05	5	10/22/24 10:18	10/10/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 09:30
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	LMM-WRA-0.5-3	**Basis:**	Dry
Lab Code:	K2410639-016		

Total Metals – IVBA Analysis

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**328**	mg/Kg	4.9	0.6	50	10/22/24 16:09	10/17/24	
Lead	6020B	**32.0**	mg/Kg	0.49	0.19	50	10/22/24 16:09	10/17/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 09:30
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	LMM-WRA-0.5-3	**Basis:**	Dry
Lab Code:	K2410639-016		

IVBA Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**16.6**	mg/Kg	2.0	0.2	20	10/17/24 11:48	10/16/24	
Lead	6020B	**10.8**	mg/Kg	0.20	0.08	20	10/17/24 11:48	10/16/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 09:30
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	LMM-WRA-0.5-3	**Basis:**	Dry
Lab Code:	K2410639-016		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**125**	mg/Kg	0.44	0.05	5	10/22/24 10:19	10/10/24	

Printed 10/23/2024 5:06:12 PM Superset Reference:24-0000711471 rev 00

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 09:25
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	LMM-WRA-0.5-3-DS	**Basis:**	Dry
Lab Code:	K2410639-017		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**21.6**	mg/Kg	0.44	0.05	5	10/22/24 10:21	10/10/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 09:45
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	LMM-WRA-0.5-4	**Basis:**	Dry
Lab Code:	K2410639-018		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**2290**	mg/Kg	8.8	1.1	100	10/22/24 11:00	10/10/24	

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 09:46
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	LMM-WRA-0.5-4-DUP	**Basis:**	Dry
Lab Code:	K2410639-019		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**2570**	mg/Kg	8.5	1.0	100	10/22/24 10:34	10/10/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 13:10
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UMM-WRB-0.5-1	**Basis:**	Dry
Lab Code:	K2410639-020		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**14000**	mg/Kg	41	5	500	10/22/24 10:35	10/10/24	
Lead	6020B	**5210**	mg/Kg	4.1	1.6	500	10/22/24 10:35	10/10/24	
Mercury	7471B	**0.663**	mg/Kg	0.098	0.010	5	10/15/24 12:04	10/14/24	

General Chemistry

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 10:50
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	LMM-WRB-0.5-3-DS	**Basis:**	As Received
Lab Code:	K2410639-001		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**95.4**	Percent	-	1	10/09/24 12:51	

Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 13:30
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UUMM-WRA-0.5-2	**Basis:**	As Received
Lab Code:	K2410639-002		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**95.2**	Percent	-	1	10/09/24 12:51	

Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 14:00
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UUMM-WRF-0.5-1	**Basis:**	As Received
Lab Code:	K2410639-003		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**95.8**	Percent	-	1	10/09/24 12:51	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 13:50
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UUMM-WRD-0.5-1	**Basis:**	As Received
Lab Code:	K2410639-004		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**96.4**	Percent	-	1	10/09/24 12:51	

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 13:45
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UUMM-WRA-0.5-3	**Basis:**	As Received
Lab Code:	K2410639-005		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**94.9**	Percent	-	1	10/09/24 12:51	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 13:44
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UUMM-WRA-0.5-3-DUP	**Basis:**	As Received
Lab Code:	K2410639-006		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**94.6**	Percent	-	1	10/09/24 12:51	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 13:35
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UUMM-WRA-0.5-3-DS	**Basis:**	As Received
Lab Code:	K2410639-007		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**89.4**	Percent	-	1	10/09/24 12:51	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 13:20
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UMM-WRB-0.5-2	**Basis:**	As Received
Lab Code:	K2410639-008		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**95.4**	Percent	-	1	10/09/24 12:51	

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 13:25
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UMM-WRB-0.5-2-DS	**Basis:**	As Received
Lab Code:	K2410639-009		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**80.9**	Percent	-	1	10/09/24 12:51	

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 10:35
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	LMM-WRB-0.5-1	**Basis:**	As Received
Lab Code:	K2410639-010		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**96.1**	Percent	-	1	10/09/24 12:51	

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 10:36
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	LMM-WRB-0.5-1-DUP	**Basis:**	As Received
Lab Code:	K2410639-011		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**96.6**	Percent	-	1	10/09/24 12:51	

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 16:27
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	CM-WRC-0.5-4	**Basis:**	As Received
Lab Code:	K2410639-012		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**95.6**	Percent	-	1	10/09/24 12:51	

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 12:15
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UMM-WRA-0.5-1	**Basis:**	As Received
Lab Code:	K2410639-013		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**95.2**	Percent	-	1	10/09/24 12:51	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 11:50
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UMM-WRA-0.5-3	**Basis:**	As Received
Lab Code:	K2410639-014		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**91.5**	Percent	-	1	10/09/24 12:51	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 12:05
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UMM-WRA-0.5-1-DS	**Basis:**	As Received
Lab Code:	K2410639-015		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**94.4**	Percent	-	1	10/09/24 12:51	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 09:30
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	LMM-WRA-0.5-3	**Basis:**	As Received
Lab Code:	K2410639-016		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**91.0**	Percent	-	1	10/09/24 12:51	

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 09:25
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	LMM-WRA-0.5-3-DS	**Basis:**	As Received
Lab Code:	K2410639-017		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**92.2**	Percent	-	1	10/09/24 12:51	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 09:45
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	LMM-WRA-0.5-4	**Basis:**	As Received
Lab Code:	K2410639-018		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**93.8**	Percent	-	1	10/09/24 12:51	

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 09:46
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	LMM-WRA-0.5-4-DUP	**Basis:**	As Received
Lab Code:	K2410639-019		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**93.7**	Percent	-	1	10/09/24 12:51	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 13:10
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UMM-WRB-0.5-1	**Basis:**	As Received
Lab Code:	K2410639-020		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**96.3**	Percent	-	1	10/09/24 12:51	

QC Summary Forms

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

Metals

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	Dry
Lab Code:	KQ2416342-03		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	ND U	mg/Kg	0.5	0.06	5	10/22/24 09:44	10/10/24	
Lead	6020B	ND U	mg/Kg	0.05	0.020	5	10/22/24 09:44	10/10/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	Dry
Lab Code:	KQ2416426-03		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Mercury	7471B	ND U	mg/Kg	0.02	0.002	1	10/15/24 09:02	10/14/24	

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	Dry
Lab Code:	KQ2416652-01		

Total Metals – IVBA Analysis

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	ND U	mg/Kg	0.5	0.06	5	10/22/24 15:43	10/17/24	
Lead	6020B	**0.043 J**	mg/Kg	0.05	0.020	5	10/22/24 15:43	10/17/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	Dry
Lab Code:	KQ2416789-01		

IVBA Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	ND U	mg/Kg	0.5	0.06	5	10/17/24 10:57	10/16/24	
Lead	6020B	ND U	mg/Kg	0.05	0.020	5	10/17/24 10:57	10/16/24	

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24
Sample Matrix:	Soil	**Date Received:**	10/08/24
		Date Analyzed:	10/22/24
		Date Extracted:	10/10/24

Matrix Spike Summary
Total Metals

Sample Name:	UUMM-WRA-0.5-2	**Units:**	mg/Kg
Lab Code:	K2410639-002	**Basis:**	Dry
Analysis Method:	6020B		
Prep Method:	EPA 3050B		

Matrix Spike
KQ2416342-02

Analyte Name	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Arsenic	1940	2330	88.4	440 #	75-125
Lead	94.3	195	88.4	114	75-125

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.

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QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24
Sample Matrix:	Soil	**Date Received:**	10/08/24
		Date Analyzed:	10/15/24
		Date Extracted:	10/14/24

Matrix Spike Summary
Total Metals

Sample Name:	UMM-WRB-0.5-1	**Units:**	mg/Kg
Lab Code:	K2410639-020	**Basis:**	Dry
Analysis Method:	7471B		
Prep Method:	Method		

Matrix Spike
KQ2416426-02

Analyte Name	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Mercury	0.66	1.25	0.50	118	80-120

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Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.

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QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24
Sample Matrix:	Soil	**Date Received:**	10/08/24
		Date Analyzed:	10/22/24

Replicate Sample Summary
Total Metals

Sample Name:	UUMM-WRA-0.5-2	**Units:**	mg/Kg
Lab Code:	K2410639-002	**Basis:**	Dry

Analyte Name	Analysis Method	MRL	MDL	Sample Result	Duplicate Sample KQ2416342-01 Result	Average	RPD	RPD Limit
Arsenic	6020B	9.2	1.1	1940	2170	2060	11	20
Lead	6020B	0.046	0.018	94.3	179	137	62 *	20

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Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24
Sample Matrix:	Soil	**Date Received:**	10/08/24
		Date Analyzed:	10/15/24

Replicate Sample Summary
Total Metals

Sample Name:	UMM-WRB-0.5-1	**Units:**	mg/Kg
Lab Code:	K2410639-020	**Basis:**	Dry

Analyte Name	Analysis Method	MRL	MDL	Sample Result	Duplicate Sample KQ2416426-01 Result	Average	RPD	RPD Limit
Mercury	7471B	0.094	0.009	0.663	0.952	0.808	36 *	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Analyzed:**	10/22/24
Sample Matrix:	Soil		

Lab Control Sample Summary
Total Metals

Units: mg/Kg
Basis: Dry

Lab Control Sample
KQ2416342-04

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Arsenic	6020B	107	100	107	80-120
Lead	6020B	111	100	111	80-120

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QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Analyzed:**	10/15/24
Sample Matrix:	Soil		

Lab Control Sample Summary
Total Metals

Units: mg/Kg
Basis: Dry

Lab Control Sample
KQ2416426-04

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Mercury	7471B	0.520	0.500	104	80-120

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QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Analyzed:**	10/22/24
Sample Matrix:	Soil		

Lab Control Sample Summary
Total Metals – IVBA Analysis

Units:mg/Kg
Basis: Dry

Lab Control Sample
KQ2416652-02

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Arsenic	6020B	108	100	108	80-120
Lead	6020B	111	100	111	80-120

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project:	Upper Granite Creek Mines/0031.005.001	**Date Analyzed:**	10/17/24
Sample Matrix:	Soil		

Lab Control Sample Summary
IVBA Metals

Units: mg/Kg
Basis: Dry

Lab Control Sample
KQ2416789-02

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Arsenic	6020B	92.9	100	93	80-120
Lead	6020B	105	100	105	80-120

General Chemistry

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

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QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24
Sample Matrix:	Soil	**Date Received:**	10/08/24
		Date Analyzed:	10/09/24

Replicate Sample Summary
Inorganic Parameters

Sample Name:	LMM-WRB-0.5-3-DS	**Units:**	Percent
Lab Code:	K2410639-001	**Basis:**	As Received

Analyte Name	Analysis Method	MRL	Sample Result	Duplicate Sample K2410639-001DUP Result	Average	RPD	RPD Limit
Solids, Total	160.3 Modified	-	95.4	94.9	95.2	<1	20

Results flagged with an asterisk (*) indicate values outside control criteria.

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Printed 10/23/2024 5:06:16 PM Superset Reference:24-0000711471 rev 00

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QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410639
Project	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24
Sample Matrix:	Soil	**Date Received:**	10/08/24
		Date Analyzed:	10/09/24

Replicate Sample Summary
Inorganic Parameters

Sample Name:	UMM-WRB-0.5-1	**Units:**	Percent
Lab Code:	K2410639-020	**Basis:**	As Received

Analyte Name	Analysis Method	MRL	Sample Result	Duplicate Sample K2410639-020DUP Result	Average	RPD	RPD Limit
Solids, Total	160.3 Modified	-	96.3	96.5	96.4	<1	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

ALS Environmental
ALS Group USA, Corp
1317 South 13th Avenue
Kelso, WA 98626
T : +1 360 577 7222
F : +1 360 636 1068
www.alsglobal.com

November 01, 2024

Analytical Report for Service Request No: K2410642
Revised Service Request No: K2410642.01

Don Malkemus
Terraphase Engineering Inc.
610 SW Broadway, Suite 405
Portland, OR 97205

RE: Upper Granite Creek Mines / 0031.005.001

Dear Don,

Enclosed is the revised report of the sample(s) submitted to our laboratory October 08, 2024
For your reference, these analyses have been assigned our service request number **K2410642.**

The bio accessibility values are now included.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

We apologize for any inconvenience this may have created.

Please contact me if you have any questions. My extension is 3376. You may also contact me via email at Mark.Harris@alsglobal.com.

Respectfully submitted,

ALS Group USA, Corp. dba ALS Environmental

Mark Harris
Project Manager

REVISED
4:33 pm, Nov 01, 2024

ALS Environmental
ALS Group USA, Corp
1317 South 13th Avenue
Kelso, WA 98626
T : +1 360 577 7222
F : +1 360 636 1068
www.alsglobal.com

Table of Contents

Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LOD	Limit of Detection
LOQ	Limit of Quantitation
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

Inorganic Data Qualifiers

- * The result is an outlier. See case narrative.
- # The control limit criteria is not applicable.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
- E The result is an estimate amount because the value exceeded the instrument calibration range.
- J The result is an estimated value.
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
  DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
- X See case narrative.
- Q See case narrative. One or more quality control criteria was outside the limits.
- H The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

- # The control limit criteria is not applicable.
- J The result is an estimated value.
- E The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
- M The duplicate injection precision was not met.
- N The Matrix Spike sample recovery is not within control limits. See case narrative.
- S The reported value was determined by the Method of Standard Additions (MSA).
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
  DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- W The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
- i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
- X See case narrative.
- + The correlation coefficient for the MSA is less than 0.995.
- Q See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

- * The result is an outlier. See case narrative.
- # The control limit criteria is not applicable. See case narrative.
- A A tentatively identified compound, a suspected aldol-condensation product.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
- C The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
- D The reported result is from a dilution.
- E The result is an estimated value.
- J The result is an estimated value.
- N The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
- P The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
  DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- i The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
- X See case narrative.
- Q See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

- F The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
- L The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
- H The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
- O The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
- Y The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
- Z The chromatographic fingerprint does not resemble a petroleum product.

ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso
State Certifications, Accreditations, and Licenses

Agency	Web Site	Number
Alaska DEH	http://dec.alaska.gov/eh/lab/cs/csapproval.htm	UST-040
Arizona DHS	http://www.azdhs.gov/lab/license/env.htm	AZ0339
Arkansas - DEQ	http://www.adeq.state.ar.us/techsvs/labcert.htm	88-0637
California DHS (ELAP)	http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx	2795
DOD ELAP	http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm	L16-58-R4
Florida DOH	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E87412
Hawaii DOH	http://health.hawaii.gov/	-
ISO 17025	http://www.pjlabs.com/	L16-57
Louisiana DEQ	http://www.deq.louisiana.gov/page/la-lab-accreditation	03016
Maine DHS	http://www.maine.gov/dhhs/	WA01276
Minnesota DOH	http://www.health.state.mn.us/accreditation	053-999-457
Nevada DEP	http://ndep.nv.gov/bsdw/labservice.htm	WA01276
New Jersey DEP	http://www.nj.gov/dep/enforcement/oqa.html	WA005
New York - DOH	https://www.wadsworth.org/regulatory/elap	12060
North Carolina DEQ	https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/laboratory-certification-branch/non-field-lab-certification	605
Oklahoma DEQ	http://www.deq.state.ok.us/CSDnew/labcert.htm	9801
Oregon – DEQ (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	WA100010
South Carolina DHEC	http://www.scdhec.gov/environment/EnvironmentalLabCertification/	61002
Texas CEQ	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704427
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C544
Wyoming (EPA Region 8)	https://www.epa.gov/region8-waterops/epa-region-8-certified-drinking-water-	-
Kelso Laboratory Website	www.alsglobal.com	NA

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.ALSGlobal.com or at the accreditation bodies web site.
Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/anlayte is offered by that state.

Case Narrative

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

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Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines	**Date Received:**	10/08/2024
Sample Matrix:	Soil		

CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples for the Tier II level requested by the client.

Sample Receipt:

Twenty soil samples were received for analysis at ALS Environmental on 10/08/2024. Any discrepancies upon initial sample inspection are annotated on the sample receipt and preservation form included within this report. The samples were stored at minimum in accordance with the analytical method requirements.

Metals:

No significant anomalies were noted with this analysis.

Approved by ______________________ Date 11/01/2024

Chain of Custody

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1317 South 13th Avenue, Kelso, WA 98626
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140510

CHAIN OF CUSTODY

140510

001, 002, 003

SR#
COC Set 4 of 8
COC#

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K2410642

Project Name: Upper Granite Creek Mines
Project Number: 0031.005.001
Project Manager: Don Malkemus
Company: Tetraphase Engineering Inc.
Address, City, State: 610 SW Broadway Suite 405
Phone #: (503) 943-0384
email: don.malkemus@tetraphase.com
Sampler Signature: [signature]
Sampler Printed Name: Don Malkemus

CLIENT SAMPLE ID	LABID	Date	Time	State	Matrix	NUMBER OF CONTAINERS	28D 7470A / Hg T	28D 7471B / Hg	180D 6020B / IVBA (Sieved Total)	180D 6020B / IVBA Extract	180D 6020B / Metals T	999D Grind / GrindSub	999D SM 2340 B / Hardness Calc	1	2	3	4	5	Remarks
UMM-TLB-0.5-1	1	10/2	1630		Soil	2		X	X	X	X								+ bag*
UMM-TLA-0.5-3		10/2	1530		Soil	2													+ bag HOLD
UMM-TLB-0.5-4	2	10/2	1645		Soil	2					X								+ bag
UMM-TLA-0.5-4		10/2	1535		Soil	2													+ bag HOLD
UMM-TLC-0.5-1	3	10/2	1700		Soil	2					X								+ bag
UMM-TLC-0.5-2	4	10/2	1715		Soil	2					X								+ bag
UMM-TLB-0.5-2		10/2	1635		Soil	2													+ bag HOLD
UMM-TLA-0.5-5		10/2	1540		Soil	2													+ bag HOLD
UMM-TLA-0.5-6	5	10/2	1545		Soil	2		X	X	X	X								+ bag

Report Requirements

I. Routine Report: Method Blank, Surrogate, as required
II. Report Dup., MS, MSD as required
III. CLP Like Summary (no raw data)
IV. Data Validation Report
V. EDD

Invoice Information

P.O.#
Bill To: ap@tetraphase.com

Turnaround Requirements

___ 24 hr. ___ 48 hr.
___ 5 Day
X Standard

Requested Report Date

Circle which metals are to be analyzed

Total Metals: Al **As** Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Special Instructions/Comments:
*Also analyze Pb + Hg on sample 1 (UMM-TLB-0.5-1) and 9 (UMM-TLA-0.5-6)

*Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other____ (Circle One)

	Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature	[signature]	[signature]	[signature]	Naomi Pedersen		
Printed Name	Don Malkemus	Franklin LaBiche	Franklin LaBiche	ALS		
Firm	TEI	ALS	ALS	10/8/24 1445		
Date/Time	10/8 1306	10/08/24 1200	10/08/24 1445			

ALS

140510

CHAIN OF CUSTODY

140510

001, 002, 003

SR#

COC Set 5 of 8

COC#

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www.alsglobal.com

K2410642

Project Name: Upper Granite Creek Mines	Project Number: 0031.005.001
Project Manager: Don Malkemus	
Company: Terraphase Engineering Inc.	
Address, City, State: 610 SW Broadway Suite 405	
Phone #: (503) 889-1067	email: don.malkemus@terraphase.com
Sampler Signature:	Sampler Printed Name: Don Malkemus

CLIENT SAMPLE ID	LABID	SAMPLING Date	Time	State	Matrix	NUMBER OF CONTAINERS	28D 7470A / Hg T	7471B / Hg	180D 6020B / IVBA (Sieved Total)	6020B / IVBA Extract	6020B / Metals T	999D Grind / GrindSub	SM 2340 B / Hardness Calc	1	2	3	4	5	Remarks
EM-WRA-0.5-4-DS	6	10/5	1230		Soil	2					X								
EM-WRB-0.5-1	7	10/5	1300		Soil	2					X								
EM-WRA-0.5-2	8	10/5	1205		Soil	2			X	X	X								+ bag
EM-WRC-0.5-1	9	10/5	1240		Soil	2					X								
GF-WRA-0.5-1	10	10/5	0930		Soil	2					X								
F-WRD-0.5-6	11	10/5	1110		Soil	2					X								
F-WRD-0.5-4-DS	12	10/5	1105		Soil	2			X	X	X								+ bag
F-DR-0.5-1	13	10/5	1035		Soil	2					X								
CS-WRA-0.5-3	14	10/4	1615		Soil	2					X								
CS-WRA-0.5-4	15	10/4	1554		Soil	2					X								

Report Requirements

I. Routine Report: Method Blank, Surrogate, as required

II. Report Dup., MS, MSD as required

III. CLP Like Summary (no raw data)

IV. Data Validation Report

V. EDD

Invoice Information

P.O.#

Bill To: ap@terraphase.com

Turnaround Requirements

___ 24 hr. ___ 48 hr.

___ 5 Day

X Standard

Requested Report Date

Circle which metals are to be analyzed

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Special Instructions/Comments:

*Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other___ (Circle One)

Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature	Signature	Signature	Signature Naomi Pedersen	Signature	Signature
Printed Name Don Malkemus	Printed Name Franklin LaBiche	Printed Name Franklin LaBiche	Printed Name ALS	Printed Name	Printed Name
Firm TEI	Firm ALS	Firm ALS	Firm 10/8/24 1445	Firm	Firm
Date/Time 10/8 1306	Date/Time 10/08/24 1306	Date/Time 10/08/24 1445	Date/Time	Date/Time	Date/Time

ALS Environmental

140510

CHAIN OF CUSTODY

140510

001, 002, 003

SR#

COC Set 6 of 8

COC#

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www.alsglobal.com

K2410637 48 TUP

Project Name: Upper Granite Creek Mines
Project Number: 0031.005.001
Project Manager: Don Malkemus
Company: Terraphase Engineering Inc.
Address, City, State: 610 SW Broadway Suite 405
Phone #: (503) 943-0384
email: don.malkemus@terraphase.com
Sampler Signature: [signature]
Sampler Printed Name: Don Malkemus

CLIENT SAMPLE ID	LABID	SAMPLING Date	Time	State	Matrix	NUMBER OF CONTAINERS	28D 7470A / Hg T	28D 7471B / Hg	180D 6020B / IVBA (Sieved Total)	180D 6020B / IVBA Extract	180D 6020B / Metals T	999D Grind / GrindSub	SM 2340 B / Hardness Calc	1	2	3	4	5	Remarks
1. GC5-WRA-0.5-4-DS	16	10/4	1555		Soil	2			X	X	X								+ bag
2. GC6-WRA-0.5-2	17	10/4	1400		Soil	2			X	X	X								+ bag
3. GC6-WRA-0.5-1	18	10/4	1045		Soil	2					X								
4. GC7-WRA-0.5-3	19	10/4	1150		Soil	2					X								
5. GC7-WRB-0.5-1	20	10/4	1115		Soil	2					X								
6. TL-WRA-0.5-3		10/4	1405		Soil	2					X								
7. TL-WRB-0.5-4		10/4	1425		Soil	2					X								
8. TL-WRA-0.5-1-DS-2		10/4	1400		Soil	2			X	X	X								+ bag
9. SH-WRB-0.5-2		10/4	1005		Soil	2					X								
10. SH-WRC-0.5-1		10/4	1015		Soil	2					X								

Report Requirements

___ I. Routine Report: Method Blank, Surrogate, as required
X II. Report Dup., MS, MSD as required
___ III. CLP Like Summary (no raw data)
___ IV. Data Validation Report
___ V. EDD

Invoice Information

P.O.#
Bill To: ap@terraphase.com

Turnaround Requirements

___ 24 hr. ___ 48 hr.
___ 5 Day
X Standard

Requested Report Date

Circle which metals are to be analyzed

Total Metals: Al **As** Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Special Instructions/Comments:

*Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other____ (Circle One)

	Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature	[signature]	[signature]	[signature]	[signature]		
Printed Name	Don Malkemus	Franklin LaBiche	Franklin LaBiche	Naomi Robeson		
Firm	TEI	ALS	ALS	ALS		
Date/Time	10/8 1306	10/08/24 1306	10/08/24 1445	10/8/24 1445		

PM MH

Cooler Receipt and Preservation Form

Client Terraphase Service Request K24 10642

Received: 10/8/24 Opened: 10/8/24 By: NP Unloaded: 10/8/24 By: NP

1. Samples were received via? *USPS* *Fed Ex* *UPS* *DHL* *PDX* ***Courier*** *Hand Delivered*
2. Samples were received in: (circle) ***Cooler*** *~~Box~~* *Envelope* *Other* ______ *NA*
3. Were custody seals on coolers? NA Y **N** If yes, how many and where? ______

   If present, were custody seals intact? Y N If present, were they signed and dated? Y N

Temp Blank	Sample Temp	IR Gun	Cooler #/COC ID / NA	Out of temp indicate with "X"	PM Notified If out of temp	Tracking Number NA	Filed
9.6	4.6	1801	140510				
6.8	5.7	↓					
6.0	4.4	↓					
9.4	4.5	↓					
8.3	4.5	↓					

4. Was a Temperature Blank present in cooler? NA **Y** N If yes, notate the temperature in the appropriate column above:

   If no, take the temperature of a representative sample bottle contained within the cooler; notate in the column "Sample Temp":

5. Were samples received within the method specified temperature ranges? NA **Y** N

   If no, were they received on ice and same day as collected? If not, notate the cooler # above and notify the PM. **NA** Y N

If applicable, tissue samples were received: *Frozen* *Partially Thawed* *Thawed*

6. Packing material: *Inserts* ***Baggies*** *Bubble Wrap* *Gel Packs* ***Wet Ice*** *Dry Ice* *Sleeves* ______
7. Were custody papers properly filled out (ink, signed, etc.)? NA **Y** N
8. Were samples received in good condition (unbroken) NA **Y** N
9. Were all sample labels complete (ie, analysis, preservation, etc.)? NA **Y** N
10. Did all sample labels and tags agree with custody papers? NA **Y** N
11. Were appropriate bottles/containers and volumes received for the tests indicated? NA **Y** N
12. Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* NA **Y** N
13. Were VOA vials received without headspace? *Indicate in the table below.* **NA** Y N
14. Was C12/Res negative? **NA** Y N
15. Were samples received within the method specified time limit? If not, notate the error below and notify the PM **NA** Y N
16. Were 100ml sterile microbiology bottles filled exactly to the 100ml mark? **NA** Y N Underfilled Overfilled

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count Bottle Type	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies, Resolutions: ______

Cooler Receipt and Preservation Form

Client Terraphase Service Request K24 10642

Temp Blank	Sample Temp	IR Gun	Cooler #/COC ID / NA	Out of temp indicate with "X"	PM Notified If out of temp	Tracking Number NA	Filed
~~18~~ 7.8	3.8	IR01					
12.2	5.5	↓					

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count Bottle Type	Out of Temp	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies & Resolutions: Ice was at top of coolers on top of samples. Temp blank was under the samples, not indicative of sample temp

Total Solids

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 - 10/05/24
Sample Matrix:	Soil	**Date Received:**	10/8/24
Analysis Method:	160.3 Modified	**Units:**	Percent
Prep Method:	None	**Basis:**	As Received

Solids, Total

Sample Name	Lab Code	Result	MRL	Dil.	Date Analyzed	Q
UMM-TLB-0.5-1	K2410642-001	**86.4**	-	1	10/10/24 10:19	
UMM-TLB-0.5-4	K2410642-002	**91.8**	-	1	10/10/24 10:19	
UMM-TLC-0.5-1	K2410642-003	**79.3**	-	1	10/10/24 10:19	
UMM-TLC-0.5-2	K2410642-004	**76.8**	-	1	10/10/24 10:19	
UMM-TLA-0.5-6	K2410642-005	**91.8**	-	1	10/10/24 10:19	
CEM-WRA-0.5-4-DS	K2410642-006	**96.8**	-	1	10/10/24 10:19	
CEM-WRB-0.5-1	K2410642-007	**96.5**	-	1	10/10/24 10:19	
CEM-WRA-0.5-2	K2410642-008	**95.3**	-	1	10/10/24 10:19	
CEM-WRC-0.5-1	K2410642-009	**95.1**	-	1	10/10/24 10:19	
GF-WRA-0.5-1	K2410642-010	**97.0**	-	1	10/10/24 10:19	
GF-WRD-0.5-6	K2410642-011	**95.1**	-	1	10/10/24 10:19	
GF-WRD-0.5-4-DS	K2410642-012	**97.0**	-	1	10/10/24 10:19	
GF-DR-0.5-1	K2410642-013	**97.2**	-	1	10/10/24 10:19	
GC5-WRA-0.5-3	K2410642-014	**96.2**	-	1	10/10/24 10:19	
GC5-WRA-0.5-4	K2410642-015	**95.8**	-	1	10/10/24 10:19	
GC5-WRA-0.5-4-DS	K2410642-016	**96.0**	-	1	10/10/24 10:19	
GC6-WRA-0.5-2	K2410642-017	**94.4**	-	1	10/10/24 10:19	
GC6-WRA-0.5-1	K2410642-018	**93.7**	-	1	10/10/24 10:19	
GC7-WRA-0.5-3	K2410642-019	**95.2**	-	1	10/10/24 10:19	
GC7-WRB-0.5-1	K2410642-020	**96.1**	-	1	10/10/24 10:19	

ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 - 10/04/24
Sample Matrix:	Soil	**Date Received:**	10/08/24
Analysis Method:	160.3 Modified	**Units:**	Percent
Prep Method:	None	**Basis:**	As Received

Replicate Sample Summary
Inorganic Parameters

Sample Name:	Lab Code:	MRL	Sample Result	Duplicate Result	Average	RPD	RPD Limit	Date Analyzed
UMM-TLB-0.5-1	K2410642-001DUP	-	86.4	86.5	86.5	<1	20	10/10/24
GC7-WRB-0.5-1	K2410642-020DUP	-	96.1	96.3	96.2	<1	20	10/10/24

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Metals

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/2/2024
Sample Matrix:	Soil	**Date Received:**	10/8/2024
		Date Extracted:	10/16-10/17/2024
		Date Analyzed:	10/17-10/22/2024

Bioaccessibility Value
Analyte: Arsenic
Units: Percent (%)

Sample Name	Lab Code	Result
UMM-TLB-0.5-1	K2410642-001	41.6
UMM-TLA-0.5-6	K2410642-005	24.3
CEM-WRA-0.5-2	K2410642-008	5.6
GF-WRD-0.5-4-DS	K2410642-012	9.0
GC5-WRA-0.5-4-DS	K2410642-016	4.7
GC6-WRA-0.5-2	K2410642-017	3.9

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/2/2024
Sample Matrix:	Soil	**Date Received:**	10/8/2024
		Date Extracted:	10/16-10/17/2024
		Date Analyzed:	10/17-10/22/2024

Bioaccessibility Value
Analyte: Lead
Units: Percent (%)

Sample Name	Lab Code	Result
UMM-TLB-0.5-1	K2410642-001	28.7
UMM-TLA-0.5-6	K2410642-005	6.2
CEM-WRA-0.5-2	K2410642-008	27.9
GF-WRD-0.5-4-DS	K2410642-012	34.9
GC5-WRA-0.5-4-DS	K2410642-016	37.5
GC6-WRA-0.5-2	K2410642-017	41.7

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 16:30
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UMM-TLB-0.5-1	**Basis:**	Dry
Lab Code:	K2410642-001		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**6130**	mg/Kg	11	1	100	10/22/24 12:10	10/10/24	
Lead	6020B	**1710**	mg/Kg	1.1	0.4	100	10/22/24 12:10	10/10/24	
Mercury	7471B	**387**	mg/Kg	11	1	500	10/15/24 13:08	10/14/24	

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Superset Reference:

Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 16:30
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UMM-TLB-0.5-1	**Basis:**	Dry
Lab Code:	K2410642-001		

Total Metals – IVBA Analysis

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**4420**	mg/Kg	4.9	0.6	50	10/22/24 15:53	10/17/24	
Lead	6020B	**840**	mg/Kg	0.49	0.20	50	10/22/24 15:53	10/17/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 16:30
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UMM-TLB-0.5-1	**Basis:**	Dry
Lab Code:	K2410642-001		

IVBA Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**1840**	mg/Kg	2.0	0.2	20	10/17/24 11:29	10/16/24	
Lead	6020B	**241**	mg/Kg	0.20	0.08	20	10/17/24 11:29	10/16/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 16:45
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UMM-TLB-0.5-4	**Basis:**	Dry
Lab Code:	K2410642-002		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**1540**	mg/Kg	8.0	1.0	100	10/22/24 12:18	10/10/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 17:00
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UMM-TLC-0.5-1	**Basis:**	Dry
Lab Code:	K2410642-003		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**5290**	mg/Kg	9.9	1.2	100	10/22/24 12:19	10/10/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 17:15
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UMM-TLC-0.5-2	**Basis:**	Dry
Lab Code:	K2410642-004		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**4980**	mg/Kg	10	1	100	10/22/24 12:21	10/10/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 15:45
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UMM-TLA-0.5-6	**Basis:**	Dry
Lab Code:	K2410642-005		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**3270**	mg/Kg	8.1	1.0	100	10/22/24 11:35	10/10/24	
Lead	6020B	**589**	mg/Kg	0.81	0.33	100	10/22/24 11:35	10/10/24	
Mercury	7471B	**9.23**	mg/Kg	0.19	0.02	10	10/15/24 10:28	10/14/24	

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Superset Reference:

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 15:45
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UMM-TLA-0.5-6	**Basis:**	Dry
Lab Code:	K2410642-005		

Total Metals – IVBA Analysis

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**5560**	mg/Kg	4.9	0.6	50	10/22/24 15:46	10/17/24	
Lead	6020B	**1110**	mg/Kg	0.49	0.20	50	10/22/24 15:46	10/17/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 15:45
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UMM-TLA-0.5-6	**Basis:**	Dry
Lab Code:	K2410642-005		

IVBA Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**1350**	mg/Kg	2.0	0.2	20	10/17/24 11:22	10/16/24	
Lead	6020B	**69.2**	mg/Kg	0.20	0.08	20	10/17/24 11:22	10/16/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 12:30
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	CEM-WRA-0.5-4-DS	**Basis:**	Dry
Lab Code:	K2410642-006		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**32.6**	mg/Kg	0.40	0.05	5	10/22/24 12:03	10/10/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 13:00
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	CEM-WRB-0.5-1	**Basis:**	Dry
Lab Code:	K2410642-007		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**151**	mg/Kg	8.6	1.0	100	10/22/24 11:38	10/10/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 12:05
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	CEM-WRA-0.5-2	**Basis:**	Dry
Lab Code:	K2410642-008		

Total Metals – IVBA Analysis

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**794**	mg/Kg	5.0	0.6	50	10/22/24 15:55	10/17/24	
Lead	6020B	**78.5**	mg/Kg	0.50	0.20	50	10/22/24 15:55	10/17/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 12:05
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	CEM-WRA-0.5-2	**Basis:**	Dry
Lab Code:	K2410642-008		

IVBA Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**44.5**	mg/Kg	2.0	0.2	20	10/17/24 11:30	10/16/24	
Lead	6020B	**21.9**	mg/Kg	0.20	0.08	20	10/17/24 11:30	10/16/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 12:05
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	CEM-WRA-0.5-2	**Basis:**	Dry
Lab Code:	K2410642-008		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**299**	mg/Kg	8.3	1.0	100	10/22/24 11:39	10/10/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 12:40
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	CEM-WRC-0.5-1	**Basis:**	Dry
Lab Code:	K2410642-009		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**110**	mg/Kg	8.0	1.0	100	10/22/24 11:41	10/10/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 09:30
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	GF-WRA-0.5-1	**Basis:**	Dry
Lab Code:	K2410642-010		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**332**	mg/Kg	7.8	0.9	100	10/22/24 11:42	10/10/24	

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Superset Reference:

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 11:10
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	GF-WRD-0.5-6	**Basis:**	Dry
Lab Code:	K2410642-011		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**66.6**	mg/Kg	7.9	0.9	100	10/22/24 11:44	10/10/24	

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Superset Reference:

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 11:05
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	GF-WRD-0.5-4-DS	**Basis:**	Dry
Lab Code:	K2410642-012		

Total Metals – IVBA Analysis

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**137**	mg/Kg	4.9	0.6	50	10/22/24 15:56	10/17/24	
Lead	6020B	**25.6**	mg/Kg	0.49	0.19	50	10/22/24 15:56	10/17/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 11:05
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	GF-WRD-0.5-4-DS	**Basis:**	Dry
Lab Code:	K2410642-012		

IVBA Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**12.3**	mg/Kg	2.0	0.2	20	10/17/24 11:32	10/16/24	
Lead	6020B	**8.94**	mg/Kg	0.20	0.08	20	10/17/24 11:32	10/16/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 11:05
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	GF-WRD-0.5-4-DS	**Basis:**	Dry
Lab Code:	K2410642-012		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**55.2**	mg/Kg	8.5	1.0	100	10/22/24 11:45	10/10/24	

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Superset Reference:

Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 10:35
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	GF-DR-0.5-1	**Basis:**	Dry
Lab Code:	K2410642-013		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**58.3**	mg/Kg	8.4	1.0	100	10/22/24 11:49	10/10/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 16:15
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	GC5-WRA-0.5-3	**Basis:**	Dry
Lab Code:	K2410642-014		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**421**	mg/Kg	8.0	1.0	100	10/22/24 11:51	10/10/24	

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Superset Reference:

Client:	Terraphase Engineering Inc.		**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001		**Date Collected:**	10/04/24 15:54
Sample Matrix:	Soil		**Date Received:**	10/08/24 14:45
Sample Name:	GC5-WRA-0.5-4		**Basis:**	Dry
Lab Code:	K2410642-015			

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**160**	mg/Kg	7.8	0.9	100	10/22/24 11:52	10/10/24	

Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 15:55
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	GC5-WRA-0.5-4-DS	**Basis:**	Dry
Lab Code:	K2410642-016		

Total Metals – IVBA Analysis

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**221**	mg/Kg	5.0	0.6	50	10/22/24 16:01	10/17/24	
Lead	6020B	**70.4**	mg/Kg	0.50	0.20	50	10/22/24 16:01	10/17/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 15:55
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	GC5-WRA-0.5-4-DS	**Basis:**	Dry
Lab Code:	K2410642-016		

IVBA Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**10.4**	mg/Kg	1.9	0.2	20	10/17/24 11:37	10/16/24	
Lead	6020B	**26.4**	mg/Kg	0.19	0.08	20	10/17/24 11:37	10/16/24	

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Superset Reference:

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 15:55
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	GC5-WRA-0.5-4-DS	**Basis:**	Dry
Lab Code:	K2410642-016		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**81.3**	mg/Kg	7.9	0.9	100	10/22/24 11:54	10/10/24	

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Analytical Report

Client: Terraphase Engineering Inc.
Project: Upper Granite Creek Mines/0031.005.001
Sample Matrix: Soil

Service Request: K2410642
Date Collected: 10/04/24 14:00
Date Received: 10/08/24 14:45

Sample Name: GC6-WRA-0.5-2
Lab Code: K2410642-017

Basis: Dry

Total Metals – IVBA Analysis

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**759**	mg/Kg	4.9	0.6	50	10/22/24 16:02	10/17/24	
Lead	6020B	**360**	mg/Kg	0.49	0.20	50	10/22/24 16:02	10/17/24	

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Superset Reference:

ALS Group USA, Corp.
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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 14:00
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	GC6-WRA-0.5-2	**Basis:**	Dry
Lab Code:	K2410642-017		

IVBA Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**29.3**	mg/Kg	2.0	0.2	20	10/17/24 11:39	10/16/24	
Lead	6020B	**150**	mg/Kg	0.20	0.08	20	10/17/24 11:39	10/16/24	

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 14:00
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	GC6-WRA-0.5-2	**Basis:**	Dry
Lab Code:	K2410642-017		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**504**	mg/Kg	8.5	1.0	100	10/22/24 11:55	10/10/24	

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 10:45
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	GC6-WRA-0.5-1	**Basis:**	Dry
Lab Code:	K2410642-018		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**257**	mg/Kg	8.5	1.0	100	10/22/24 11:57	10/10/24	

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 11:50
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	GC7-WRA-0.5-3	**Basis:**	Dry
Lab Code:	K2410642-019		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**26.9**	mg/Kg	8.5	1.0	100	10/22/24 11:58	10/10/24	
Arsenic	6020B	**26.2**	mg/Kg	0.43	0.05	5	10/22/24 12:04	10/10/24	

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 11:15
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	GC7-WRB-0.5-1	**Basis:**	Dry
Lab Code:	K2410642-020		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**7.43**	mg/Kg	0.43	0.05	5	10/22/24 12:09	10/10/24	

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Superset Reference:

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	Dry
Lab Code:	KQ2416652-01		

Total Metals – IVBA Analysis

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	ND U	mg/Kg	0.5	0.06	5	10/22/24 15:43	10/17/24	
Lead	6020B	**0.043 J**	mg/Kg	0.05	0.020	5	10/22/24 15:43	10/17/24	

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	Dry
Lab Code:	KQ2416789-01		

IVBA Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	ND U	mg/Kg	0.5	0.06	5	10/17/24 10:57	10/16/24	
Lead	6020B	ND U	mg/Kg	0.05	0.020	5	10/17/24 10:57	10/16/24	

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ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	Dry
Lab Code:	KQ2416391-03		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**0.07 J**	mg/Kg	0.5	0.06	5	10/22/24 11:05	10/10/24	
Lead	6020B	ND U	mg/Kg	0.05	0.020	5	10/22/24 11:05	10/10/24	

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Superset Reference:

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	Dry
Lab Code:	KQ2416426-03		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Mercury	7471B	ND U	mg/Kg	0.02	0.002	1	10/15/24 09:02	10/14/24	

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ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24
Sample Matrix:	Soil	**Date Received:**	10/08/24
		Date Analyzed:	10/22/24

Replicate Sample Summary
Total Metals – IVBA Analysis

Sample Name:	UMM-TLA-0.5-6	**Units:**	mg/Kg
Lab Code:	K2410642-005	**Basis:**	Dry

Analyte Name	Analysis Method	MRL	MDL	Sample Result	Duplicate Sample KQ2416652-03 Result	Average	RPD	RPD Limit
Arsenic	6020B	5.0	0.6	5560	6460	6010	15	20
Lead	6020B	0.50	0.20	1110	1280	1200	14	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

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ALS Group USA, Corp.
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QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24
Sample Matrix:	Soil	**Date Received:**	10/08/24
		Date Analyzed:	10/17/24

Replicate Sample Summary
IVBA Metals

Sample Name:	UMM-TLA-0.5-6	**Units:**	mg/Kg
Lab Code:	K2410642-005	**Basis:**	Dry

Analyte Name	Analysis Method	MRL	MDL	Sample Result	Duplicate Sample KQ2416789-04 Result	Average	RPD	RPD Limit
Arsenic	6020B	2.0	0.2	1350	1360	1360	<1	20
Lead	6020B	0.20	0.08	69.2	72.3	70.8	4	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

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Superset Reference:

ALS Group USA, Corp.

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QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24
Sample Matrix:	Soil	**Date Received:**	10/08/24
		Date Analyzed:	10/22/24

Replicate Sample Summary

Total Metals

Sample Name:	UMM-TLB-0.5-1	**Units:**	mg/Kg
Lab Code:	K2410642-001	**Basis:**	Dry

Analyte Name	Analysis Method	MRL	MDL	Sample Result	Duplicate Sample KQ2416391-01 Result	Average	RPD	RPD Limit
Arsenic	6020B	11	1	6130	7400	6770	19	20
Lead	6020B	1.1	0.4	1710	1560	1640	9	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

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QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24
Sample Matrix:	Soil	**Date Received:**	10/08/24
		Date Analyzed:	10/22/24
		Date Extracted:	10/17/24

Matrix Spike Summary
Total Metals – IVBA Analysis

Sample Name:	UMM-TLA-0.5-6	**Units:**	mg/Kg
Lab Code:	K2410642-005	**Basis:**	Dry
Analysis Method:	6020B		
Prep Method:	EPA 3050B		

Matrix Spike
KQ2416652-04

Analyte Name	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Arsenic	5560	5980	97.0	435 #	75-125
Lead	1110	1250	97.0	145 #	75-125

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.

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QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24
Sample Matrix:	Soil	**Date Received:**	10/08/24
		Date Analyzed:	10/22/24
		Date Extracted:	10/10/24

Matrix Spike Summary
Total Metals

Sample Name:	UMM-TLB-0.5-1	**Units:**	mg/Kg
Lab Code:	K2410642-001	**Basis:**	Dry
Analysis Method:	6020B		
Prep Method:	EPA 3050B		

Matrix Spike
KQ2416391-02

Analyte Name	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Arsenic	6130	5760	11	-3268 #	75-125
Lead	1710	1750	5.6	557 #	75-125

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.

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Client: Terraphase Engineering Inc.
Project: Upper Granite Creek Mines/0031.005.001
Sample Matrix: Soil

Service Request: K2410642
Date Analyzed: 10/22/24

Lab Control Sample Summary
Total Metals – IVBA Analysis

Units: mg/Kg
Basis: Dry

Lab Control Sample
KQ2416652-02

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Arsenic	6020B	108	100	108	80-120
Lead	6020B	111	100	111	80-120

Client: Terraphase Engineering Inc.
Project: Upper Granite Creek Mines/0031.005.001
Sample Matrix: Soil

Service Request: K2410642
Date Analyzed: 10/17/24

Lab Control Sample Summary
IVBA Metals

Units: mg/Kg
Basis: Dry

Lab Control Sample
KQ2416789-02

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Arsenic	6020B	92.9	100	93	80-120
Lead	6020B	105	100	105	80-120

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QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Analyzed:**	10/22/24
Sample Matrix:	Soil		

Lab Control Sample Summary
Total Metals

Units: mg/Kg
Basis: Dry

Lab Control Sample
KQ2416391-04

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Arsenic	6020B	107	100	107	80-120
Lead	6020B	113	100	113	80-120

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Superset Reference:

Client: Terraphase Engineering Inc.
Project: Upper Granite Creek Mines/0031.005.001
Sample Matrix: Soil

Service Request: K2410642
Date Analyzed: 10/15/24

Lab Control Sample Summary
Total Metals

Units: mg/Kg
Basis: Dry

Lab Control Sample
KQ2416426-04

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Mercury	7471B	0.520	0.500	104	80-120

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QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	NA
LCS Matrix:	Soil	**Date Received:**	NA
		Date Extracted:	10/16/2024
		Date Analyzed:	10/17/2024

Standard Reference Material (SRM) Summary
Bioaccessible Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	KQ2416789-03	Basis:	Dry
Test Notes:	Montana II Solids = 97.8%		

Source: NIST 2711a - Montana II Soil

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	Control Limits (%)	Result Notes
Lead	EPA 1340	6020B	1300	1250	96	75.2 - 96.2	

October 23, 2024

Service Request No:K2410643

Don Malkemus
Terraphase Engineering Inc.
610 SW Broadway, Suite 405
Portland, OR 97205

Laboratory Results for: Upper Granite Creek Mines

Dear Don,

Enclosed are the results of the sample(s) submitted to our laboratory October 08, 2024
For your reference, these analyses have been assigned our service request number **K2410643.**

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please contact me if you have any questions. My extension is 3376. You may also contact me via email at Mark.Harris@alsglobal.com.

Respectfully submitted,

ALS Group USA, Corp. dba ALS Environmental

Mark Harris
Project Manager

ADDRESS 1317 S. 13th Avenue, Kelso, WA 98626
PHONE +1 360 577 7222 | FAX +1 360 636 1068
ALS Group USA, Corp.
dba ALS Environmental

Narrative Documents

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

1317 South 13th Ave, Kelso, WA 98626 | 1-360-577-7222 | www.alsglobal.com

Client: Terraphase Engineering Inc.
Project: Upper Granite Creek Mines
Sample Matrix: Soil

Service Request: K2410643
Date Received: 10/08/2024

CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples for the Tier II level requested by the client.

Sample Receipt:

Fourteen soil samples were received for analysis at ALS Environmental on 10/08/2024. Any discrepancies upon initial sample inspection are annotated on the sample receipt and preservation form included within this report. The samples were stored at minimum in accordance with the analytical method requirements.

Metals:

Method 6020B, 10/22/2024: The Relative Percent Difference (RPD) for the replicate analysis of Silver in sample TL-WRA-0.5-3 was outside the normal ALS control limits. The variability in the results was attributed to the heterogeneous character of the sample. Standard mixing techniques were used, but were not sufficient for complete homogenization of this sample.

Method 6020B, 10/22/2024: Antimony recoveries are generally low for soil and sediment samples when digested using EPA Method 3050B. Despite anticipated low recoveries, the method is still generally prescribed because of its versatility for general metals analysis. Antimony results (in conjunction with the matrix spike recovery) from this procedure should only be used as indicators to estimate concentrations. The matrix spike recovery of Antimony for sample TL-WRA-0.5-3 was below the ALS control criterion. Since low recoveries resulted from a method defect and were possibly magnified by certain matrix components, no corrective action was appropriate. Alternative procedures that specifically target Antimony are available but were not specified for this project. The associated QA/QC results (e.g. control sample, calibration standards, etc.) indicated the analysis was in control.

Method 6020B, 10/22/2024: The matrix spike recovery of Lead for sample TL-WRA-0.5-3 was outside control criteria. Recovery in the Laboratory Control Sample (LCS) was acceptable, which indicated the analytical batch was in control. No further corrective action was appropriate.

Approved by Noel D. Diaz

Date 10/23/2024

SAMPLE DETECTION SUMMARY

This form includes only detections above the reporting levels. For a full listing of sample results, continue to the Sample Results section of this Report.

CLIENT ID: CS-SD-1 — **Lab ID: K2410643-006**

Analyte	Results	Flag	MDL	MRL	Units	Method
Antimony	0.26		0.05	0.13	mg/Kg	6020B
Arsenic	5.8		0.2	1.3	mg/Kg	6020B
Cadmium	0.234		0.019	0.053	mg/Kg	6020B
Chromium	7.81		0.16	0.53	mg/Kg	6020B
Lead	4.12		0.05	0.13	mg/Kg	6020B
Mercury	0.031	J	0.005	0.053	mg/Kg	7471B
Silver	0.282		0.011	0.053	mg/Kg	6020B
Solids, Total	34.2				Percent	160.3 Modified
Zinc	45.0		0.5	1.3	mg/Kg	6020B

CLIENT ID: CS-SD-2 — **Lab ID: K2410643-007**

Analyte	Results	Flag	MDL	MRL	Units	Method
Antimony	0.038	J	0.022	0.054	mg/Kg	6020B
Arsenic	4.52		0.07	0.54	mg/Kg	6020B
Cadmium	0.038		0.008	0.022	mg/Kg	6020B
Chromium	2.49		0.07	0.22	mg/Kg	6020B
Lead	0.927		0.022	0.054	mg/Kg	6020B
Silver	0.043		0.004	0.022	mg/Kg	6020B
Solids, Total	76.9				Percent	160.3 Modified
Zinc	16.9		0.22	0.54	mg/Kg	6020B

CLIENT ID: CS-SD-3 — **Lab ID: K2410643-008**

Analyte	Results	Flag	MDL	MRL	Units	Method
Antimony	0.069		0.025	0.063	mg/Kg	6020B
Arsenic	11.7		0.08	0.63	mg/Kg	6020B
Cadmium	0.062		0.009	0.025	mg/Kg	6020B
Chromium	4.90		0.08	0.25	mg/Kg	6020B
Lead	1.53		0.025	0.063	mg/Kg	6020B
Mercury	0.923		0.003	0.027	mg/Kg	7471B
Silver	0.112		0.005	0.025	mg/Kg	6020B
Solids, Total	69.1				Percent	160.3 Modified
Zinc	29.7		0.25	0.63	mg/Kg	6020B

CLIENT ID: CS-SD-4 — **Lab ID: K2410643-009**

Analyte	Results	Flag	MDL	MRL	Units	Method
Antimony	0.892		0.023	0.058	mg/Kg	6020B
Arsenic	32.7		0.07	0.58	mg/Kg	6020B
Cadmium	1.09		0.008	0.023	mg/Kg	6020B
Chromium	9.05		0.07	0.23	mg/Kg	6020B
Lead	25.6		0.023	0.058	mg/Kg	6020B
Mercury	0.011	J	0.003	0.029	mg/Kg	7471B
Silver	0.961		0.005	0.023	mg/Kg	6020B

SAMPLE DETECTION SUMMARY

This form includes only detections above the reporting levels. For a full listing of sample results, continue to the Sample Results section of this Report.

CLIENT ID: CS-SD-4	Lab ID: K2410643-009					
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Solids, Total	64.9				Percent	160.3 Modified
Zinc	47.2		0.23	0.58	mg/Kg	6020B

CLIENT ID: CS-SD-5	Lab ID: K2410643-010					
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Antimony	0.146		0.020	0.051	mg/Kg	6020B
Arsenic	14.1		0.06	0.51	mg/Kg	6020B
Cadmium	0.169		0.007	0.020	mg/Kg	6020B
Chromium	5.03		0.06	0.20	mg/Kg	6020B
Lead	2.79		0.020	0.051	mg/Kg	6020B
Mercury	0.056		0.002	0.025	mg/Kg	7471B
Silver	0.582		0.004	0.020	mg/Kg	6020B
Solids, Total	71.1				Percent	160.3 Modified
Zinc	32.7		0.20	0.51	mg/Kg	6020B

CLIENT ID: CS-SD-6	Lab ID: K2410643-011					
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Antimony	0.147		0.018	0.045	mg/Kg	6020B
Arsenic	16.6		0.05	0.45	mg/Kg	6020B
Cadmium	0.146		0.006	0.018	mg/Kg	6020B
Chromium	4.76		0.05	0.18	mg/Kg	6020B
Lead	2.74		0.018	0.045	mg/Kg	6020B
Mercury	0.033		0.002	0.021	mg/Kg	7471B
Silver	0.200		0.004	0.018	mg/Kg	6020B
Solids, Total	82.1				Percent	160.3 Modified
Zinc	37.1		0.18	0.45	mg/Kg	6020B

CLIENT ID: CS-SD-7	Lab ID: K2410643-012					
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Antimony	0.355		0.019	0.048	mg/Kg	6020B
Arsenic	24.2		0.06	0.48	mg/Kg	6020B
Cadmium	0.538		0.007	0.019	mg/Kg	6020B
Chromium	10.6		0.06	0.19	mg/Kg	6020B
Lead	12.1		0.019	0.048	mg/Kg	6020B
Mercury	0.097		0.002	0.023	mg/Kg	7471B
Silver	1.10		0.004	0.019	mg/Kg	6020B
Solids, Total	80.2				Percent	160.3 Modified
Zinc	168		0.19	0.48	mg/Kg	6020B

CLIENT ID: CS-SD-7-DUP	Lab ID: K2410643-013					
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Antimony	0.334		0.022	0.054	mg/Kg	6020B

SAMPLE DETECTION SUMMARY

This form includes only detections above the reporting levels. For a full listing of sample results, continue to the Sample Results section of this Report.

CLIENT ID: CS-SD-7-DUP **Lab ID: K2410643-013**

Analyte	Results	Flag	MDL	MRL	Units	Method
Arsenic	24.3		0.06	0.54	mg/Kg	6020B
Cadmium	0.446		0.008	0.022	mg/Kg	6020B
Chromium	9.10		0.06	0.22	mg/Kg	6020B
Lead	12.8		0.022	0.054	mg/Kg	6020B
Mercury	0.099		0.002	0.024	mg/Kg	7471B
Silver	1.62		0.004	0.022	mg/Kg	6020B
Solids, Total	73.2				Percent	160.3 Modified
Zinc	102		0.22	0.54	mg/Kg	6020B

CLIENT ID: CS-SD-8 **Lab ID: K2410643-014**

Analyte	Results	Flag	MDL	MRL	Units	Method
Antimony	0.406		0.023	0.058	mg/Kg	6020B
Arsenic	35.2		0.07	0.58	mg/Kg	6020B
Cadmium	0.316		0.008	0.023	mg/Kg	6020B
Chromium	9.13		0.07	0.23	mg/Kg	6020B
Lead	10.7		0.023	0.058	mg/Kg	6020B
Mercury	0.096		0.003	0.026	mg/Kg	7471B
Silver	1.26		0.005	0.023	mg/Kg	6020B
Solids, Total	69.0				Percent	160.3 Modified
Zinc	103		0.23	0.58	mg/Kg	6020B

CLIENT ID: TL-WRA-0.5-3 **Lab ID: K2410643-001**

Analyte	Results	Flag	MDL	MRL	Units	Method
Arsenic	454		0.05	0.42	mg/Kg	6020B
Solids, Total	95.0				Percent	160.3 Modified

CLIENT ID: TL-WRB-0.5-4 **Lab ID: K2410643-002**

Analyte	Results	Flag	MDL	MRL	Units	Method
Arsenic	194		0.05	0.42	mg/Kg	6020B
Solids, Total	95.5				Percent	160.3 Modified

CLIENT ID: TL-WRA-0.5-1-DS-2 **Lab ID: K2410643-003**

Analyte	Results	Flag	MDL	MRL	Units	Method
Arsenic	550		0.6	4.9	mg/Kg	6020B
Arsenic	14.4		0.2	1.9	mg/Kg	6020B
Arsenic	267		0.05	0.44	mg/Kg	6020B
Lead	218		0.19	0.49	mg/Kg	6020B
Lead	83.3		0.08	0.19	mg/Kg	6020B
Solids, Total	93.4				Percent	160.3 Modified

CLIENT ID: SH-WRB-0.5-2 **Lab ID: K2410643-004**

Analyte	Results	Flag	MDL	MRL	Units	Method
Arsenic	80.8		0.05	0.39	mg/Kg	6020B

SAMPLE DETECTION SUMMARY

This form includes only detections above the reporting levels. For a full listing of sample results, continue to the Sample Results section of this Report.

CLIENT ID: SH-WRB-0.5-2	Lab ID: K2410643-004					
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Solids, Total	94.1				Percent	160.3 Modified

CLIENT ID: SH-WRC-0.5-1	Lab ID: K2410643-005					
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Arsenic	14.4		0.05	0.44	mg/Kg	6020B
Solids, Total	92.3				Percent	160.3 Modified

Sample Receipt Information

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

RIGHT SOLUTIONS | RIGHT PARTNER

Client: Terraphase Engineering Inc. **Service Request:** K2410643
Project: Upper Granite Creek Mines/0031.005.001

SAMPLE CROSS-REFERENCE

SAMPLE #	CLIENT SAMPLE ID	DATE	TIME
K2410643-001	TL-WRA-0.5-3	10/4/2024	1405
K2410643-002	TL-WRB-0.5-4	10/4/2024	1425
K2410643-003	TL-WRA-0.5-1-DS-2	10/4/2024	1400
K2410643-004	SH-WRB-0.5-2	10/4/2024	1005
K2410643-005	SH-WRC-0.5-1	10/4/2024	1015
K2410643-006	CS-SD-1	10/5/2024	1006
K2410643-007	CS-SD-2	10/3/2024	1505
K2410643-008	CS-SD-3	10/3/2024	0900
K2410643-009	CS-SD-4	10/3/2024	1424
K2410643-010	CS-SD-5	10/4/2024	0930
K2410643-011	CS-SD-6	10/4/2024	1521
K2410643-012	CS-SD-7	10/4/2024	1335
K2410643-013	CS-SD-7-DUP	10/4/2024	1340
K2410643-014	CS-SD-8	10/5/2024	1030

ALS Environmental

140510

CHAIN OF CUSTODY

140510

001, 002, 003

SR#

COC Set 6 of 8

COC#

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www.alsglobal.com

K2410639
43

Project Name: Upper Granite Creek Mines
Project Number: 0031.005.001
Project Manager: Dan Malkemus
Company: Terraphase Engineering Inc.
Address, City, State: 610 SW Broadway Suite 405
Phone #: (503) 943-0384
email: dan.malkemus@terraphase.com
Sampler Signature: [signature]
Sampler Printed Name: Dan Malkemus

CLIENT SAMPLE ID	LABID	Sampling Date	Sampling Time	Sampling State	Matrix	NUMBER OF CONTAINERS	28D: 7470A / Hg T	28D: 7471B / Hg	180D: 6020B / IVBA (Sieved Total)	180D: 6020B / IVBA Extract	180D: 6020B / Metals T	999D: Grind / GrindSub	999D: SM 2340 B / Hardness Calc	1	2	3	4	5	Remarks
1. GC5-WRA-0.5-4-DS		10/4	1555		Soil	2			X	X	X								+ bag
2. GC6-WRA-0.5-2		10/4	1400		Soil	2			X	X	X								+ bag
3. GC6-WRA-0.5-1		10/4	1045		Soil	2					X								
4. GC7-WRA-0.5-3		10/4	1150		Soil	2					X								
5. GC7-WRB-0.5-1		10/4	1115		Soil	2					X								
6. TL-WRA-0.5-3	1	10/4	1405		Soil	2					X								
7. TL-WRB-0.5-4	2	10/4	1425		Soil	2					X								
8. TL-WRA-0.5-1-DS-2	3	10/4	1400		Soil	2			X	X	X								+ bag
9. SH-WRB-0.5-2	4	10/4	1005		Soil	2					X								
10. SH-WRC-0.5-1	5	10/4	1015		Soil	2					X								

Report Requirements

- ___ I. Routine Report: Method Blank, Surrogate, as required
- X II. Report Dup., MS, MSD as required
- ___ III. CLP Like Summary (no raw data)
- ___ IV. Data Validation Report
- ___ V. EDD

Invoice Information

P.O.#
Bill To: ap@terraphase.com

Turnaround Requirements

- ___ 24 hr.
- ___ 48 hr.
- ___ 5 Day
- X Standard

Requested Report Date

Circle which metals are to be analyzed

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Special Instructions/Comments:

*Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other___ (Circle One)

	Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature	[signature]	[signature]	[signature]	Naomi Rodesen		
Printed Name	Dan Malkemus	Franklin LaBiche	Franklin LaBiche	ALS		
Firm	TEI	ALS	ALS	10/8/24 1445		
Date/Time	10/8 1306	10/08/24 1306	10/08/24 1445			

ALS

140510

CHAIN OF CUSTODY

140510

001, 002, 003

SR#

COC Set 8 of 8

COC#

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www.alsglobal.com

K2410639 43

Project Name: Upper Granite Creek Mines
Project Number: 0031-005.001
Project Manager: Don Malkemus
Company: Terraphase Engineering Inc.
Address, City, State: 610 SW Broadway Suite 405
Phone #: (503) 943 0384
email: don.malkemus@terraphase.com
Sampler Signature:
Sampler Printed Name: Don Malkemus

CLIENT SAMPLE ID	LABID	SAMPLING Date	Time	State	Matrix	NUMBER OF CONTAINERS	28D 7470A / Hg T	28D 7471B / Hg	180D 6020B / IVBA (Sieved Total)	180D 6020B / IVBA Extract	180D 6020B / Metals T	999D Grind / GrindSub	SM 2340 B / Hardness Calc	1	2	3	4	5	Remarks
1. CS-SD-1	6	10/5	1006		Soil	2		X			X								
2. CS-SD-2	7	10/3	1505		Soil	2		X			X								
3. CS-SD-3	8	10/3	0900		Soil	2		X			X								
4. CS-SD-4	9	10/3	1424		Soil	2		X			X								
5. CS-SD-5	10	10/4	0930		Soil	2		X			X								
6. CS-SD-6	11	10/4	1521		Soil	2		X			X								
7. CS-SD-7	12	10/4	1335		Soil	2		X			X								
8. CS-SD-7-DUP	13	10/4	1340		Soil	2		X			X								
9. CS-SD-8	14	10/5	1030		Soil	2		X			X								
10.																			

Report Requirements

___ I. Routine Report: Method Blank, Surrogate, as required
X II. Report Dup., MS, MSD as required
___ III. CLP Like Summary (no raw data)
___ IV. Data Validation Report
___ V. EDD

Invoice Information

P.O.#
Bill To: ap@terraphase.com

Turnaround Requirements

___ 24 hr. ___ 48 hr.
___ 5 Day
X Standard

Requested Report Date

Circle which metals are to be analyzed

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Special Instructions/Comments:

*Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other____ (Circle One)

	Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature				Nason Pedersen		
Printed Name	Don Malkemus	Franklin LaBiche	Franklin LaBiche	ALS		
Firm	TEI	ALS	ALS	10/8/24 1445		
Date/Time	10/8 1306	10/08/24 1306	10/08/24 1445			

PM MH

Cooler Receipt and Preservation Form

Client Terraphase Service Request K24 10643

Received: 10/8/24 Opened: 10/8/24 By: AP Unloaded: 10/8/24 By: AP

1. Samples were received via? *USPS* *Fed Ex* *UPS* *DHL* *PDX* *Courier* *Hand Delivered*
2. Samples were received in: (circle) *Cooler* *Box* *Envelope* *Other* ______ *NA*
3. Were custody seals on coolers? NA Y N If yes, how many and where? ______

If present, were custody seals intact? Y N If present, were they signed and dated? Y N

Temp Blank	Sample Temp	IR Gun	Cooler #/COC ID / NA	Out of temp indicate with "X"	PM Notified If out of temp	Tracking Number NA	Filed
9.6	4.6	1801	140510				
16.8	5.7						
6.0	4.4						
9.4	4.5						
18.3	4.5						

4. Was a Temperature Blank present in cooler? NA Y N If yes, notate the temperature in the appropriate column above:

If no, take the temperature of a representative sample bottle contained within the cooler; notate in the column "Sample Temp":

5. Were samples received within the method specified temperature ranges? NA Y N

If no, were they received on ice and same day as collected? If not, notate the cooler # above and notify the PM. NA Y N

If applicable, tissue samples were received: *Frozen* *Partially Thawed* *Thawed*

6. Packing material: *Inserts* *Baggies* *Bubble Wrap* *Gel Packs* *Wet Ice* *Dry Ice* *Sleeves* ______
7. Were custody papers properly filled out (ink, signed, etc.)? NA Y N
8. Were samples received in good condition (unbroken) NA Y N
9. Were all sample labels complete (ie, analysis, preservation, etc.)? NA Y N
10. Did all sample labels and tags agree with custody papers? NA Y N
11. Were appropriate bottles/containers and volumes received for the tests indicated? NA Y N
12. Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* NA Y N
13. Were VOA vials received without headspace? *Indicate in the table below.* NA Y N
14. Was C12/Res negative? NA Y N
15. Were samples received within the method specified time limit? If not, notate the error below and notify the PM NA Y N
16. Were 100ml sterile microbiology bottles filled exactly to the 100ml mark? NA Y N Underfilled Overfilled

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count Bottle Type	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies, Resolutions: ______

Cooler Receipt and Preservation Form

Client Terraphase Service Request K24 10643

Temp Blank	Sample Temp	IR Gun	Cooler #/COC ID / NA	Out of temp indicate with "X"	PM Notified If out of temp	Tracking Number NA	Filed
~~NA 8.~~ 7.8	3.8	IR01					
12.2	5.5	↓					

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count Bottle Type	Out of Temp	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies & Resolutions: Ice was at top of coolers on top of samples. Temp blank was under the samples, not indicative of sample temp

Miscellaneous Forms

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

Inorganic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
E	The result is an estimate amount because the value exceeded the instrument calibration range.
J	The result is an estimated value.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.
H	The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

#	The control limit criteria is not applicable.
J	The result is an estimated value.
E	The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
M	The duplicate injection precision was not met.
N	The Matrix Spike sample recovery is not within control limits. See case narrative.
S	The reported value was determined by the Method of Standard Additions (MSA).
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
W	The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
+	The correlation coefficient for the MSA is less than 0.995.
Q	See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
A	A tentatively identified compound, a suspected aldol-condensation product.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
C	The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
D	The reported result is from a dilution.
E	The result is an estimated value over the calibration range.
J	The result is an estimated value between the MDL and the MRL.
N	The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
P	The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

F	The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
L	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
H	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
O	The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
Y	The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
Z	The chromatographic fingerprint does not resemble a petroleum product.

ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso
State Certifications, Accreditations, and Licenses

Agency	Web Site	Number
Alaska DEH	http://dec.alaska.gov/eh/lab/cs/csapproval.htm	UST-040
Arizona DHS	http://www.azdhs.gov/lab/license/env.htm	AZ0339
Arkansas - DEQ	http://www.adeq.state.ar.us/techsvs/labcert.htm	88-0637
California DHS (ELAP)	http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx	2795
DOD ELAP	http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm	L16-58-R4
Florida DOH	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E87412
Hawaii DOH	http://health.hawaii.gov/	-
ISO 17025	http://www.pjlabs.com/	L16-57
Louisiana DEQ	http://www.deq.louisiana.gov/page/la-lab-accreditation	03016
Maine DHS	http://www.maine.gov/dhhs/	WA01276
Minnesota DOH	http://www.health.state.mn.us/accreditation	053-999-457
Nevada DEP	http://ndep.nv.gov/bsdw/labservice.htm	WA01276
New Jersey DEP	http://www.nj.gov/dep/enforcement/oqa.html	WA005
New York - DOH	https://www.wadsworth.org/regulatory/elap	12060
North Carolina DEQ	https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/laboratory-certification-branch/non-field-lab-certification	605
Oklahoma DEQ	http://www.deq.state.ok.us/CSDnew/labcert.htm	9801
Oregon – DEQ (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	WA100010
South Carolina DHEC	http://www.scdhec.gov/environment/EnvironmentalLabCertification/	61002
Texas CEQ	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704427
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C544
Wyoming (EPA Region 8)	https://www.epa.gov/region8-waterops/epa-region-8-certified-drinking-water-	-
Kelso Laboratory Website	www.alsglobal.com	NA

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.ALSGlobal.com or at the accreditation bodies web site.
Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/anlayte is offered by that state.

Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LOD	Limit of Detection
LOQ	Limit of Quantitation
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

ALS Group USA, Corp.
dba ALS Environmental

Analyst Summary report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001		

Sample Name:	TL-WRA-0.5-3	**Date Collected:**	10/4/24
Lab Code:	K2410643-001	**Date Received:**	10/8/24
Sample Matrix:	Soil		

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN

Sample Name:	TL-WRB-0.5-4	**Date Collected:**	10/4/24
Lab Code:	K2410643-002	**Date Received:**	10/8/24
Sample Matrix:	Soil		

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN

Sample Name:	TL-WRA-0.5-1-DS-2	**Date Collected:**	10/4/24
Lab Code:	K2410643-003	**Date Received:**	10/8/24
Sample Matrix:	Soil		

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN
6020B	MSOLADEY	JCHAN

Sample Name:	SH-WRB-0.5-2	**Date Collected:**	10/4/24
Lab Code:	K2410643-004	**Date Received:**	10/8/24
Sample Matrix:	Soil		

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001		

Sample Name:	SH-WRC-0.5-1	**Date Collected:**	10/4/24
Lab Code:	K2410643-005	**Date Received:**	10/8/24
Sample Matrix:	Soil		

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN

Sample Name:	CS-SD-1	**Date Collected:**	10/5/24
Lab Code:	K2410643-006	**Date Received:**	10/8/24
Sample Matrix:	Soil		

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN
7471B	KLINN	KLINN

Sample Name:	CS-SD-2	**Date Collected:**	10/3/24
Lab Code:	K2410643-007	**Date Received:**	10/8/24
Sample Matrix:	Soil		

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN
7471B	KLINN	KLINN

Sample Name:	CS-SD-3	**Date Collected:**	10/3/24
Lab Code:	K2410643-008	**Date Received:**	10/8/24
Sample Matrix:	Soil		

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN
7471B	KLINN	KLINN

Analyst Summary report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001		

Sample Name:	CS-SD-4	**Date Collected:**	10/3/24
Lab Code:	K2410643-009	**Date Received:**	10/8/24
Sample Matrix:	Soil		

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN
7471B	KLINN	KLINN

Sample Name:	CS-SD-5	**Date Collected:**	10/4/24
Lab Code:	K2410643-010	**Date Received:**	10/8/24
Sample Matrix:	Soil		

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN
7471B	KLINN	KLINN

Sample Name:	CS-SD-6	**Date Collected:**	10/4/24
Lab Code:	K2410643-011	**Date Received:**	10/8/24
Sample Matrix:	Soil		

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN
7471B	KLINN	KLINN

Sample Name:	CS-SD-7	**Date Collected:**	10/4/24
Lab Code:	K2410643-012	**Date Received:**	10/8/24
Sample Matrix:	Soil		

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN
7471B	KLINN	KLINN

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001		

Sample Name:	CS-SD-7-DUP	**Date Collected:**	10/4/24
Lab Code:	K2410643-013	**Date Received:**	10/8/24
Sample Matrix:	Soil		

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN
7471B	KLINN	KLINN

Sample Name:	CS-SD-8	**Date Collected:**	10/5/24
Lab Code:	K2410643-014	**Date Received:**	10/8/24
Sample Matrix:	Soil		

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN
7471B	KLINN	KLINN

Sample Results

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
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Metals

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 14:05
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	TL-WRA-0.5-3	**Basis:**	Dry
Lab Code:	K2410643-001		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**454**	mg/Kg	0.42	0.05	5	10/22/24 13:49	10/14/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 14:25
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	TL-WRB-0.5-4	**Basis:**	Dry
Lab Code:	K2410643-002		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**194**	mg/Kg	0.42	0.05	5	10/22/24 13:58	10/14/24	

Printed 10/23/2024 5:16:34 PM

Superset Reference:24-0000711615 rev 00

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 14:00
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	TL-WRA-0.5-1-DS-2	**Basis:**	Dry
Lab Code:	K2410643-003		

Total Metals – IVBA Analysis

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**550**	mg/Kg	4.9	0.6	50	10/22/24 16:11	10/17/24	
Lead	6020B	**218**	mg/Kg	0.49	0.19	50	10/22/24 16:11	10/17/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 14:00
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	TL-WRA-0.5-1-DS-2	**Basis:**	Dry
Lab Code:	K2410643-003		

IVBA Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**14.4**	mg/Kg	1.9	0.2	20	10/17/24 11:50	10/16/24	
Lead	6020B	**83.3**	mg/Kg	0.19	0.08	20	10/17/24 11:50	10/16/24	

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 14:00
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	TL-WRA-0.5-1-DS-2	**Basis:**	Dry
Lab Code:	K2410643-003		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**267**	mg/Kg	0.44	0.05	5	10/22/24 14:00	10/14/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 10:05
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	SH-WRB-0.5-2	**Basis:**	Dry
Lab Code:	K2410643-004		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**80.8**	mg/Kg	0.39	0.05	5	10/22/24 14:02	10/14/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 10:15
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	SH-WRC-0.5-1	**Basis:**	Dry
Lab Code:	K2410643-005		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**14.4**	mg/Kg	0.44	0.05	5	10/22/24 14:08	10/14/24	

Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 10:06
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-1	**Basis:**	Dry
Lab Code:	K2410643-006		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.26**	mg/Kg	0.13	0.05	5	10/22/24 14:10	10/14/24	
Arsenic	6020B	**5.8**	mg/Kg	1.3	0.2	5	10/22/24 14:10	10/14/24	
Cadmium	6020B	**0.234**	mg/Kg	0.053	0.019	5	10/22/24 14:10	10/14/24	
Chromium	6020B	**7.81**	mg/Kg	0.53	0.16	5	10/22/24 14:10	10/14/24	
Lead	6020B	**4.12**	mg/Kg	0.13	0.05	5	10/22/24 14:10	10/14/24	
Mercury	7471B	**0.031 J**	mg/Kg	0.053	0.005	1	10/15/24 12:21	10/14/24	
Silver	6020B	**0.282**	mg/Kg	0.053	0.011	5	10/22/24 14:10	10/14/24	
Zinc	6020B	**45.0**	mg/Kg	1.3	0.5	5	10/22/24 14:10	10/14/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 15:05
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-2	**Basis:**	Dry
Lab Code:	K2410643-007		

Total Metals

Analyte Name	Analysis Method	Result		Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.038**	**J**	mg/Kg	0.054	0.022	5	10/22/24 14:12	10/14/24	
Arsenic	6020B	**4.52**		mg/Kg	0.54	0.07	5	10/22/24 14:12	10/14/24	
Cadmium	6020B	**0.038**		mg/Kg	0.022	0.008	5	10/22/24 14:12	10/14/24	
Chromium	6020B	**2.49**		mg/Kg	0.22	0.07	5	10/22/24 14:12	10/14/24	
Lead	6020B	**0.927**		mg/Kg	0.054	0.022	5	10/22/24 14:12	10/14/24	
Mercury	7471B	ND	U	mg/Kg	0.024	0.002	1	10/15/24 12:22	10/14/24	
Silver	6020B	**0.043**		mg/Kg	0.022	0.004	5	10/22/24 14:12	10/14/24	
Zinc	6020B	**16.9**		mg/Kg	0.54	0.22	5	10/22/24 14:12	10/14/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 09:00
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-3	**Basis:**	Dry
Lab Code:	K2410643-008		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.069**	mg/Kg	0.063	0.025	5	10/22/24 14:14	10/14/24	
Arsenic	6020B	**11.7**	mg/Kg	0.63	0.08	5	10/22/24 14:14	10/14/24	
Cadmium	6020B	**0.062**	mg/Kg	0.025	0.009	5	10/22/24 14:14	10/14/24	
Chromium	6020B	**4.90**	mg/Kg	0.25	0.08	5	10/22/24 14:14	10/14/24	
Lead	6020B	**1.53**	mg/Kg	0.063	0.025	5	10/22/24 14:14	10/14/24	
Mercury	7471B	**0.923**	mg/Kg	0.027	0.003	1	10/15/24 12:24	10/14/24	
Silver	6020B	**0.112**	mg/Kg	0.025	0.005	5	10/22/24 14:14	10/14/24	
Zinc	6020B	**29.7**	mg/Kg	0.63	0.25	5	10/22/24 14:14	10/14/24	

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 14:24
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-4	**Basis:**	Dry
Lab Code:	K2410643-009		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.892**	mg/Kg	0.058	0.023	5	10/22/24 14:16	10/14/24	
Arsenic	6020B	**32.7**	mg/Kg	0.58	0.07	5	10/22/24 14:16	10/14/24	
Cadmium	6020B	**1.09**	mg/Kg	0.023	0.008	5	10/22/24 14:16	10/14/24	
Chromium	6020B	**9.05**	mg/Kg	0.23	0.07	5	10/22/24 14:16	10/14/24	
Lead	6020B	**25.6**	mg/Kg	0.058	0.023	5	10/22/24 14:16	10/14/24	
Mercury	7471B	**0.011 J**	mg/Kg	0.029	0.003	1	10/15/24 12:26	10/14/24	
Silver	6020B	**0.961**	mg/Kg	0.023	0.005	5	10/22/24 14:16	10/14/24	
Zinc	6020B	**47.2**	mg/Kg	0.58	0.23	5	10/22/24 14:16	10/14/24	

Client:	Terraphase Engineering Inc.		**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001		**Date Collected:**	10/04/24 09:30
Sample Matrix:	Soil		**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-5		**Basis:**	Dry
Lab Code:	K2410643-010			

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.146**	mg/Kg	0.051	0.020	5	10/22/24 14:18	10/14/24	
Arsenic	6020B	**14.1**	mg/Kg	0.51	0.06	5	10/22/24 14:18	10/14/24	
Cadmium	6020B	**0.169**	mg/Kg	0.020	0.007	5	10/22/24 14:18	10/14/24	
Chromium	6020B	**5.03**	mg/Kg	0.20	0.06	5	10/22/24 14:18	10/14/24	
Lead	6020B	**2.79**	mg/Kg	0.051	0.020	5	10/22/24 14:18	10/14/24	
Mercury	7471B	**0.056**	mg/Kg	0.025	0.002	1	10/15/24 12:27	10/14/24	
Silver	6020B	**0.582**	mg/Kg	0.020	0.004	5	10/22/24 14:18	10/14/24	
Zinc	6020B	**32.7**	mg/Kg	0.51	0.20	5	10/22/24 14:18	10/14/24	

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Analytical Report

Client:	Terraphase Engineering Inc.		**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001		**Date Collected:**	10/04/24 15:21
Sample Matrix:	Soil		**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-6		**Basis:**	Dry
Lab Code:	K2410643-011			

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.147**	mg/Kg	0.045	0.018	5	10/22/24 14:20	10/14/24	
Arsenic	6020B	**16.6**	mg/Kg	0.45	0.05	5	10/22/24 14:20	10/14/24	
Cadmium	6020B	**0.146**	mg/Kg	0.018	0.006	5	10/22/24 14:20	10/14/24	
Chromium	6020B	**4.76**	mg/Kg	0.18	0.05	5	10/22/24 14:20	10/14/24	
Lead	6020B	**2.74**	mg/Kg	0.045	0.018	5	10/22/24 14:20	10/14/24	
Mercury	7471B	**0.033**	mg/Kg	0.021	0.002	1	10/15/24 12:29	10/14/24	
Silver	6020B	**0.200**	mg/Kg	0.018	0.004	5	10/22/24 14:20	10/14/24	
Zinc	6020B	**37.1**	mg/Kg	0.45	0.18	5	10/22/24 14:20	10/14/24	

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Analytical Report

Client: Terraphase Engineering Inc.
Project: Upper Granite Creek Mines/0031.005.001
Sample Matrix: Soil

Service Request: K2410643
Date Collected: 10/04/24 13:35
Date Received: 10/08/24 11:45

Sample Name: CS-SD-7
Lab Code: K2410643-012

Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.355**	mg/Kg	0.048	0.019	5	10/22/24 14:21	10/14/24	
Arsenic	6020B	**24.2**	mg/Kg	0.48	0.06	5	10/22/24 14:21	10/14/24	
Cadmium	6020B	**0.538**	mg/Kg	0.019	0.007	5	10/22/24 14:21	10/14/24	
Chromium	6020B	**10.6**	mg/Kg	0.19	0.06	5	10/22/24 14:21	10/14/24	
Lead	6020B	**12.1**	mg/Kg	0.048	0.019	5	10/22/24 14:21	10/14/24	
Mercury	7471B	**0.097**	mg/Kg	0.023	0.002	1	10/15/24 12:30	10/14/24	
Silver	6020B	**1.10**	mg/Kg	0.019	0.004	5	10/22/24 14:21	10/14/24	
Zinc	6020B	**168**	mg/Kg	0.48	0.19	5	10/22/24 14:21	10/14/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 13:40
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-7-DUP	**Basis:**	Dry
Lab Code:	K2410643-013		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.334**	mg/Kg	0.054	0.022	5	10/22/24 14:23	10/14/24	
Arsenic	6020B	**24.3**	mg/Kg	0.54	0.06	5	10/22/24 14:23	10/14/24	
Cadmium	6020B	**0.446**	mg/Kg	0.022	0.008	5	10/22/24 14:23	10/14/24	
Chromium	6020B	**9.10**	mg/Kg	0.22	0.06	5	10/22/24 14:23	10/14/24	
Lead	6020B	**12.8**	mg/Kg	0.054	0.022	5	10/22/24 14:23	10/14/24	
Mercury	7471B	**0.099**	mg/Kg	0.024	0.002	1	10/15/24 12:35	10/14/24	
Silver	6020B	**1.62**	mg/Kg	0.022	0.004	5	10/22/24 14:23	10/14/24	
Zinc	6020B	**102**	mg/Kg	0.54	0.22	5	10/22/24 14:23	10/14/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 10:30
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-8	**Basis:**	Dry
Lab Code:	K2410643-014		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.406**	mg/Kg	0.058	0.023	5	10/22/24 14:25	10/14/24	
Arsenic	6020B	**35.2**	mg/Kg	0.58	0.07	5	10/22/24 14:25	10/14/24	
Cadmium	6020B	**0.316**	mg/Kg	0.023	0.008	5	10/22/24 14:25	10/14/24	
Chromium	6020B	**9.13**	mg/Kg	0.23	0.07	5	10/22/24 14:25	10/14/24	
Lead	6020B	**10.7**	mg/Kg	0.058	0.023	5	10/22/24 14:25	10/14/24	
Mercury	7471B	**0.096**	mg/Kg	0.026	0.003	1	10/15/24 12:37	10/14/24	
Silver	6020B	**1.26**	mg/Kg	0.023	0.005	5	10/22/24 14:25	10/14/24	
Zinc	6020B	**103**	mg/Kg	0.58	0.23	5	10/22/24 14:25	10/14/24	

General Chemistry

ALS Environmental—Kelso Laboratory
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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 14:05
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	TL-WRA-0.5-3	**Basis:**	As Received
Lab Code:	K2410643-001		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**95.0**	Percent	-	1	10/10/24 15:28	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 14:25
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	TL-WRB-0.5-4	**Basis:**	As Received
Lab Code:	K2410643-002		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**95.5**	Percent	-	1	10/10/24 15:28	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 14:00
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	TL-WRA-0.5-1-DS-2	**Basis:**	As Received
Lab Code:	K2410643-003		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**93.4**	Percent	-	1	10/10/24 15:28	

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 10:05
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	SH-WRB-0.5-2	**Basis:**	As Received
Lab Code:	K2410643-004		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**94.1**	Percent	-	1	10/10/24 15:28	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 10:15
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	SH-WRC-0.5-1	**Basis:**	As Received
Lab Code:	K2410643-005		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**92.3**	Percent	-	1	10/10/24 15:28	

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 10:06
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-1	**Basis:**	As Received
Lab Code:	K2410643-006		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**34.2**	Percent	-	1	10/10/24 15:28	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 15:05
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-2	**Basis:**	As Received
Lab Code:	K2410643-007		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**76.9**	Percent	-	1	10/10/24 15:28	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 09:00
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-3	**Basis:**	As Received
Lab Code:	K2410643-008		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**69.1**	Percent	-	1	10/10/24 15:28	

Printed 10/23/2024 5:16:38 PM
Superset Reference:24-0000711615 rev 00

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 14:24
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-4	**Basis:**	As Received
Lab Code:	K2410643-009		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**64.9**	Percent	-	1	10/10/24 15:28	

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 09:30
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-5	**Basis:**	As Received
Lab Code:	K2410643-010		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**71.1**	Percent	-	1	10/10/24 15:28	

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Analytical Report

Client:	Terraphase Engineering Inc.		**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001		**Date Collected:**	10/04/24 15:21
Sample Matrix:	Soil		**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-6		**Basis:**	As Received
Lab Code:	K2410643-011			

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**82.1**	Percent	-	1	10/10/24 15:28	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 13:35
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-7	**Basis:**	As Received
Lab Code:	K2410643-012		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**80.2**	Percent	-	1	10/10/24 15:28	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 13:40
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-7-DUP	**Basis:**	As Received
Lab Code:	K2410643-013		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**73.2**	Percent	-	1	10/10/24 15:28	

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 10:30
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-8	**Basis:**	As Received
Lab Code:	K2410643-014		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**69.0**	Percent	-	1	10/10/24 15:28	

QC Summary Forms

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Metals

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	Dry
Lab Code:	KQ2416426-03		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Mercury	7471B	ND U	mg/Kg	0.02	0.002	1	10/15/24 09:02	10/14/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	Dry
Lab Code:	KQ2416427-03		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	ND U	mg/Kg	0.05	0.020	5	10/22/24 14:55	10/14/24	
Arsenic	6020B	ND U	mg/Kg	0.5	0.06	5	10/22/24 14:55	10/14/24	
Cadmium	6020B	ND U	mg/Kg	0.020	0.007	5	10/22/24 14:55	10/14/24	
Chromium	6020B	**0.06 J**	mg/Kg	0.20	0.06	5	10/22/24 14:55	10/14/24	
Lead	6020B	**0.036 J**	mg/Kg	0.05	0.020	5	10/22/24 14:55	10/14/24	
Silver	6020B	ND U	mg/Kg	0.020	0.004	5	10/22/24 14:55	10/14/24	
Zinc	6020B	**0.27 J**	mg/Kg	0.5	0.20	5	10/22/24 14:55	10/14/24	

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	Dry
Lab Code:	KQ2416652-01		

Total Metals – IVBA Analysis

Analyte Name	Analysis Method	Result		Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	ND	U	mg/Kg	0.5	0.06	5	10/22/24 15:43	10/17/24	
Lead	6020B	**0.043**	**J**	mg/Kg	0.05	0.020	5	10/22/24 15:43	10/17/24	

Analytical Report

Client:	Terraphase Engineering Inc.		**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001		**Date Collected:**	NA
Sample Matrix:	Soil		**Date Received:**	NA
Sample Name:	Method Blank		**Basis:**	Dry
Lab Code:	KQ2416789-01			

IVBA Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	ND U	mg/Kg	0.5	0.06	5	10/17/24 10:57	10/16/24	
Lead	6020B	ND U	mg/Kg	0.05	0.020	5	10/17/24 10:57	10/16/24	

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QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24
Sample Matrix:	Soil	**Date Received:**	10/08/24
		Date Analyzed:	10/22/24
		Date Extracted:	10/14/24

Matrix Spike Summary
Total Metals

Sample Name:	TL-WRA-0.5-3	**Units:**	mg/Kg
Lab Code:	K2410643-001	**Basis:**	Dry
Analysis Method:	6020B		
Prep Method:	EPA 3050B		

Matrix Spike
KQ2416427-02

Analyte Name	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Antimony	1.54	23.7	85.7	26 N	75-125
Arsenic	454	510	85.7	65 #	75-125
Cadmium	12.3	20.7	8.57	97	75-125
Chromium	2.38	38.0	34.3	104	75-125
Lead	183	244	85.7	71 N	75-125
Silver	2.80	11.4	8.57	101	75-125
Zinc	517	610	85.7	108 #	75-125

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.

QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24
Sample Matrix:	Soil	**Date Received:**	10/08/24
		Date Analyzed:	10/22/24

Replicate Sample Summary
Total Metals

Sample Name:	TL-WRA-0.5-3	**Units:**	mg/Kg
Lab Code:	K2410643-001	**Basis:**	Dry

Analyte Name	Analysis Method	MRL	MDL	Sample Result	Duplicate Sample KQ2416427-01 Result	Average	RPD	RPD Limit
Antimony	6020B	0.043	0.017	1.54	1.76	1.65	13	20
Arsenic	6020B	0.43	0.05	454	453	454	<1	20
Cadmium	6020B	0.017	0.006	12.3	12.1	12.2	2	20
Chromium	6020B	0.17	0.05	2.38	2.33	2.36	2	20
Lead	6020B	0.043	0.017	183	177	180	4	20
Silver	6020B	0.017	0.003	2.80	3.57	3.19	24 *	20
Zinc	6020B	0.43	0.17	517	510	514	1	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Client: Terraphase Engineering Inc.
Project: Upper Granite Creek Mines/0031.005.001
Sample Matrix: Soil

Service Request: K2410643
Date Analyzed: 10/15/24

Lab Control Sample Summary
Total Metals

Units: mg/Kg
Basis: Dry

Lab Control Sample
KQ2416426-04

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Mercury	7471B	0.520	0.500	104	80-120

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QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Analyzed:**	10/22/24
Sample Matrix:	Soil		

Lab Control Sample Summary
Total Metals

Units: mg/Kg
Basis: Dry

Lab Control Sample
KQ2416427-04

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Antimony	6020B	99.4	100	99	80-120
Arsenic	6020B	105	100	105	80-120
Cadmium	6020B	10.3	10.0	103	80-120
Chromium	6020B	42.3	40.0	106	80-120
Lead	6020B	108	100	108	80-120
Silver	6020B	10.5	10.0	105	80-120
Zinc	6020B	105	100	105	80-120

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QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Analyzed:**	10/22/24
Sample Matrix:	Soil		

Lab Control Sample Summary
Total Metals – IVBA Analysis

Units: mg/Kg
Basis: Dry

Lab Control Sample
KQ2416652-02

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Arsenic	6020B	108	100	108	80-120
Lead	6020B	111	100	111	80-120

Printed 10/23/2024 5:16:33 PM   Superset Reference:24-0000711615 rev 00

Client: Terraphase Engineering Inc.
Project: Upper Granite Creek Mines/0031.005.001
Sample Matrix: Soil

Service Request: K2410643
Date Analyzed: 10/17/24

Lab Control Sample Summary
IVBA Metals

Units: mg/Kg
Basis: Dry

Lab Control Sample
KQ2416789-02

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Arsenic	6020B	92.9	100	93	80-120
Lead	6020B	105	100	105	80-120

General Chemistry

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QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24
Sample Matrix:	Soil	**Date Received:**	10/08/24
		Date Analyzed:	10/10/24

Replicate Sample Summary

Inorganic Parameters

Sample Name:	TL-WRA-0.5-3	**Units:**	Percent
Lab Code:	K2410643-001	**Basis:**	As Received

Analyte Name	Analysis Method	MRL	Sample Result	Duplicate Sample K2410643-001DUP Result	Average	RPD	RPD Limit
Solids, Total	160.3 Modified	-	95.0	94.6	94.8	<1	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

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QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24
Sample Matrix:	Soil	**Date Received:**	10/08/24
		Date Analyzed:	10/10/24

Replicate Sample Summary
Inorganic Parameters

Sample Name:	CS-SD-8	**Units:**	Percent
Lab Code:	K2410643-014	**Basis:**	As Received

Analyte Name	Analysis Method	MRL	Sample Result	Duplicate Sample K2410643-014DUP Result	Average	RPD	RPD Limit
Solids, Total	160.3 Modified	-	69.0	69.5	69.3	<1	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

October 22, 2024 Service Request No:K2410651

Don Malkemus
Terraphase Engineering Inc.
610 SW Broadway, Suite 405
Portland, OR 97205

Laboratory Results for: Upper Granite Creek Mines

Dear Don,

Enclosed are the results of the sample(s) submitted to our laboratory October 08, 2024
For your reference, these analyses have been assigned our service request number **K2410651.**

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please contact me if you have any questions. My extension is 3376. You may also contact me via email at Mark.Harris@alsglobal.com.

Respectfully submitted,

ALS Group USA, Corp. dba ALS Environmental

Mark Harris
Project Manager

ADDRESS 1317 S. 13th Avenue, Kelso, WA 98626
PHONE +1 360 577 7222 | FAX +1 360 636 1068
ALS Group USA, Corp.
dba ALS Environmental

Narrative Documents

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
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ALS Environmental

Client: Terraphase Engineering Inc.
Project: Upper Granite Creek Mines
Sample Matrix: Water

Service Request: K2410651
Date Received: 10/08/2024

CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples for the Tier II level requested by the client.

Sample Receipt:

Twelve water samples were received for analysis at ALS Environmental on 10/08/2024. Any discrepancies upon initial sample inspection are annotated on the sample receipt and preservation form included within this report. The samples were stored at minimum in accordance with the analytical method requirements.

Metals:

No significant anomalies were noted with this analysis.

Approved by ______________________ Date 10/22/2024

SAMPLE DETECTION SUMMARY

This form includes only detections above the reporting levels. For a full listing of sample results, continue to the Sample Results section of this Report.

CLIENT ID: CS-SW-1			Lab ID: K2410651-004			
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Antimony	0.036	J	0.020	0.050	ug/L	6020B
Arsenic	0.36	J	0.09	0.50	ug/L	6020B
Calcium	5590		6	20	ug/L	6020B
Chromium	0.11	J	0.03	0.20	ug/L	6020B
Hardness, Total as CaCO3	18.1		0.023	0.09	mg/L	SM 2340 B
Lead	0.013	J	0.006	0.020	ug/L	6020B
Magnesium	996		2	10	ug/L	6020B

CLIENT ID: CS-SW-2			Lab ID: K2410651-005			
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Antimony	0.025	J	0.020	0.050	ug/L	6020B
Arsenic	0.67		0.09	0.50	ug/L	6020B
Calcium	6070		6	20	ug/L	6020B
Chromium	0.11	J	0.03	0.20	ug/L	6020B
Hardness, Total as CaCO3	19.7		0.023	0.09	mg/L	SM 2340 B
Lead	0.012	J	0.006	0.020	ug/L	6020B
Magnesium	1110		2	10	ug/L	6020B

CLIENT ID: CS-SW-2-Dup			Lab ID: K2410651-006			
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Antimony	0.031	J	0.020	0.050	ug/L	6020B
Arsenic	0.61		0.09	0.50	ug/L	6020B
Calcium	5920		6	20	ug/L	6020B
Chromium	0.11	J	0.03	0.20	ug/L	6020B
Hardness, Total as CaCO3	19.3		0.023	0.09	mg/L	SM 2340 B
Lead	0.007	J	0.006	0.020	ug/L	6020B
Magnesium	1090		2	10	ug/L	6020B

CLIENT ID: CS-SW-3			Lab ID: K2410651-007			
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Antimony	0.038	J	0.020	0.050	ug/L	6020B
Arsenic	0.87		0.09	0.50	ug/L	6020B
Calcium	6490		6	20	ug/L	6020B
Chromium	0.12	J	0.03	0.20	ug/L	6020B
Hardness, Total as CaCO3	21.0		0.023	0.09	mg/L	SM 2340 B
Lead	0.012	J	0.006	0.020	ug/L	6020B
Magnesium	1170		2	10	ug/L	6020B

CLIENT ID: CS-SW-4			Lab ID: K2410651-008			
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Antimony	0.036	J	0.020	0.050	ug/L	6020B
Arsenic	0.92		0.09	0.50	ug/L	6020B

SAMPLE DETECTION SUMMARY

This form includes only detections above the reporting levels. For a full listing of sample results, continue to the Sample Results section of this Report.

CLIENT ID: CS-SW-4		Lab ID: K2410651-008				
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Calcium	8410		6	20	ug/L	6020B
Chromium	0.14	J	0.03	0.20	ug/L	6020B
Hardness, Total as CaCO3	27.5		0.023	0.09	mg/L	SM 2340 B
Magnesium	1590		2	10	ug/L	6020B

CLIENT ID: CS-SW-5		Lab ID: K2410651-009				
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Antimony	0.098		0.020	0.050	ug/L	6020B
Arsenic	1.78		0.09	0.50	ug/L	6020B
Cadmium	0.010	J	0.008	0.020	ug/L	6020B
Calcium	9550		6	20	ug/L	6020B
Chromium	0.11	J	0.03	0.20	ug/L	6020B
Hardness, Total as CaCO3	31.8		0.023	0.09	mg/L	SM 2340 B
Lead	0.018	J	0.006	0.020	ug/L	6020B
Magnesium	1930		2	10	ug/L	6020B
Zinc	1.8	J	0.5	2.0	ug/L	6020B

CLIENT ID: CS-SW-6		Lab ID: K2410651-010				
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Antimony	0.076		0.020	0.050	ug/L	6020B
Arsenic	2.04		0.09	0.50	ug/L	6020B
Calcium	9710		6	20	ug/L	6020B
Chromium	0.11	J	0.03	0.20	ug/L	6020B
Hardness, Total as CaCO3	32.3		0.023	0.09	mg/L	SM 2340 B
Lead	0.013	J	0.006	0.020	ug/L	6020B
Magnesium	1960		2	10	ug/L	6020B
Zinc	0.7	J	0.5	2.0	ug/L	6020B

CLIENT ID: CS-SW-7		Lab ID: K2410651-011				
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Antimony	0.104		0.020	0.050	ug/L	6020B
Arsenic	1.99		0.09	0.50	ug/L	6020B
Cadmium	0.019	J	0.008	0.020	ug/L	6020B
Calcium	10900		6	20	ug/L	6020B
Chromium	0.09	J	0.03	0.20	ug/L	6020B
Hardness, Total as CaCO3	36.3		0.023	0.09	mg/L	SM 2340 B
Lead	0.022		0.006	0.020	ug/L	6020B
Magnesium	2200		2	10	ug/L	6020B
Zinc	0.8	J	0.5	2.0	ug/L	6020B

SAMPLE DETECTION SUMMARY

This form includes only detections above the reporting levels. For a full listing of sample results, continue to the Sample Results section of this Report.

CLIENT ID: CS-SW-8 | **Lab ID: K2410651-012**

Analyte	Results	Flag	MDL	MRL	Units	Method
Antimony	0.108		0.020	0.050	ug/L	6020B
Arsenic	2.21		0.09	0.50	ug/L	6020B
Cadmium	0.020	J	0.008	0.020	ug/L	6020B
Calcium	10900		6	20	ug/L	6020B
Chromium	0.11	J	0.03	0.20	ug/L	6020B
Hardness, Total as CaCO3	36.7		0.023	0.09	mg/L	SM 2340 B
Lead	0.084		0.006	0.020	ug/L	6020B
Magnesium	2310		2	10	ug/L	6020B
Zinc	0.8	J	0.5	2.0	ug/L	6020B

CLIENT ID: EB-2024 1003 | **Lab ID: K2410651-001**

Analyte	Results	Flag	MDL	MRL	Units	Method
Arsenic	0.64		0.09	0.50	ug/L	6020B

CLIENT ID: EB-2024 1004 | **Lab ID: K2410651-002**

Analyte	Results	Flag	MDL	MRL	Units	Method
Arsenic	3.12		0.09	0.50	ug/L	6020B

CLIENT ID: EB-2024 1005 | **Lab ID: K2410651-003**

Analyte	Results	Flag	MDL	MRL	Units	Method
Arsenic	0.11	J	0.09	0.50	ug/L	6020B

Sample Receipt Information

ALS Environmental—Kelso Laboratory
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Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

Client: Terraphase Engineering Inc. **Service Request:** K2410651
Project: Upper Granite Creek Mines/0031.005.001

SAMPLE CROSS-REFERENCE

SAMPLE #	CLIENT SAMPLE ID	DATE	TIME
K2410651-001	EB-2024 1003	10/5/2024	0830
K2410651-002	EB-2024 1004	10/4/2024	0800
K2410651-003	EB-2024 1005	10/5/2024	0830
K2410651-004	CS-SW-1	10/5/2024	1004
K2410651-005	CS-SW-2	10/3/2024	1700
K2410651-006	CS-SW-2-Dup	10/3/2024	1701
K2410651-007	CS-SW-3	10/3/2024	1600
K2410651-008	CS-SW-4	10/3/2024	1419
K2410651-009	CS-SW-5	10/4/2024	0925
K2410651-010	CS-SW-6	10/4/2024	1523
K2410651-011	CS-SW-7	10/4/2024	1334
K2410651-012	CS-SW-8	10/5/2024	1035

ALS

140510

CHAIN OF CUSTODY

140510

001, 002, 003

SR# 1241065I

COC Set 2 of 8

COC#

1317 South 13th Ave, Kelso, WA 98626 Phone (360) 577-7222 / 800-695-7222 / FAX (360) 636-1068
www.alsglobal.com

oject Name: Upper Basin Creek Mines
Project Number: 0131.005.001
oject Manager: Dan Malkemus
mpany: Terraphase Engineering Inc.
dress, City, State: 610 SW Broadway Suite 405
one #: (503) 948-0384
email: dan.malkemus@terraphase.com
mpler Signature: [signature]
Sampler Printed Name: Dan Malkemus

CLIENT SAMPLE ID	LABID	SAMPLING Date	Time	State	Matrix	NUMBER OF CONTAINERS	28D: 7470A / Hg T	28D: 7471B / Hg	180D: 6020B / IVBA (Sieved Total)	180D: 6020B / IVBA Extract	180D: 6020B / Metals T	999D: Grind / GrindSub	999D: SM 2340 B / Hardness Calc	1	2	3	4	5	Remarks
EB-20241003		10/5	0830		H_2O	1					X								
EB-20241004		10/4	0800		H_2O	1					X								
EB-20241005		10/5	0830		H_2O	1					X								
UMM-WRB-0.5-4		10/2	1335		Soil	2													+ bag HOLD
UMM-WRB-0.5-2		10/2	1320		Soil	2					X								~~HOLD~~ DM
UMM-WRB-0.5-2		10/3	1045		Soil	2													+ bag HOLD
UMM-WRB-0.5-2-DS		10/2	1325		Soil	2					X								+ bag
UMM-WRB-0.5-1		10/3	1035		Soil	2					X								+ bag ~~HOLD~~ DM
UMM-WRB-0.5-3		10/3	1055		Soil	2													+ bag HOLD
UMM-WRB-0.5-1-DUP		10/3	1036		Soil	2					X								

Report Requirements

I. Routine Report: Method Blank, Surrogate, as required

II. Report Dup., MS, MSD as required

III. CLP Like Summary (no raw data)

IV. Data Validation Report

V. EDD

Invoice Information

P.O.#
Bill To: ap@terraphase.com

Turnaround Requirements

___ 24 hr. ___ 48 hr.
___ 5 Day
X Standard

Requested Report Date

Circle which metals are to be analyzed

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Special Instructions/Comments:

*Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other ____ (Circle One)

Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
ature: [signature]	Signature: [signature]	Signature: [signature]	Signature: Naomi Pedersen	Signature	Signature
ed Name: Dan Malkemus	Printed Name: Franklin LaBiche	Printed Name: Franklin LaBiche	Printed Name: ALS	Printed Name	Printed Name
TEI	Firm: ALS	Firm: ALS	Firm: 10/8/24 1445	Firm	Firm
Time: 10/8 1300	Date/Time: 10/08/24 1306	Date/Time: 10/08/24 1445	Date/Time	Date/Time	Date/Time

ALS

140510

CHAIN OF CUSTODY 140510

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001, 002, 003

SR# 1241065
COC Set 7 of 8
COC#

Page 1 of 1

Project Name: Upper Granite Creek Mines
Project Number: 0031.005.001
Project Manager: Don Malkemus
Company: Terraphase Engineering Inc.
Address, City, State: 610 SW Broadway Suite 405
Phone #: (503) 943-0384
email: don.malkemus@terraphase.com
Sampler Signature:
Sampler Printed Name: Don Malkemus

CLIENT SAMPLE ID	LABID	SAMPLING Date	Time	Matrix	NUMBER OF CONTAINERS	28D 7470A / Hg T	28D 7471B / Hg	180D 6020B / IVBA (Sieved Total)	180D 6020B / IVBA Extract	180D 6020B / Metals T	999D Grind / GrindSub	999D SM 2340 B / Hardness Calc	1	2	3	4	5	Remarks
CS-SW-1		10/5	~~1035~~ 1004	H_2O	1	X				X		X						
CS-SW-2		10/3	1700	H_2O	1	X				X		X						
CS-SW-2-DUP		10/3	1701	H_2O	1	X				X		X						
CS-SW-3		10/3	1600	H_2O	1	X				X		X						
CS-SW-4		10/3	1419	H_2O	1	X				X		X						
CS-SW-5		10/4	0925	H_2O	1	X				X		X						
CS-SW-6		10/4	1523	H_2O	1	X				X		X						
CS-SW-7		10/4	1334	H_2O	1	X				X		X						
CS-SW-8		10/5	1035	H_2O	1	X				X		X						

Report Requirements
- I. Routine Report: Method Blank, Surrogate, as required
- II. Report Dup., MS, MSD as required
- III. CLP Like Summary (no raw data)
- IV. Data Validation Report
- V. EDD

Invoice Information
P.O.#
Bill To: ap@terraphase.com

Turnaround Requirements
- 24 hr.
- 48 hr.
- 5 Day
- X Standard

Requested Report Date

Circle which metals are to be analyzed

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Special Instructions/Comments:

*Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other ____ (Circle One)

	Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature				Naomi Pedersen		
Printed Name	Don Malkemus	Franklin LaBiche	Franklin LaBiche	ALS		
Firm	TEI	ALS	ALS	10/8/24 1445		
Date/Time	10/8 1306	10/08/24 1306	10/08/24 1445			

PM Mack

Cooler Receipt and Preservation Form

Client Terraphase Service Request K24 10651

Received: 10/8/24 Opened: 10/8/24 By: AP Unloaded: 10/8/24 By: AP

1. Samples were received via? *USPS* *Fed Ex* *UPS* *DHL* *PDX* ***Courier*** *Hand Delivered*
2. Samples were received in: (circle) ***Cooler*** ~~*Box*~~ *Envelope* *Other* ______ *NA*
3. Were custody seals on coolers? NA Y **N** If yes, how many and where? ______
   If present, were custody seals intact? Y N If present, were they signed and dated? Y N

Temp Blank	Sample Temp	IR Gun	Cooler #/COC ID / NA	Out of temp indicate with "X"	PM Notified If out of temp	Tracking Number NA	Filed
9.6	4.6	1801	140510				
16.8	5.7	↓					
16.0	4.4	↓					
9.4	4.5	↓					
18.3	4.5	↓					

4. Was a Temperature Blank present in cooler? NA **Y** N If yes, notate the temperature in the appropriate column above:
   If no, take the temperature of a representative sample bottle contained within the cooler; notate in the column "Sample Temp":
5. Were samples received within the method specified temperature ranges? NA **Y** N
   If no, were they received on ice and same day as collected? If not, notate the cooler # above and notify the PM. **NA** Y N

If applicable, tissue samples were received: *Frozen* *Partially Thawed* *Thawed*

6. Packing material: *Inserts* ***Baggies*** *Bubble Wrap* *Gel Packs* ***Wet Ice*** *Dry Ice* *Sleeves* ______
7. Were custody papers properly filled out (ink, signed, etc.)? NA **Y** N
8. Were samples received in good condition (unbroken) NA **Y** N
9. Were all sample labels complete (ie, analysis, preservation, etc.)? NA **Y** N
10. Did all sample labels and tags agree with custody papers? NA **Y** N
11. Were appropriate bottles/containers and volumes received for the tests indicated? NA **Y** N
12. Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* NA **Y** N
13. Were VOA vials received without headspace? *Indicate in the table below.* **NA** Y N
14. Was C12/Res negative? **NA** Y N
15. Were samples received within the method specified time limit? If not, notate the error below and notify the PM **NA** Y N
16. Were 100ml sterile microbiology bottles filled exactly to the 100ml mark? **NA** Y N Underfilled Overfilled

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count Bottle Type	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies, Resolutions: ______

Cooler Receipt and Preservation Form

Client Terraphase Service Request **K24**

Temp Blank	Sample Temp	IR Gun	Cooler #/COC ID / NA	Out of temp indicate with "X"	PM Notified If out of temp	Tracking Number NA	Filed
~~8.~~ 7.8	3.8	IR01					
12.2	5.5	↓					

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count Bottle Type	Out of Temp	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies & Resolutions: Ice was at top of coolers on top of samples. Temp blank was under the samples, not indicative of sample temp

Miscellaneous Forms

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

Inorganic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
E	The result is an estimate amount because the value exceeded the instrument calibration range.
J	The result is an estimated value.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.
H	The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

#	The control limit criteria is not applicable.
J	The result is an estimated value.
E	The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
M	The duplicate injection precision was not met.
N	The Matrix Spike sample recovery is not within control limits. See case narrative.
S	The reported value was determined by the Method of Standard Additions (MSA).
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
W	The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
+	The correlation coefficient for the MSA is less than 0.995.
Q	See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
A	A tentatively identified compound, a suspected aldol-condensation product.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
C	The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
D	The reported result is from a dilution.
E	The result is an estimated value over the calibration range.
J	The result is an estimated value between the MDL and the MRL.
N	The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
P	The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

F	The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
L	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
H	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
O	The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
Y	The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
Z	The chromatographic fingerprint does not resemble a petroleum product.

ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso
State Certifications, Accreditations, and Licenses

Agency	Web Site	Number
Alaska DEH	http://dec.alaska.gov/eh/lab/cs/csapproval.htm	UST-040
Arizona DHS	http://www.azdhs.gov/lab/license/env.htm	AZ0339
Arkansas - DEQ	http://www.adeq.state.ar.us/techsvs/labcert.htm	88-0637
California DHS (ELAP)	http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx	2795
DOD ELAP	http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm	L16-58-R4
Florida DOH	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E87412
Hawaii DOH	http://health.hawaii.gov/	-
ISO 17025	http://www.pjlabs.com/	L16-57
Louisiana DEQ	http://www.deq.louisiana.gov/page/la-lab-accreditation	03016
Maine DHS	http://www.maine.gov/dhhs/	WA01276
Minnesota DOH	http://www.health.state.mn.us/accreditation	053-999-457
Nevada DEP	http://ndep.nv.gov/bsdw/labservice.htm	WA01276
New Jersey DEP	http://www.nj.gov/dep/enforcement/oqa.html	WA005
New York - DOH	https://www.wadsworth.org/regulatory/elap	12060
North Carolina DEQ	https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/laboratory-certification-branch/non-field-lab-certification	605
Oklahoma DEQ	http://www.deq.state.ok.us/CSDnew/labcert.htm	9801
Oregon – DEQ (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	WA100010
South Carolina DHEC	http://www.scdhec.gov/environment/EnvironmentalLabCertification/	61002
Texas CEQ	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704427
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C544
Wyoming (EPA Region 8)	https://www.epa.gov/region8-waterops/epa-region-8-certified-drinking-water-	-
Kelso Laboratory Website	www.alsglobal.com	NA

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.ALSGlobal.com or at the accreditation bodies web site.
Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/anlayte is offered by that state.

Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LOD	Limit of Detection
LOQ	Limit of Quantitation
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

Analyst Summary report

Client: Terraphase Engineering Inc. **Service Request:** K2410651
Project: Upper Granite Creek Mines/0031.005.001

Sample Name: EB-2024 1003 **Date Collected:** 10/5/24
Lab Code: K2410651-001 **Date Received:** 10/8/24
Sample Matrix: Water

Analysis Method	Extracted/Digested By	Analyzed By
6020B	MCHATTICK	ABOYER

Sample Name: EB-2024 1004 **Date Collected:** 10/4/24
Lab Code: K2410651-002 **Date Received:** 10/8/24
Sample Matrix: Water

Analysis Method	Extracted/Digested By	Analyzed By
6020B	MCHATTICK	ABOYER

Sample Name: EB-2024 1005 **Date Collected:** 10/5/24
Lab Code: K2410651-003 **Date Received:** 10/8/24
Sample Matrix: Water

Analysis Method	Extracted/Digested By	Analyzed By
6020B	MCHATTICK	ABOYER

Sample Name: CS-SW-1 **Date Collected:** 10/5/24
Lab Code: K2410651-004 **Date Received:** 10/8/24
Sample Matrix: Water

Analysis Method	Extracted/Digested By	Analyzed By
6020B	MCHATTICK	ABOYER
7470A	KLINN	KLINN

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001		

Sample Name:	CS-SW-2	**Date Collected:**	10/3/24
Lab Code:	K2410651-005	**Date Received:**	10/8/24
Sample Matrix:	Water		

Analysis Method	Extracted/Digested By	Analyzed By
6020B	MCHATTICK	ABOYER
7470A	KLINN	KLINN

Sample Name:	CS-SW-2-Dup	**Date Collected:**	10/3/24
Lab Code:	K2410651-006	**Date Received:**	10/8/24
Sample Matrix:	Water		

Analysis Method	Extracted/Digested By	Analyzed By
6020B	MCHATTICK	ABOYER
7470A	KLINN	KLINN

Sample Name:	CS-SW-3	**Date Collected:**	10/3/24
Lab Code:	K2410651-007	**Date Received:**	10/8/24
Sample Matrix:	Water		

Analysis Method	Extracted/Digested By	Analyzed By
6020B	MCHATTICK	ABOYER
7470A	KLINN	KLINN

Sample Name:	CS-SW-4	**Date Collected:**	10/3/24
Lab Code:	K2410651-008	**Date Received:**	10/8/24
Sample Matrix:	Water		

Analysis Method	Extracted/Digested By	Analyzed By
6020B	MCHATTICK	ABOYER
7470A	KLINN	KLINN

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dba ALS Environmental

Analyst Summary report

Client: Terraphase Engineering Inc. **Service Request:** K2410651
Project: Upper Granite Creek Mines/0031.005.001

Sample Name: CS-SW-5 **Date Collected:** 10/4/24
Lab Code: K2410651-009 **Date Received:** 10/8/24
Sample Matrix: Water

Analysis Method	Extracted/Digested By	Analyzed By
6020B	MCHATTICK	ABOYER
7470A	KLINN	KLINN

Sample Name: CS-SW-6 **Date Collected:** 10/4/24
Lab Code: K2410651-010 **Date Received:** 10/8/24
Sample Matrix: Water

Analysis Method	Extracted/Digested By	Analyzed By
6020B	MCHATTICK	ABOYER
7470A	KLINN	KLINN

Sample Name: CS-SW-7 **Date Collected:** 10/4/24
Lab Code: K2410651-011 **Date Received:** 10/8/24
Sample Matrix: Water

Analysis Method	Extracted/Digested By	Analyzed By
6020B	MCHATTICK	ABOYER
7470A	KLINN	KLINN

Sample Name: CS-SW-8 **Date Collected:** 10/5/24
Lab Code: K2410651-012 **Date Received:** 10/8/24
Sample Matrix: Water

Analysis Method	Extracted/Digested By	Analyzed By
6020B	MCHATTICK	ABOYER
7470A	KLINN	KLINN

Sample Results

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
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Metals

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 08:30
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	EB-2024 1003	**Basis:**	NA
Lab Code:	K2410651-001		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**0.64**	ug/L	0.50	0.09	1	10/21/24 16:32	10/18/24	

Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 08:00
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	EB-2024 1004	**Basis:**	NA
Lab Code:	K2410651-002		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**3.12**	ug/L	0.50	0.09	1	10/21/24 16:34	10/18/24	

Analytical Report

Client: Terraphase Engineering Inc.
Project: Upper Granite Creek Mines/0031.005.001
Sample Matrix: Water

Service Request: K2410651
Date Collected: 10/05/24 08:30
Date Received: 10/08/24 14:45

Sample Name: EB-2024 1005
Lab Code: K2410651-003

Basis: NA

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**0.11 J**	ug/L	0.50	0.09	1	10/21/24 16:36	10/18/24	

Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 10:04
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-1	**Basis:**	NA
Lab Code:	K2410651-004		

Hardness by ICP-AES Calculation 20th Ed.

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Q
Hardness, Total as CaCO3	SM 2340 B	**18.1**	mg/L	0.09	0.023	1	10/21/24 16:39	

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 10:04
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-1	**Basis:**	NA
Lab Code:	K2410651-004		

Total Metals

Analyte Name	Analysis Method	Result		Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.036**	**J**	ug/L	0.050	0.020	1	10/21/24 16:39	10/18/24	
Arsenic	6020B	**0.36**	**J**	ug/L	0.50	0.09	1	10/21/24 16:39	10/18/24	
Cadmium	6020B	ND	U	ug/L	0.020	0.008	1	10/21/24 16:39	10/18/24	
Calcium	6020B	**5590**		ug/L	20	6	1	10/21/24 16:39	10/18/24	
Chromium	6020B	**0.11**	**J**	ug/L	0.20	0.03	1	10/21/24 16:39	10/18/24	
Lead	6020B	**0.013**	**J**	ug/L	0.020	0.006	1	10/21/24 16:39	10/18/24	
Magnesium	6020B	**996**		ug/L	10	2	1	10/21/24 16:39	10/18/24	
Mercury	7470A	ND	U	ug/L	0.20	0.02	1	10/15/24 09:17	10/14/24	
Silver	6020B	ND	U	ug/L	0.020	0.009	1	10/21/24 16:39	10/18/24	
Zinc	6020B	ND	U	ug/L	2.0	0.5	1	10/21/24 16:39	10/18/24	

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 17:00
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-2	**Basis:**	NA
Lab Code:	K2410651-005		

Hardness by ICP-AES Calculation 20th Ed.

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Q
Hardness, Total as $CaCO_3$	SM 2340 B	**19.7**	mg/L	0.09	0.023	1	10/21/24 16:53	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 17:00
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-2	**Basis:**	NA
Lab Code:	K2410651-005		

Total Metals

Analyte Name	Analysis Method	Result		Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.025**	**J**	ug/L	0.050	0.020	1	10/21/24 16:53	10/18/24	
Arsenic	6020B	**0.67**		ug/L	0.50	0.09	1	10/21/24 16:53	10/18/24	
Cadmium	6020B	ND	U	ug/L	0.020	0.008	1	10/21/24 16:53	10/18/24	
Calcium	6020B	**6070**		ug/L	20	6	1	10/21/24 16:53	10/18/24	
Chromium	6020B	**0.11**	**J**	ug/L	0.20	0.03	1	10/21/24 16:53	10/18/24	
Lead	6020B	**0.012**	**J**	ug/L	0.020	0.006	1	10/21/24 16:53	10/18/24	
Magnesium	6020B	**1110**		ug/L	10	2	1	10/21/24 16:53	10/18/24	
Mercury	7470A	ND	U	ug/L	0.20	0.02	1	10/15/24 09:22	10/14/24	
Silver	6020B	ND	U	ug/L	0.020	0.009	1	10/21/24 16:53	10/18/24	
Zinc	6020B	ND	U	ug/L	2.0	0.5	1	10/21/24 16:53	10/18/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 17:01
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-2-Dup	**Basis:**	NA
Lab Code:	K2410651-006		

Hardness by ICP-AES Calculation 20th Ed.

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Q
Hardness, Total as CaCO3	SM 2340 B	**19.3**	mg/L	0.09	0.023	1	10/21/24 16:55	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 17:01
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-2-Dup	**Basis:**	NA
Lab Code:	K2410651-006		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.031 J**	ug/L	0.050	0.020	1	10/21/24 16:55	10/18/24	
Arsenic	6020B	**0.61**	ug/L	0.50	0.09	1	10/21/24 16:55	10/18/24	
Cadmium	6020B	ND U	ug/L	0.020	0.008	1	10/21/24 16:55	10/18/24	
Calcium	6020B	**5920**	ug/L	20	6	1	10/21/24 16:55	10/18/24	
Chromium	6020B	**0.11 J**	ug/L	0.20	0.03	1	10/21/24 16:55	10/18/24	
Lead	6020B	**0.007 J**	ug/L	0.020	0.006	1	10/21/24 16:55	10/18/24	
Magnesium	6020B	**1090**	ug/L	10	2	1	10/21/24 16:55	10/18/24	
Mercury	7470A	ND U	ug/L	0.20	0.02	1	10/15/24 09:23	10/14/24	
Silver	6020B	ND U	ug/L	0.020	0.009	1	10/21/24 16:55	10/18/24	
Zinc	6020B	ND U	ug/L	2.0	0.5	1	10/21/24 16:55	10/18/24	

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 16:00
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-3	**Basis:**	NA
Lab Code:	K2410651-007		

Hardness by ICP-AES Calculation 20th Ed.

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Q
Hardness, Total as CaCO3	SM 2340 B	**21.0**	mg/L	0.09	0.023	1	10/21/24 16:57	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 16:00
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-3	**Basis:**	NA
Lab Code:	K2410651-007		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.038 J**	ug/L	0.050	0.020	1	10/21/24 16:57	10/18/24	
Arsenic	6020B	**0.87**	ug/L	0.50	0.09	1	10/21/24 16:57	10/18/24	
Cadmium	6020B	ND U	ug/L	0.020	0.008	1	10/21/24 16:57	10/18/24	
Calcium	6020B	**6490**	ug/L	20	6	1	10/21/24 16:57	10/18/24	
Chromium	6020B	**0.12 J**	ug/L	0.20	0.03	1	10/21/24 16:57	10/18/24	
Lead	6020B	**0.012 J**	ug/L	0.020	0.006	1	10/21/24 16:57	10/18/24	
Magnesium	6020B	**1170**	ug/L	10	2	1	10/21/24 16:57	10/18/24	
Mercury	7470A	ND U	ug/L	0.20	0.02	1	10/15/24 09:25	10/14/24	
Silver	6020B	ND U	ug/L	0.020	0.009	1	10/21/24 16:57	10/18/24	
Zinc	6020B	ND U	ug/L	2.0	0.5	1	10/21/24 16:57	10/18/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 14:19
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-4	**Basis:**	NA
Lab Code:	K2410651-008		

Hardness by ICP-AES Calculation 20th Ed.

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Q
Hardness, Total as CaCO3	SM 2340 B	**27.5**	mg/L	0.09	0.023	1	10/21/24 16:59	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 14:19
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-4	**Basis:**	NA
Lab Code:	K2410651-008		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.036 J**	ug/L	0.050	0.020	1	10/21/24 16:59	10/18/24	
Arsenic	6020B	**0.92**	ug/L	0.50	0.09	1	10/21/24 16:59	10/18/24	
Cadmium	6020B	ND U	ug/L	0.020	0.008	1	10/21/24 16:59	10/18/24	
Calcium	6020B	**8410**	ug/L	20	6	1	10/21/24 16:59	10/18/24	
Chromium	6020B	**0.14 J**	ug/L	0.20	0.03	1	10/21/24 16:59	10/18/24	
Lead	6020B	ND U	ug/L	0.020	0.006	1	10/21/24 16:59	10/18/24	
Magnesium	6020B	**1590**	ug/L	10	2	1	10/21/24 16:59	10/18/24	
Mercury	7470A	ND U	ug/L	0.20	0.02	1	10/15/24 09:27	10/14/24	
Silver	6020B	ND U	ug/L	0.020	0.009	1	10/21/24 16:59	10/18/24	
Zinc	6020B	ND U	ug/L	2.0	0.5	1	10/21/24 16:59	10/18/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 09:25
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-5	**Basis:**	NA
Lab Code:	K2410651-009		

Hardness by ICP-AES Calculation 20th Ed.

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Q
Hardness, Total as CaCO3	SM 2340 B	**31.8**	mg/L	0.09	0.023	1	10/21/24 17:01	

Analytical Report

Client:	Terraphase Engineering Inc.		**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001		**Date Collected:**	10/04/24 09:25
Sample Matrix:	Water		**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-5		**Basis:**	NA
Lab Code:	K2410651-009			

Total Metals

Analyte Name	Analysis Method	Result		Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.098**		ug/L	0.050	0.020	1	10/21/24 17:01	10/18/24	
Arsenic	6020B	**1.78**		ug/L	0.50	0.09	1	10/21/24 17:01	10/18/24	
Cadmium	6020B	**0.010**	**J**	ug/L	0.020	0.008	1	10/21/24 17:01	10/18/24	
Calcium	6020B	**9550**		ug/L	20	6	1	10/21/24 17:01	10/18/24	
Chromium	6020B	**0.11**	**J**	ug/L	0.20	0.03	1	10/21/24 17:01	10/18/24	
Lead	6020B	**0.018**	**J**	ug/L	0.020	0.006	1	10/21/24 17:01	10/18/24	
Magnesium	6020B	**1930**		ug/L	10	2	1	10/21/24 17:01	10/18/24	
Mercury	7470A	ND	U	ug/L	0.20	0.02	1	10/15/24 09:28	10/14/24	
Silver	6020B	ND	U	ug/L	0.020	0.009	1	10/21/24 17:01	10/18/24	
Zinc	6020B	**1.8**	**J**	ug/L	2.0	0.5	1	10/21/24 17:01	10/18/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 15:23
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-6	**Basis:**	NA
Lab Code:	K2410651-010		

Hardness by ICP-AES Calculation 20th Ed.

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Q
Hardness, Total as CaCO3	SM 2340 B	**32.3**	mg/L	0.09	0.023	1	10/21/24 17:03	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 15:23
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-6	**Basis:**	NA
Lab Code:	K2410651-010		

Total Metals

Analyte Name	Analysis Method	Result		Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.076**		ug/L	0.050	0.020	1	10/21/24 17:03	10/18/24	
Arsenic	6020B	**2.04**		ug/L	0.50	0.09	1	10/21/24 17:03	10/18/24	
Cadmium	6020B	ND	U	ug/L	0.020	0.008	1	10/21/24 17:03	10/18/24	
Calcium	6020B	**9710**		ug/L	20	6	1	10/21/24 17:03	10/18/24	
Chromium	6020B	**0.11**	**J**	ug/L	0.20	0.03	1	10/21/24 17:03	10/18/24	
Lead	6020B	**0.013**	**J**	ug/L	0.020	0.006	1	10/21/24 17:03	10/18/24	
Magnesium	6020B	**1960**		ug/L	10	2	1	10/21/24 17:03	10/18/24	
Mercury	7470A	ND	U	ug/L	0.20	0.02	1	10/15/24 09:33	10/14/24	
Silver	6020B	ND	U	ug/L	0.020	0.009	1	10/21/24 17:03	10/18/24	
Zinc	6020B	**0.7**	**J**	ug/L	2.0	0.5	1	10/21/24 17:03	10/18/24	

Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 13:34
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-7	**Basis:**	NA
Lab Code:	K2410651-011		

Hardness by ICP-AES Calculation 20th Ed.

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Q
Hardness, Total as CaCO3	SM 2340 B	**36.3**	mg/L	0.09	0.023	1	10/21/24 17:05	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 13:34
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-7	**Basis:**	NA
Lab Code:	K2410651-011		

Total Metals

Analyte Name	Analysis Method	Result		Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.104**		ug/L	0.050	0.020	1	10/21/24 17:05	10/18/24	
Arsenic	6020B	**1.99**		ug/L	0.50	0.09	1	10/21/24 17:05	10/18/24	
Cadmium	6020B	**0.019**	**J**	ug/L	0.020	0.008	1	10/21/24 17:05	10/18/24	
Calcium	6020B	**10900**		ug/L	20	6	1	10/21/24 17:05	10/18/24	
Chromium	6020B	**0.09**	**J**	ug/L	0.20	0.03	1	10/21/24 17:05	10/18/24	
Lead	6020B	**0.022**		ug/L	0.020	0.006	1	10/21/24 17:05	10/18/24	
Magnesium	6020B	**2200**		ug/L	10	2	1	10/21/24 17:05	10/18/24	
Mercury	7470A	ND	U	ug/L	0.20	0.02	1	10/15/24 09:35	10/14/24	
Silver	6020B	ND	U	ug/L	0.020	0.009	1	10/21/24 17:05	10/18/24	
Zinc	6020B	**0.8**	**J**	ug/L	2.0	0.5	1	10/21/24 17:05	10/18/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 10:35
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-8	**Basis:**	NA
Lab Code:	K2410651-012		

Hardness by ICP-AES Calculation 20th Ed.

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Q
Hardness, Total as CaCO3	SM 2340 B	**36.7**	mg/L	0.09	0.023	1	10/21/24 17:07	

Client:	Terraphase Engineering Inc.		**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001		**Date Collected:**	10/05/24 10:35
Sample Matrix:	Water		**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-8		**Basis:**	NA
Lab Code:	K2410651-012			

Total Metals

Analyte Name	Analysis Method	Result		Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.108**		ug/L	0.050	0.020	1	10/21/24 17:07	10/18/24	
Arsenic	6020B	**2.21**		ug/L	0.50	0.09	1	10/21/24 17:07	10/18/24	
Cadmium	6020B	**0.020**	**J**	ug/L	0.020	0.008	1	10/21/24 17:07	10/18/24	
Calcium	6020B	**10900**		ug/L	20	6	1	10/21/24 17:07	10/18/24	
Chromium	6020B	**0.11**	**J**	ug/L	0.20	0.03	1	10/21/24 17:07	10/18/24	
Lead	6020B	**0.084**		ug/L	0.020	0.006	1	10/21/24 17:07	10/18/24	
Magnesium	6020B	**2310**		ug/L	10	2	1	10/21/24 17:07	10/18/24	
Mercury	7470A	ND	U	ug/L	0.20	0.02	1	10/15/24 09:36	10/14/24	
Silver	6020B	ND	U	ug/L	0.020	0.009	1	10/21/24 17:07	10/18/24	
Zinc	6020B	**0.8**	**J**	ug/L	2.0	0.5	1	10/21/24 17:07	10/18/24	

QC Summary Forms

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

Metals

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	NA
Sample Matrix:	Water	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	NA
Lab Code:	KQ2416479-01		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	ND U	ug/L	0.050	0.020	1	10/21/24 17:13	10/18/24	
Arsenic	6020B	ND U	ug/L	0.50	0.09	1	10/21/24 17:13	10/18/24	
Cadmium	6020B	ND U	ug/L	0.020	0.008	1	10/21/24 17:13	10/18/24	
Calcium	6020B	ND U	ug/L	20	6	1	10/21/24 17:13	10/18/24	
Chromium	6020B	ND U	ug/L	0.20	0.03	1	10/21/24 17:13	10/18/24	
Lead	6020B	ND U	ug/L	0.020	0.006	1	10/21/24 17:13	10/18/24	
Magnesium	6020B	ND U	ug/L	10	2	1	10/21/24 17:13	10/18/24	
Silver	6020B	ND U	ug/L	0.020	0.009	1	10/21/24 17:13	10/18/24	
Zinc	6020B	ND U	ug/L	2.0	0.5	1	10/21/24 17:13	10/18/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	NA
Sample Matrix:	Water	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	NA
Lab Code:	KQ2416532-01		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Mercury	7470A	ND U	ug/L	0.20	0.02	1	10/15/24 09:14	10/14/24	

Printed 10/22/2024 4:18:38 PM

Superset Reference:24-0000712756 rev 00

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QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24
Sample Matrix:	Water	**Date Received:**	10/08/24
		Date Analyzed:	10/21/24
		Date Extracted:	10/18/24

Matrix Spike Summary
Total Metals

Sample Name:	CS-SW-1	**Units:**	ug/L
Lab Code:	K2410651-004	**Basis:**	NA
Analysis Method:	6020B		
Prep Method:	EPA CLP ILM04.0		

Matrix Spike
KQ2416479-04

Analyte Name	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Antimony	0.036 J	9.93	10.0	99	75-125
Arsenic	0.36 J	51.1	50.0	101	75-125
Cadmium	ND U	25.8	25.0	103	75-125
Calcium	5590	15900	10300	100	75-125
Chromium	0.11 J	10.6	10.0	105	75-125
Lead	0.013 J	51.9	50.0	104	75-125
Magnesium	996	11700	10300	104	75-125
Silver	ND U	13.4	12.5	107	75-125
Zinc	ND U	24.9	25.0	100	75-125

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.

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QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24
Sample Matrix:	Water	**Date Received:**	10/08/24
		Date Analyzed:	10/15/24
		Date Extracted:	10/14/24

Matrix Spike Summary
Total Metals

Sample Name:	CS-SW-1	**Units:**	ug/L
Lab Code:	K2410651-004	**Basis:**	NA
Analysis Method:	7470A		
Prep Method:	Method		

Matrix Spike
KQ2416532-04

Analyte Name	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Mercury	ND U	4.91	5.00	98	75-125

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.

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QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24
Sample Matrix:	Water	**Date Received:**	10/08/24
		Date Analyzed:	10/21/24

Replicate Sample Summary
Total Metals

Sample Name:	CS-SW-1	**Units:**	ug/L
Lab Code:	K2410651-004	**Basis:**	NA

Analyte Name	Analysis Method	MRL	MDL	Sample Result	Duplicate Sample KQ2416479-03 Result	Average	RPD	RPD Limit
Antimony	6020B	0.050	0.020	0.036 J	0.027 J	0.032	29 #	20
Arsenic	6020B	0.50	0.09	0.36 J	0.33 J	0.35	9	20
Cadmium	6020B	0.020	0.008	ND U	ND U	ND	-	20
Calcium	6020B	20	6	5590	5530	5560	1	20
Chromium	6020B	0.20	0.03	0.11 J	0.12 J	0.12	9	20
Lead	6020B	0.020	0.006	0.013 J	0.008 J	0.011	48 #	20
Magnesium	6020B	10	2	996	1020	1010	2	20
Silver	6020B	0.020	0.009	ND U	ND U	ND	-	20
Zinc	6020B	2.0	0.5	ND U	ND U	ND	-	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Printed 10/22/2024 4:18:38 PM Superset Reference:24-0000712756 rev 00

QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24
Sample Matrix:	Water	**Date Received:**	10/08/24
		Date Analyzed:	10/15/24

Replicate Sample Summary
Total Metals

Sample Name:	CS-SW-1	**Units:**	ug/L
Lab Code:	K2410651-004	**Basis:**	NA

Analyte Name	Analysis Method	MRL	MDL	Sample Result	Duplicate Sample KQ2416532-03 Result	Average	RPD	RPD Limit
Mercury	7470A	0.20	0.02	ND U	ND U	ND	-	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Analyzed:**	10/21/24
Sample Matrix:	Water		

Lab Control Sample Summary
Total Metals

Units:ug/L
Basis:NA

Lab Control Sample
KQ2416479-02

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Antimony	6020B	9.49	10.0	95	80-120
Arsenic	6020B	50.1	50.0	100	80-120
Cadmium	6020B	25.3	25.0	101	80-120
Calcium	6020B	10000	10300	98	80-120
Chromium	6020B	10.2	10.0	102	80-120
Lead	6020B	51.0	50.0	102	80-120
Magnesium	6020B	10600	10300	103	80-120
Silver	6020B	12.9	12.5	103	80-120
Zinc	6020B	25.4	25.0	101	80-120

ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Analyzed:**	10/15/24
Sample Matrix:	Water		

Lab Control Sample Summary
Total Metals

Units:ug/L
Basis:NA

Lab Control Sample
KQ2416532-02

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Mercury	7470A	4.68	5.00	94	80-120

ALS Environmental
ALS Group USA, Corp
1317 South 13th Avenue
Kelso, WA 98626
T : +1 360 577 7222
F : +1 360 636 1068
www.alsglobal.com

November 01, 2024

Analytical Report for Service Request No: K2410642
Revised Service Request No: K2410642.01

Don Malkemus
Terraphase Engineering Inc.
610 SW Broadway, Suite 405
Portland, OR 97205

RE: Upper Granite Creek Mines / 0031.005.001

Dear Don,

Enclosed is the revised report of the sample(s) submitted to our laboratory October 08, 2024
For your reference, these analyses have been assigned our service request number **K2410642.**

The bio accessibility values are now included.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

We apologize for any inconvenience this may have created.

Please contact me if you have any questions. My extension is 3376. You may also contact me via email at Mark.Harris@alsglobal.com.

Respectfully submitted,

ALS Group USA, Corp. dba ALS Environmental

Mark Harris
Project Manager

REVISED
4:33 pm, Nov 01, 2024

ALS Environmental
ALS Group USA, Corp
1317 South 13th Avenue
Kelso, WA 98626
T : +1 360 577 7222
F : +1 360 636 1068
www.alsglobal.com

Table of Contents

Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LOD	Limit of Detection
LOQ	Limit of Quantitation
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

Inorganic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
E	The result is an estimate amount because the value exceeded the instrument calibration range.
J	The result is an estimated value.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.
H	The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

#	The control limit criteria is not applicable.
J	The result is an estimated value.
E	The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
M	The duplicate injection precision was not met.
N	The Matrix Spike sample recovery is not within control limits. See case narrative.
S	The reported value was determined by the Method of Standard Additions (MSA).
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
W	The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
+	The correlation coefficient for the MSA is less than 0.995.
Q	See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
A	A tentatively identified compound, a suspected aldol-condensation product.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
C	The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
D	The reported result is from a dilution.
E	The result is an estimated value.
J	The result is an estimated value.
N	The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
P	The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

F	The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
L	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
H	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
O	The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
Y	The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
Z	The chromatographic fingerprint does not resemble a petroleum product.

ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso
State Certifications, Accreditations, and Licenses

Agency	Web Site	Number
Alaska DEH	http://dec.alaska.gov/eh/lab/cs/csapproval.htm	UST-040
Arizona DHS	http://www.azdhs.gov/lab/license/env.htm	AZ0339
Arkansas - DEQ	http://www.adeq.state.ar.us/techsvs/labcert.htm	88-0637
California DHS (ELAP)	http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx	2795
DOD ELAP	http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm	L16-58-R4
Florida DOH	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E87412
Hawaii DOH	http://health.hawaii.gov/	-
ISO 17025	http://www.pjlabs.com/	L16-57
Louisiana DEQ	http://www.deq.louisiana.gov/page/la-lab-accreditation	03016
Maine DHS	http://www.maine.gov/dhhs/	WA01276
Minnesota DOH	http://www.health.state.mn.us/accreditation	053-999-457
Nevada DEP	http://ndep.nv.gov/bsdw/labservice.htm	WA01276
New Jersey DEP	http://www.nj.gov/dep/enforcement/oqa.html	WA005
New York - DOH	https://www.wadsworth.org/regulatory/elap	12060
North Carolina DEQ	https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/laboratory-certification-branch/non-field-lab-certification	605
Oklahoma DEQ	http://www.deq.state.ok.us/CSDnew/labcert.htm	9801
Oregon – DEQ (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	WA100010
South Carolina DHEC	http://www.scdhec.gov/environment/EnvironmentalLabCertification/	61002
Texas CEQ	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704427
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C544
Wyoming (EPA Region 8)	https://www.epa.gov/region8-waterops/epa-region-8-certified-drinking-water-	-
Kelso Laboratory Website	www.alsglobal.com	NA

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.ALSGlobal.com or at the accreditation bodies web site.
Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/anlayte is offered by that state.

Case Narrative

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

1317 South 13th Ave, Kelso, WA 98626 | 1-360-577-7222 | www.alsglobal.com

ALS Environmental

Client: Terraphase Engineering Inc.
Project: Upper Granite Creek Mines
Sample Matrix: Soil

Service Request: K2410642
Date Received: 10/08/2024

CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples for the Tier II level requested by the client.

Sample Receipt:

Twenty soil samples were received for analysis at ALS Environmental on 10/08/2024. Any discrepancies upon initial sample inspection are annotated on the sample receipt and preservation form included within this report. The samples were stored at minimum in accordance with the analytical method requirements.

Metals:

No significant anomalies were noted with this analysis.

Approved by ______________________ Date 11/01/2024

Chain of Custody

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CHAIN OF COUSTODY

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001, 002, 003

SR#____

COC Set 4 of 8

COC#____

K2410642

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Project Name: Upper Granite Creek Mines | Project Number: 0031.005.001

Project Manager: Don Malkemus

Company: Terraphase Engineering Inc.

Address, City, State: 610 SW Broadway Suite 405

Phone #: (503) 943-0384 | email: don.malkemus@terraphase.com

Sampler Signature: [signature] | Sampler Printed Name: Don Malkemus

CLIENT SAMPLE ID	LABID	Date	Time	State	Matrix	NUMBER OF CONTAINERS	28D 7470A / Hg T	7471B / Hg	180D 6020B / IVBA (Sieved Total)	6020B / IVBA Extract	6020B / Metals T	999D Grind / GrindSub	SM 2340 B / Hardness Calc	1	2	3	4	5	Remarks
UMM-TLB-0.5-1	1	10/2	1630		Soil	2		X	X	X	X								+ bag*
UMM-TLA-0.5-3		10/2	1530		Soil	2													+ bag HOLD
UMM-TLB-0.5-4	2	10/2	1645		Soil	2					X								+ bag
UMM-TLA-0.5-4		10/2	1535		Soil	2													+ bag HOLD
UMM-TLC-0.5-1	3	10/2	1700		Soil	2					X								+ bag
UMM-TLC-0.5-2	4	10/2	1715		Soil	2					X								+ bag
UMM-TLB-0.5-2		10/2	1635		Soil	2													+ bag HOLD
UMM-TLA-0.5-5		10/2	1540		Soil	2													+ bag HOLD
UMM-TLA-0.5-6	5	10/2	1545		Soil	2		X	X	X	X								+ bag

Report Requirements

I. Routine Report: Method Blank, Surrogate, as required

II. Report Dup., MS, MSD as required

III. CLP Like Summary (no raw data)

IV. Data Validation Report

V. EDD

Invoice Information

P.O.#____

Bill To: ap@terraphase.com

Turnaround Requirements

____ 24 hr. ____ 48 hr.

____ 5 Day

X Standard

Requested Report Date

Circle which metals are to be analyzed

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

*Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other____ (Circle One)

Special Instructions/Comments:

*Also analyze Pb + Hg on sample 1 (UMM-TLB-0.5-1) and 9 (UMM-TLA-0.5-6)

Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature [signature]	Signature [signature]	Signature [signature]	Signature Naomi Pedersen	Signature	Signature
Printed Name Don Malkemus	Printed Name Franklin LaBiche	Printed Name Franklin LaBiche	Printed Name ALS	Printed Name	Printed Name
Firm TEI	Firm ALS	Firm ALS	Firm 10/8/24 1445	Firm	Firm
Date/Time 10/8 1306	Date/Time 10/08/24 1206	Date/Time 10/08/24 1445	Date/Time	Date/Time	Date/Time

ALS

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SR#

COC Set 5 of 8

COC#

K2410642

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Project Name: Upper Granite Creek Mines
Project Number: 0031.005.001
Project Manager: Don Malkemus
Company: Terraphase Engineering Inc.
Address, City, State: 610 SW Broadway Suite 405
Phone # (503) 889-1067
email: don.malkemus@terraphase.com
Sampler Signature:
Sampler Printed Name: Don Malkemus

CLIENT SAMPLE ID	LABID	SAMPLING Date	Time	State	Matrix	NUMBER OF CONTAINERS	7470A / Hg T	7471B / Hg	6020B / IVBA (Sieved Total)	6020B / IVBA Extract	6020B / Metals T	Grind / GrindSub	SM 2340 B / Hardness Calc	1	2	3	4	5	Remarks
							28D		180D			999D							
EM-WRA-0.5-4-DS	6	10/5	1230		Soil	2					X								
EM-WRB-0.5-1	7	10/5	1300		Soil	2					X								
EM-WRA-0.5-2	8	10/5	1205		Soil	2			X	X	X								+ bag
EM-WRC-0.5-1	9	10/5	1240		Soil	2					X								
GF-WRA-0.5-1	10	10/5	0930		Soil	2					X								
GF-WRD-0.5-6	11	10/5	1110		Soil	2					X								
GF-WRD-0.5-4-DS	12	10/5	1105		Soil	2			X	X	X								+ bag
F-DR-0.5-1	13	10/5	1035		Soil	2					X								
CS-WRA-0.5-3	14	10/4	1615		Soil	2					X								
SCS-WRA-0.5-4	15	10/4	1554		Soil	2					X								

Report Requirements

I. Routine Report: Method Blank, Surrogate, as required

II. Report Dup., MS, MSD as required

III. CLP Like Summary (no raw data)

IV. Data Validation Report

V. EDD

Invoice Information

P.O.#

Bill To: ap@terraphase.com

Turnaround Requirements

___ 24 hr. ___ 48 hr.
___ 5 Day
X Standard

Requested Report Date

Circle which metals are to be analyzed

Total Metals: Al **As** Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Special Instructions/Comments:

*Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other ____ (Circle One)

Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature	Signature	Signature	Signature	Signature	Signature
Printed Name: Don Malkemus	Printed Name: Franklin LaBiche	Printed Name: Franklin LaBiche	Printed Name: Naomi Pedersen	Printed Name	Printed Name
Firm: TEI	Firm: ALS	Firm: ALS	Firm: ALS	Firm	Firm
Date/Time: 10/8 1306	Date/Time: 10/08/24 1306	Date/Time: 10/08/24 1445	Date/Time: 10/8/24 1445	Date/Time	Date/Time

ALS Environmental

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001, 002, 003

SR#
COC Set 6 of 8
COC#

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K2410639 48 FLP

Project Name: Upper Granite Creek Mines | Project Number: 0031.005.001
Project Manager: Don Mulkemus
Company: Terraphase Engineering Inc.
Address, City, State: 610 SW Broadway Suite 405
Phone #: (503) 943-0384 | email: don.mulkemus@terraphase.com
Sampler Signature: [signature] | Sampler Printed Name: Don Mulkemus

CLIENT SAMPLE ID	LABID	SAMPLING Date	Time	State	Matrix	NUMBER OF CONTAINERS	28D 7470A / Hg T	28D 7471B / Hg	180D 6020B / IVBA (Sieved Total)	180D 6020B / IVBA Extract	180D 6020B / Metals T	999D Grind / GrindSub	999D SM 2340 B / Hardness Calc	1	2	3	4	5	Remarks
1. GC5-WRA-0.5-4-DS	16	10/4	1555		Soil	2			X	X	X								+ bag
2. GC6-WRA-0.5-2	17	10/4	1400		Soil	2			X	X	X								+ bag
3. GC6-WRA-0.5-1	18	10/4	1045		Soil	2					X								
4. GC7-WRA-0.5-3	19	10/4	1150		Soil	2					X								
5. GC7-WRB-0.5-1	20	10/4	1115		Soil	2					X								
6. TL-WRA-0.5-3		10/4	1405		Soil	2					X								
7. TL-WRB-0.5-4		10/4	1425		Soil	2					X								
8. TL-WRA-0.5-1-DS-2		10/4	1400		Soil	2			X	X	X								+ bag
9. SH-WRB-0.5-2		10/4	1005		Soil	2					X								
10. SH-WRC-0.5-1		10/4	1015		Soil	2					X								

Report Requirements

- ___ I. Routine Report: Method Blank, Surrogate, as required
- X II. Report Dup., MS, MSD as required
- ___ III. CLP Like Summary (no raw data)
- ___ IV. Data Validation Report
- ___ V. EDD

Invoice Information

P.O.#
Bill To: ap@terraphase.com

Turnaround Requirements

___ 24 hr. ___ 48 hr.
___ 5 Day
X Standard

Requested Report Date

Circle which metals are to be analyzed

Total Metals: Al (As) Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Special Instructions/Comments:

*Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other____ (Circle One)

	Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature	[signature]	[signature]	[signature]	Naomi Rodeberg		
Printed Name	Don Mulkemus	Franklin LaBiche	Franklin LaBiche	ALS		
Firm	TEI	ALS	ALS	10/8/24 1445		
Date/Time	10/8 1306	10/08/24 1306	10/08/24 1445			

PM MH

Cooler Receipt and Preservation Form

Client: Terraphase Service Request K24 10642

Received: 10/8/24 Opened: 10/8/24 By: NP Unloaded: 10/8/24 By: NP

1. Samples were received via? *USPS* *Fed Ex* *UPS* *DHL* *PDX* *Courier* *Hand Delivered*
2. Samples were received in: (circle) *Cooler* *Box* *Envelope* *Other* ________ *NA*
3. Were custody seals on coolers? NA Y N If yes, how many and where? ________

If present, were custody seals intact? Y N If present, were they signed and dated? Y N

Temp Blank	Sample Temp	IR Gun	Cooler #/COC ID / NA	Out of temp indicate with "X"	PM Notified If out of temp	Tracking Number NA	Filed
9.6	4.6	1801	140510				
6.8	5.7						
6.0	4.4						
9.4	4.5						
18.3	4.5						

4. Was a Temperature Blank present in cooler? NA Y N If yes, notate the temperature in the appropriate column above:

   If no, take the temperature of a representative sample bottle contained within the cooler; notate in the column "Sample Temp":

5. Were samples received within the method specified temperature ranges? NA Y N

   If no, were they received on ice and same day as collected? If not, notate the cooler # above and notify the PM. NA Y N

If applicable, tissue samples were received: *Frozen* *Partially Thawed* *Thawed*

6. Packing material: *Inserts* *Baggies* *Bubble Wrap* *Gel Packs* *Wet Ice* *Dry Ice* *Sleeves* ________
7. Were custody papers properly filled out (ink, signed, etc.)? NA Y N
8. Were samples received in good condition (unbroken) NA Y N
9. Were all sample labels complete (ie, analysis, preservation, etc.)? NA Y N
10. Did all sample labels and tags agree with custody papers? NA Y N
11. Were appropriate bottles/containers and volumes received for the tests indicated? NA Y N
12. Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* NA Y N
13. Were VOA vials received without headspace? *Indicate in the table below.* NA Y N
14. Was C12/Res negative? NA Y N
15. Were samples received within the method specified time limit? If not, notate the error below and notify the PM NA Y N
16. Were 100ml sterile microbiology bottles filled exactly to the 100ml mark? NA Y N Underfilled Overfilled

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count Bottle Type	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies, Resolutions: ________

ALS

Cooler Receipt and Preservation Form

Client Terraphase Service Request K24 10642

Temp Blank	Sample Temp	IR Gun	Cooler #/COC ID / NA	Out of temp indicate with "X"	PM Notified If out of temp	Tracking Number NA	Filed
~~8.8~~ 7.8	3.8	IR01					
12.2	5.5	↓					

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count Bottle Type	Out of Temp	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies & Resolutions: Ice was at top of coolers on top of samples. Temp blank was under the samples, not indicative of sample temp

Total Solids

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1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 - 10/05/24
Sample Matrix:	Soil	**Date Received:**	10/8/24
Analysis Method:	160.3 Modified	**Units:**	Percent
Prep Method:	None	**Basis:**	As Received

Solids, Total

Sample Name	Lab Code	Result	MRL	Dil.	Date Analyzed	Q
UMM-TLB-0.5-1	K2410642-001	**86.4**	-	1	10/10/24 10:19	
UMM-TLB-0.5-4	K2410642-002	**91.8**	-	1	10/10/24 10:19	
UMM-TLC-0.5-1	K2410642-003	**79.3**	-	1	10/10/24 10:19	
UMM-TLC-0.5-2	K2410642-004	**76.8**	-	1	10/10/24 10:19	
UMM-TLA-0.5-6	K2410642-005	**91.8**	-	1	10/10/24 10:19	
CEM-WRA-0.5-4-DS	K2410642-006	**96.8**	-	1	10/10/24 10:19	
CEM-WRB-0.5-1	K2410642-007	**96.5**	-	1	10/10/24 10:19	
CEM-WRA-0.5-2	K2410642-008	**95.3**	-	1	10/10/24 10:19	
CEM-WRC-0.5-1	K2410642-009	**95.1**	-	1	10/10/24 10:19	
GF-WRA-0.5-1	K2410642-010	**97.0**	-	1	10/10/24 10:19	
GF-WRD-0.5-6	K2410642-011	**95.1**	-	1	10/10/24 10:19	
GF-WRD-0.5-4-DS	K2410642-012	**97.0**	-	1	10/10/24 10:19	
GF-DR-0.5-1	K2410642-013	**97.2**	-	1	10/10/24 10:19	
GC5-WRA-0.5-3	K2410642-014	**96.2**	-	1	10/10/24 10:19	
GC5-WRA-0.5-4	K2410642-015	**95.8**	-	1	10/10/24 10:19	
GC5-WRA-0.5-4-DS	K2410642-016	**96.0**	-	1	10/10/24 10:19	
GC6-WRA-0.5-2	K2410642-017	**94.4**	-	1	10/10/24 10:19	
GC6-WRA-0.5-1	K2410642-018	**93.7**	-	1	10/10/24 10:19	
GC7-WRA-0.5-3	K2410642-019	**95.2**	-	1	10/10/24 10:19	
GC7-WRB-0.5-1	K2410642-020	**96.1**	-	1	10/10/24 10:19	

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 - 10/04/24
Sample Matrix:	Soil	**Date Received:**	10/08/24
Analysis Method:	160.3 Modified	**Units:**	Percent
Prep Method:	None	**Basis:**	As Received

Replicate Sample Summary
Inorganic Parameters

Sample Name:	Lab Code:	MRL	Sample Result	Duplicate Result	Average	RPD	RPD Limit	Date Analyzed
UMM-TLB-0.5-1	K2410642-001DUP	-	86.4	86.5	86.5	<1	20	10/10/24
GC7-WRB-0.5-1	K2410642-020DUP	-	96.1	96.3	96.2	<1	20	10/10/24

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Metals

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/2/2024
Sample Matrix:	Soil	**Date Received:**	10/8/2024
		Date Extracted:	10/16-10/17/2024
		Date Analyzed:	10/17-10/22/2024

Bioaccessibility Value
Analyte: Arsenic
Units: Percent (%)

Sample Name	Lab Code	Result
UMM-TLB-0.5-1	K2410642-001	41.6
UMM-TLA-0.5-6	K2410642-005	24.3
CEM-WRA-0.5-2	K2410642-008	5.6
GF-WRD-0.5-4-DS	K2410642-012	9.0
GC5-WRA-0.5-4-DS	K2410642-016	4.7
GC6-WRA-0.5-2	K2410642-017	3.9

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/2/2024
Sample Matrix:	Soil	**Date Received:**	10/8/2024
		Date Extracted:	10/16-10/17/2024
		Date Analyzed:	10/17-10/22/2024

Bioaccessibility Value
Analyte: Lead
Units: Percent (%)

Sample Name	Lab Code	Result
UMM-TLB-0.5-1	K2410642-001	28.7
UMM-TLA-0.5-6	K2410642-005	6.2
CEM-WRA-0.5-2	K2410642-008	27.9
GF-WRD-0.5-4-DS	K2410642-012	34.9
GC5-WRA-0.5-4-DS	K2410642-016	37.5
GC6-WRA-0.5-2	K2410642-017	41.7

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 16:30
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UMM-TLB-0.5-1	**Basis:**	Dry
Lab Code:	K2410642-001		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**6130**	mg/Kg	11	1	100	10/22/24 12:10	10/10/24	
Lead	6020B	**1710**	mg/Kg	1.1	0.4	100	10/22/24 12:10	10/10/24	
Mercury	7471B	**387**	mg/Kg	11	1	500	10/15/24 13:08	10/14/24	

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Superset Reference:

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 16:30
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UMM-TLB-0.5-1	**Basis:**	Dry
Lab Code:	K2410642-001		

Total Metals – IVBA Analysis

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**4420**	mg/Kg	4.9	0.6	50	10/22/24 15:53	10/17/24	
Lead	6020B	**840**	mg/Kg	0.49	0.20	50	10/22/24 15:53	10/17/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 16:30
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UMM-TLB-0.5-1	**Basis:**	Dry
Lab Code:	K2410642-001		

IVBA Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**1840**	mg/Kg	2.0	0.2	20	10/17/24 11:29	10/16/24	
Lead	6020B	**241**	mg/Kg	0.20	0.08	20	10/17/24 11:29	10/16/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 16:45
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UMM-TLB-0.5-4	**Basis:**	Dry
Lab Code:	K2410642-002		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**1540**	mg/Kg	8.0	1.0	100	10/22/24 12:18	10/10/24	

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Superset Reference:

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 17:00
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UMM-TLC-0.5-1	**Basis:**	Dry
Lab Code:	K2410642-003		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**5290**	mg/Kg	9.9	1.2	100	10/22/24 12:19	10/10/24	

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Superset Reference:

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 17:15
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UMM-TLC-0.5-2	**Basis:**	Dry
Lab Code:	K2410642-004		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**4980**	mg/Kg	10	1	100	10/22/24 12:21	10/10/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 15:45
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UMM-TLA-0.5-6	**Basis:**	Dry
Lab Code:	K2410642-005		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**3270**	mg/Kg	8.1	1.0	100	10/22/24 11:35	10/10/24	
Lead	6020B	**589**	mg/Kg	0.81	0.33	100	10/22/24 11:35	10/10/24	
Mercury	7471B	**9.23**	mg/Kg	0.19	0.02	10	10/15/24 10:28	10/14/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 15:45
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UMM-TLA-0.5-6	**Basis:**	Dry
Lab Code:	K2410642-005		

Total Metals – IVBA Analysis

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**5560**	mg/Kg	4.9	0.6	50	10/22/24 15:46	10/17/24	
Lead	6020B	**1110**	mg/Kg	0.49	0.20	50	10/22/24 15:46	10/17/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 15:45
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	UMM-TLA-0.5-6	**Basis:**	Dry
Lab Code:	K2410642-005		

IVBA Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**1350**	mg/Kg	2.0	0.2	20	10/17/24 11:22	10/16/24	
Lead	6020B	**69.2**	mg/Kg	0.20	0.08	20	10/17/24 11:22	10/16/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24 12:30
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	CEM-WRA-0.5-4-DS	**Basis:**	Dry
Lab Code:	K2410642-006		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**32.6**	mg/Kg	0.40	0.05	5	10/22/24 12:03	10/10/24	

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Superset Reference:

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 13:00
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	CEM-WRB-0.5-1	**Basis:**	Dry
Lab Code:	K2410642-007		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**151**	mg/Kg	8.6	1.0	100	10/22/24 11:38	10/10/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 12:05
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	CEM-WRA-0.5-2	**Basis:**	Dry
Lab Code:	K2410642-008		

Total Metals – IVBA Analysis

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**794**	mg/Kg	5.0	0.6	50	10/22/24 15:55	10/17/24	
Lead	6020B	**78.5**	mg/Kg	0.50	0.20	50	10/22/24 15:55	10/17/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 12:05
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	CEM-WRA-0.5-2	**Basis:**	Dry
Lab Code:	K2410642-008		

IVBA Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**44.5**	mg/Kg	2.0	0.2	20	10/17/24 11:30	10/16/24	
Lead	6020B	**21.9**	mg/Kg	0.20	0.08	20	10/17/24 11:30	10/16/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 12:05
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	CEM-WRA-0.5-2	**Basis:**	Dry
Lab Code:	K2410642-008		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**299**	mg/Kg	8.3	1.0	100	10/22/24 11:39	10/10/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 12:40
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	CEM-WRC-0.5-1	**Basis:**	Dry
Lab Code:	K2410642-009		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**110**	mg/Kg	8.0	1.0	100	10/22/24 11:41	10/10/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 09:30
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	GF-WRA-0.5-1	**Basis:**	Dry
Lab Code:	K2410642-010		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**332**	mg/Kg	7.8	0.9	100	10/22/24 11:42	10/10/24	

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Superset Reference:

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 11:10
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	GF-WRD-0.5-6	**Basis:**	Dry
Lab Code:	K2410642-011		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**66.6**	mg/Kg	7.9	0.9	100	10/22/24 11:44	10/10/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 11:05
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	GF-WRD-0.5-4-DS	**Basis:**	Dry
Lab Code:	K2410642-012		

Total Metals – IVBA Analysis

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**137**	mg/Kg	4.9	0.6	50	10/22/24 15:56	10/17/24	
Lead	6020B	**25.6**	mg/Kg	0.49	0.19	50	10/22/24 15:56	10/17/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 11:05
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	GF-WRD-0.5-4-DS	**Basis:**	Dry
Lab Code:	K2410642-012		

IVBA Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**12.3**	mg/Kg	2.0	0.2	20	10/17/24 11:32	10/16/24	
Lead	6020B	**8.94**	mg/Kg	0.20	0.08	20	10/17/24 11:32	10/16/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 11:05
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	GF-WRD-0.5-4-DS	**Basis:**	Dry
Lab Code:	K2410642-012		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**55.2**	mg/Kg	8.5	1.0	100	10/22/24 11:45	10/10/24	

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Superset Reference:

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 10:35
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	GF-DR-0.5-1	**Basis:**	Dry
Lab Code:	K2410642-013		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**58.3**	mg/Kg	8.4	1.0	100	10/22/24 11:49	10/10/24	

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Analytical Report

Client:	Terraphase Engineering Inc.		**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001		**Date Collected:**	10/04/24 16:15
Sample Matrix:	Soil		**Date Received:**	10/08/24 14:45
Sample Name:	GC5-WRA-0.5-3		**Basis:**	Dry
Lab Code:	K2410642-014			

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**421**	mg/Kg	8.0	1.0	100	10/22/24 11:51	10/10/24	

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Superset Reference:

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 15:54
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	GC5-WRA-0.5-4	**Basis:**	Dry
Lab Code:	K2410642-015		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**160**	mg/Kg	7.8	0.9	100	10/22/24 11:52	10/10/24	

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Superset Reference:

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 15:55
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	GC5-WRA-0.5-4-DS	**Basis:**	Dry
Lab Code:	K2410642-016		

Total Metals – IVBA Analysis

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**221**	mg/Kg	5.0	0.6	50	10/22/24 16:01	10/17/24	
Lead	6020B	**70.4**	mg/Kg	0.50	0.20	50	10/22/24 16:01	10/17/24	

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ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 15:55
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	GC5-WRA-0.5-4-DS	**Basis:**	Dry
Lab Code:	K2410642-016		

IVBA Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**10.4**	mg/Kg	1.9	0.2	20	10/17/24 11:37	10/16/24	
Lead	6020B	**26.4**	mg/Kg	0.19	0.08	20	10/17/24 11:37	10/16/24	

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ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 15:55
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	GC5-WRA-0.5-4-DS	**Basis:**	Dry
Lab Code:	K2410642-016		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**81.3**	mg/Kg	7.9	0.9	100	10/22/24 11:54	10/10/24	

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Superset Reference:

ALS Group USA, Corp.
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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 14:00
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	GC6-WRA-0.5-2	**Basis:**	Dry
Lab Code:	K2410642-017		

Total Metals – IVBA Analysis

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**759**	mg/Kg	4.9	0.6	50	10/22/24 16:02	10/17/24	
Lead	6020B	**360**	mg/Kg	0.49	0.20	50	10/22/24 16:02	10/17/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 14:00
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	GC6-WRA-0.5-2	**Basis:**	Dry
Lab Code:	K2410642-017		

IVBA Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**29.3**	mg/Kg	2.0	0.2	20	10/17/24 11:39	10/16/24	
Lead	6020B	**150**	mg/Kg	0.20	0.08	20	10/17/24 11:39	10/16/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 14:00
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	GC6-WRA-0.5-2	**Basis:**	Dry
Lab Code:	K2410642-017		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**504**	mg/Kg	8.5	1.0	100	10/22/24 11:55	10/10/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 10:45
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	GC6-WRA-0.5-1	**Basis:**	Dry
Lab Code:	K2410642-018		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**257**	mg/Kg	8.5	1.0	100	10/22/24 11:57	10/10/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 11:50
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	GC7-WRA-0.5-3	**Basis:**	Dry
Lab Code:	K2410642-019		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**26.9**	mg/Kg	8.5	1.0	100	10/22/24 11:58	10/10/24	
Arsenic	6020B	**26.2**	mg/Kg	0.43	0.05	5	10/22/24 12:04	10/10/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 11:15
Sample Matrix:	Soil	**Date Received:**	10/08/24 14:45
Sample Name:	GC7-WRB-0.5-1	**Basis:**	Dry
Lab Code:	K2410642-020		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**7.43**	mg/Kg	0.43	0.05	5	10/22/24 12:09	10/10/24	

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Superset Reference:

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	Dry
Lab Code:	KQ2416652-01		

Total Metals – IVBA Analysis

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	ND U	mg/Kg	0.5	0.06	5	10/22/24 15:43	10/17/24	
Lead	6020B	**0.043 J**	mg/Kg	0.05	0.020	5	10/22/24 15:43	10/17/24	

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Superset Reference:

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	Dry
Lab Code:	KQ2416789-01		

IVBA Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	ND U	mg/Kg	0.5	0.06	5	10/17/24 10:57	10/16/24	
Lead	6020B	ND U	mg/Kg	0.05	0.020	5	10/17/24 10:57	10/16/24	

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Superset Reference:

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	Dry
Lab Code:	KQ2416391-03		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**0.07 J**	mg/Kg	0.5	0.06	5	10/22/24 11:05	10/10/24	
Lead	6020B	ND U	mg/Kg	0.05	0.020	5	10/22/24 11:05	10/10/24	

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Superset Reference:

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	Dry
Lab Code:	KQ2416426-03		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Mercury	7471B	ND U	mg/Kg	0.02	0.002	1	10/15/24 09:02	10/14/24	

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Superset Reference:

ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24
Sample Matrix:	Soil	**Date Received:**	10/08/24
		Date Analyzed:	10/22/24

Replicate Sample Summary
Total Metals – IVBA Analysis

Sample Name:	UMM-TLA-0.5-6	**Units:**	mg/Kg
Lab Code:	K2410642-005	**Basis:**	Dry

Analyte Name	Analysis Method	MRL	MDL	Sample Result	Duplicate Sample KQ2416652-03 Result	Average	RPD	RPD Limit
Arsenic	6020B	5.0	0.6	5560	6460	6010	15	20
Lead	6020B	0.50	0.20	1110	1280	1200	14	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Printed 10/22/2024 8:04:36 PM Superset Reference:

QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24
Sample Matrix:	Soil	**Date Received:**	10/08/24
		Date Analyzed:	10/17/24

Replicate Sample Summary
IVBA Metals

Sample Name:	UMM-TLA-0.5-6	**Units:**	mg/Kg
Lab Code:	K2410642-005	**Basis:**	Dry

Analyte Name	Analysis Method	MRL	MDL	Sample Result	Duplicate Sample KQ2416789-04 Result	Average	RPD	RPD Limit
Arsenic	6020B	2.0	0.2	1350	1360	1360	<1	20
Lead	6020B	0.20	0.08	69.2	72.3	70.8	4	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24
Sample Matrix:	Soil	**Date Received:**	10/08/24
		Date Analyzed:	10/22/24

Replicate Sample Summary
Total Metals

Sample Name:	UMM-TLB-0.5-1	**Units:**	mg/Kg
Lab Code:	K2410642-001	**Basis:**	Dry

Analyte Name	Analysis Method	MRL	MDL	Sample Result	Duplicate Sample KQ2416391-01 Result	Average	RPD	RPD Limit
Arsenic	6020B	11	1	6130	7400	6770	19	20
Lead	6020B	1.1	0.4	1710	1560	1640	9	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

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Superset Reference:

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QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24
Sample Matrix:	Soil	**Date Received:**	10/08/24
		Date Analyzed:	10/22/24
		Date Extracted:	10/17/24

Matrix Spike Summary
Total Metals – IVBA Analysis

Sample Name:	UMM-TLA-0.5-6	**Units:**	mg/Kg
Lab Code:	K2410642-005	**Basis:**	Dry
Analysis Method:	6020B		
Prep Method:	EPA 3050B		

Matrix Spike
KQ2416652-04

Analyte Name	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Arsenic	5560	5980	97.0	435 #	75-125
Lead	1110	1250	97.0	145 #	75-125

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.

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dba ALS Environmental

QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/02/24
Sample Matrix:	Soil	**Date Received:**	10/08/24
		Date Analyzed:	10/22/24
		Date Extracted:	10/10/24

Matrix Spike Summary
Total Metals

Sample Name:	UMM-TLB-0.5-1	**Units:**	mg/Kg
Lab Code:	K2410642-001	**Basis:**	Dry
Analysis Method:	6020B		
Prep Method:	EPA 3050B		

Matrix Spike
KQ2416391-02

Analyte Name	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Arsenic	6130	5760	11	-3268 #	75-125
Lead	1710	1750	5.6	557 #	75-125

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.

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ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Analyzed:**	10/22/24
Sample Matrix:	Soil		

Lab Control Sample Summary
Total Metals – IVBA Analysis

Units: mg/Kg
Basis: Dry

Lab Control Sample
KQ2416652-02

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Arsenic	6020B	108	100	108	80-120
Lead	6020B	111	100	111	80-120

Printed 10/22/2024 8:04:36 PM Superset Reference:

Client: Terraphase Engineering Inc.
Project: Upper Granite Creek Mines/0031.005.001
Sample Matrix: Soil

Service Request: K2410642
Date Analyzed: 10/17/24

Lab Control Sample Summary
IVBA Metals

Units: mg/Kg
Basis: Dry

Lab Control Sample
KQ2416789-02

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Arsenic	6020B	92.9	100	93	80-120
Lead	6020B	105	100	105	80-120

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QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Analyzed:**	10/22/24
Sample Matrix:	Soil		

Lab Control Sample Summary
Total Metals

Units: mg/Kg
Basis: Dry

Lab Control Sample
KQ2416391-04

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Arsenic	6020B	107	100	107	80-120
Lead	6020B	113	100	113	80-120

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dba ALS Environmental

QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Analyzed:**	10/15/24
Sample Matrix:	Soil		

Lab Control Sample Summary
Total Metals

Units: mg/Kg
Basis: Dry

Lab Control Sample
KQ2416426-04

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Mercury	7471B	0.520	0.500	104	80-120

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Superset Reference:

ALS Group USA, Corp.
dba ALS Environmental
QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410642
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	NA
LCS Matrix:	Soil	**Date Received:**	NA
		Date Extracted:	10/16/2024
		Date Analyzed:	10/17/2024

Standard Reference Material (SRM) Summary
Bioaccessible Metals

Sample Name:	Standard Reference Material	Units:	mg/Kg (ppm)
Lab Code:	KQ2416789-03	Basis:	Dry
Test Notes:	Montana II Solids = 97.8%		

Source: NIST 2711a - Montana II Soil

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	Control Limits (%)	Result Notes
Lead	EPA 1340	6020B	1300	1250	96	75.2 - 96.2	

October 23, 2024 Service Request No:K2410643

Don Malkemus
Terraphase Engineering Inc.
610 SW Broadway, Suite 405
Portland, OR 97205

Laboratory Results for: Upper Granite Creek Mines

Dear Don,

Enclosed are the results of the sample(s) submitted to our laboratory October 08, 2024
For your reference, these analyses have been assigned our service request number **K2410643.**

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please contact me if you have any questions. My extension is 3376. You may also contact me via email at Mark.Harris@alsglobal.com.

Respectfully submitted,

ALS Group USA, Corp. dba ALS Environmental

Mark Harris
Project Manager

ADDRESS 1317 S. 13th Avenue, Kelso, WA 98626
PHONE +1 360 577 7222 | FAX +1 360 636 1068
ALS Group USA, Corp.
dba ALS Environmental

Narrative Documents

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

1317 South 13th Ave, Kelso, WA 98626 | 1-360-577-7222 | www.alsglobal.com

ALS Environmental

Client: Terraphase Engineering Inc.
Project: Upper Granite Creek Mines
Sample Matrix: Soil

Service Request: K2410643
Date Received: 10/08/2024

CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples for the Tier II level requested by the client.

Sample Receipt:

Fourteen soil samples were received for analysis at ALS Environmental on 10/08/2024. Any discrepancies upon initial sample inspection are annotated on the sample receipt and preservation form included within this report. The samples were stored at minimum in accordance with the analytical method requirements.

Metals:

Method 6020B, 10/22/2024: The Relative Percent Difference (RPD) for the replicate analysis of Silver in sample TL-WRA-0.5-3 was outside the normal ALS control limits. The variability in the results was attributed to the heterogeneous character of the sample. Standard mixing techniques were used, but were not sufficient for complete homogenization of this sample.

Method 6020B, 10/22/2024: Antimony recoveries are generally low for soil and sediment samples when digested using EPA Method 3050B. Despite anticipated low recoveries, the method is still generally prescribed because of its versatility for general metals analysis. Antimony results (in conjunction with the matrix spike recovery) from this procedure should only be used as indicators to estimate concentrations. The matrix spike recovery of Antimony for sample TL-WRA-0.5-3 was below the ALS control criterion. Since low recoveries resulted from a method defect and were possibly magnified by certain matrix components, no corrective action was appropriate. Alternative procedures that specifically target Antimony are available but were not specified for this project. The associated QA/QC results (e.g. control sample, calibration standards, etc.) indicated the analysis was in control.

Method 6020B, 10/22/2024: The matrix spike recovery of Lead for sample TL-WRA-0.5-3 was outside control criteria. Recovery in the Laboratory Control Sample (LCS) was acceptable, which indicated the analytical batch was in control. No further corrective action was appropriate.

Approved by ______________________ Date 10/23/2024

SAMPLE DETECTION SUMMARY

This form includes only detections above the reporting levels. For a full listing of sample results, continue to the Sample Results section of this Report.

CLIENT ID: CS-SD-1			Lab ID: K2410643-006			
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Antimony	0.26		0.05	0.13	mg/Kg	6020B
Arsenic	5.8		0.2	1.3	mg/Kg	6020B
Cadmium	0.234		0.019	0.053	mg/Kg	6020B
Chromium	7.81		0.16	0.53	mg/Kg	6020B
Lead	4.12		0.05	0.13	mg/Kg	6020B
Mercury	0.031	J	0.005	0.053	mg/Kg	7471B
Silver	0.282		0.011	0.053	mg/Kg	6020B
Solids, Total	34.2				Percent	160.3 Modified
Zinc	45.0		0.5	1.3	mg/Kg	6020B

CLIENT ID: CS-SD-2			Lab ID: K2410643-007			
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Antimony	0.038	J	0.022	0.054	mg/Kg	6020B
Arsenic	4.52		0.07	0.54	mg/Kg	6020B
Cadmium	0.038		0.008	0.022	mg/Kg	6020B
Chromium	2.49		0.07	0.22	mg/Kg	6020B
Lead	0.927		0.022	0.054	mg/Kg	6020B
Silver	0.043		0.004	0.022	mg/Kg	6020B
Solids, Total	76.9				Percent	160.3 Modified
Zinc	16.9		0.22	0.54	mg/Kg	6020B

CLIENT ID: CS-SD-3			Lab ID: K2410643-008			
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Antimony	0.069		0.025	0.063	mg/Kg	6020B
Arsenic	11.7		0.08	0.63	mg/Kg	6020B
Cadmium	0.062		0.009	0.025	mg/Kg	6020B
Chromium	4.90		0.08	0.25	mg/Kg	6020B
Lead	1.53		0.025	0.063	mg/Kg	6020B
Mercury	0.923		0.003	0.027	mg/Kg	7471B
Silver	0.112		0.005	0.025	mg/Kg	6020B
Solids, Total	69.1				Percent	160.3 Modified
Zinc	29.7		0.25	0.63	mg/Kg	6020B

CLIENT ID: CS-SD-4			Lab ID: K2410643-009			
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Antimony	0.892		0.023	0.058	mg/Kg	6020B
Arsenic	32.7		0.07	0.58	mg/Kg	6020B
Cadmium	1.09		0.008	0.023	mg/Kg	6020B
Chromium	9.05		0.07	0.23	mg/Kg	6020B
Lead	25.6		0.023	0.058	mg/Kg	6020B
Mercury	0.011	J	0.003	0.029	mg/Kg	7471B
Silver	0.961		0.005	0.023	mg/Kg	6020B

SAMPLE DETECTION SUMMARY

This form includes only detections above the reporting levels. For a full listing of sample results, continue to the Sample Results section of this Report.

CLIENT ID: CS-SD-4		Lab ID: K2410643-009				
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Solids, Total	64.9				Percent	160.3 Modified
Zinc	47.2		0.23	0.58	mg/Kg	6020B

CLIENT ID: CS-SD-5		Lab ID: K2410643-010				
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Antimony	0.146		0.020	0.051	mg/Kg	6020B
Arsenic	14.1		0.06	0.51	mg/Kg	6020B
Cadmium	0.169		0.007	0.020	mg/Kg	6020B
Chromium	5.03		0.06	0.20	mg/Kg	6020B
Lead	2.79		0.020	0.051	mg/Kg	6020B
Mercury	0.056		0.002	0.025	mg/Kg	7471B
Silver	0.582		0.004	0.020	mg/Kg	6020B
Solids, Total	71.1				Percent	160.3 Modified
Zinc	32.7		0.20	0.51	mg/Kg	6020B

CLIENT ID: CS-SD-6		Lab ID: K2410643-011				
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Antimony	0.147		0.018	0.045	mg/Kg	6020B
Arsenic	16.6		0.05	0.45	mg/Kg	6020B
Cadmium	0.146		0.006	0.018	mg/Kg	6020B
Chromium	4.76		0.05	0.18	mg/Kg	6020B
Lead	2.74		0.018	0.045	mg/Kg	6020B
Mercury	0.033		0.002	0.021	mg/Kg	7471B
Silver	0.200		0.004	0.018	mg/Kg	6020B
Solids, Total	82.1				Percent	160.3 Modified
Zinc	37.1		0.18	0.45	mg/Kg	6020B

CLIENT ID: CS-SD-7		Lab ID: K2410643-012				
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Antimony	0.355		0.019	0.048	mg/Kg	6020B
Arsenic	24.2		0.06	0.48	mg/Kg	6020B
Cadmium	0.538		0.007	0.019	mg/Kg	6020B
Chromium	10.6		0.06	0.19	mg/Kg	6020B
Lead	12.1		0.019	0.048	mg/Kg	6020B
Mercury	0.097		0.002	0.023	mg/Kg	7471B
Silver	1.10		0.004	0.019	mg/Kg	6020B
Solids, Total	80.2				Percent	160.3 Modified
Zinc	168		0.19	0.48	mg/Kg	6020B

CLIENT ID: CS-SD-7-DUP		Lab ID: K2410643-013				
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Antimony	0.334		0.022	0.054	mg/Kg	6020B

SAMPLE DETECTION SUMMARY

This form includes only detections above the reporting levels. For a full listing of sample results, continue to the Sample Results section of this Report.

CLIENT ID: CS-SD-7-DUP | **Lab ID: K2410643-013**

Analyte	Results	Flag	MDL	MRL	Units	Method
Arsenic	24.3		0.06	0.54	mg/Kg	6020B
Cadmium	0.446		0.008	0.022	mg/Kg	6020B
Chromium	9.10		0.06	0.22	mg/Kg	6020B
Lead	12.8		0.022	0.054	mg/Kg	6020B
Mercury	0.099		0.002	0.024	mg/Kg	7471B
Silver	1.62		0.004	0.022	mg/Kg	6020B
Solids, Total	73.2				Percent	160.3 Modified
Zinc	102		0.22	0.54	mg/Kg	6020B

CLIENT ID: CS-SD-8 | **Lab ID: K2410643-014**

Analyte	Results	Flag	MDL	MRL	Units	Method
Antimony	0.406		0.023	0.058	mg/Kg	6020B
Arsenic	35.2		0.07	0.58	mg/Kg	6020B
Cadmium	0.316		0.008	0.023	mg/Kg	6020B
Chromium	9.13		0.07	0.23	mg/Kg	6020B
Lead	10.7		0.023	0.058	mg/Kg	6020B
Mercury	0.096		0.003	0.026	mg/Kg	7471B
Silver	1.26		0.005	0.023	mg/Kg	6020B
Solids, Total	69.0				Percent	160.3 Modified
Zinc	103		0.23	0.58	mg/Kg	6020B

CLIENT ID: TL-WRA-0.5-3 | **Lab ID: K2410643-001**

Analyte	Results	Flag	MDL	MRL	Units	Method
Arsenic	454		0.05	0.42	mg/Kg	6020B
Solids, Total	95.0				Percent	160.3 Modified

CLIENT ID: TL-WRB-0.5-4 | **Lab ID: K2410643-002**

Analyte	Results	Flag	MDL	MRL	Units	Method
Arsenic	194		0.05	0.42	mg/Kg	6020B
Solids, Total	95.5				Percent	160.3 Modified

CLIENT ID: TL-WRA-0.5-1-DS-2 | **Lab ID: K2410643-003**

Analyte	Results	Flag	MDL	MRL	Units	Method
Arsenic	550		0.6	4.9	mg/Kg	6020B
Arsenic	14.4		0.2	1.9	mg/Kg	6020B
Arsenic	267		0.05	0.44	mg/Kg	6020B
Lead	218		0.19	0.49	mg/Kg	6020B
Lead	83.3		0.08	0.19	mg/Kg	6020B
Solids, Total	93.4				Percent	160.3 Modified

CLIENT ID: SH-WRB-0.5-2 | **Lab ID: K2410643-004**

Analyte	Results	Flag	MDL	MRL	Units	Method
Arsenic	80.8		0.05	0.39	mg/Kg	6020B

SAMPLE DETECTION SUMMARY

This form includes only detections above the reporting levels. For a full listing of sample results, continue to the Sample Results section of this Report.

CLIENT ID: SH-WRB-0.5-2	Lab ID: K2410643-004					
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Solids, Total	94.1				Percent	160.3 Modified

CLIENT ID: SH-WRC-0.5-1	Lab ID: K2410643-005					
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Arsenic	14.4		0.05	0.44	mg/Kg	6020B
Solids, Total	92.3				Percent	160.3 Modified

Sample Receipt Information

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

RIGHT SOLUTIONS | RIGHT PARTNER

Client: Terraphase Engineering Inc. **Service Request:** K2410643

Project: Upper Granite Creek Mines/0031.005.001

SAMPLE CROSS-REFERENCE

SAMPLE #	CLIENT SAMPLE ID	DATE	TIME
K2410643-001	TL-WRA-0.5-3	10/4/2024	1405
K2410643-002	TL-WRB-0.5-4	10/4/2024	1425
K2410643-003	TL-WRA-0.5-1-DS-2	10/4/2024	1400
K2410643-004	SH-WRB-0.5-2	10/4/2024	1005
K2410643-005	SH-WRC-0.5-1	10/4/2024	1015
K2410643-006	CS-SD-1	10/5/2024	1006
K2410643-007	CS-SD-2	10/3/2024	1505
K2410643-008	CS-SD-3	10/3/2024	0900
K2410643-009	CS-SD-4	10/3/2024	1424
K2410643-010	CS-SD-5	10/4/2024	0930
K2410643-011	CS-SD-6	10/4/2024	1521
K2410643-012	CS-SD-7	10/4/2024	1335
K2410643-013	CS-SD-7-DUP	10/4/2024	1340
K2410643-014	CS-SD-8	10/5/2024	1030

140510

CHAIN OF CUSTODY

140510

001, 002, 003

SR#

COC Set 6 of 8

COC#

1317 South 13th Ave, Kelso, WA 98626 Phone (360) 577-7222 / 800-695-7222 / FAX (360) 636-1068
www.alsglobal.com

K2410639
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Project Name: Upper Granite Creek Mines	Project Number: 0031.005.001
Project Manager: Dan Malkemus	
Company: Terraphase Engineering Inc.	
Address, City, State: 610 SW Broadway Suite 405	
Phone #: (503) 943-0384	email: dan.malkemus@terraphase.com
Sampler Signature:	Sampler Printed Name: Dan Malkemus

CLIENT SAMPLE ID	LABID	Date	Time	State	Matrix	NUMBER OF CONTAINERS	28D 7470A / Hg T	28D 7471B / Hg	180D 6020B / IVBA (Sieved Total)	180D 6020B / IVBA Extract	180D 6020B / Metals T	999D Grind / GrindSub	999D SM 2340 B / Hardness Calc	1	2	3	4	5	Remarks
1. GC5-WRA-0.5-4-DS		10/4	1555		Soil	2			X	X	X								+ bag
2. GC6-WRA-0.5-2		10/4	1400		Soil	2			X	X	X								+ bag
3. GC6-WRA-0.5-1		10/4	1045		Soil	2					X								
4. GC7-WRA-0.5-3		10/4	1150		Soil	2					X								
5. GC7-WRB-0.5-1		10/4	1115		Soil	2					X								
6. TL-WRA-0.5-3	1	10/4	1405		Soil	2					X								
7. TL-WRB-0.5-4	2	10/4	1425		Soil	2					X								
8. TL-WRA-0.5-1-DS-2	3	10/4	1400		Soil	2			X	X	X								+ bag
9. SH-WRB-0.5-2	4	10/4	1005		Soil	2					X								
10. SH-WRC-0.5-1	5	10/4	1015		Soil	2					X								

Report Requirements

___ I. Routine Report: Method Blank, Surrogate, as required

X II. Report Dup., MS, MSD as required

___ III. CLP Like Summary (no raw data)

___ IV. Data Validation Report

___ V. EDD

Invoice Information

P.O.#

Bill To: ap@terraphase.com

Turnaround Requirements

___ 24 hr. ___ 48 hr.

___ 5 Day

X Standard

Requested Report Date

Circle which metals are to be analyzed

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Special Instructions/Comments:

*Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other____ (Circle One)

Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature	Signature	Signature	Signature Naomi Redeson	Signature	Signature
Printed Name Dan Malkemus	Printed Name Franklin LaBiche	Printed Name Franklin LaBiche	Printed Name ALS	Printed Name	Printed Name
Firm TEI	Firm ALS	Firm ALS	Firm 10/8/24 1445	Firm	Firm
Date/Time 10/8 1306	Date/Time 10/08/24 1306	Date/Time 10/08/24 1445	Date/Time	Date/Time	Date/Time

ALS

CHAIN OF CUSTODY

140510

140510

001, 002, 003

SR#

COC Set 8 of 8

COC#

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www.alsglobal.com

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K2410639

Project Name: Upper Granite Creek Mines | Project Number: 0031-005.001

Project Manager: Don Malkemus

Company: Terraphase Engineering Inc.

Address, City, State: 610 SW Broadway Suite 405

Phone #: (503) 943 0384 | email: don.malkemus@terraphase.com

Sampler Signature: | Sampler Printed Name: Don Malkemus

CLIENT SAMPLE ID	LABID	SAMPLING Date	Time	State	Matrix	NUMBER OF CONTAINERS	28D 7470A / Hg T	28D 7471B / Hg	180D 6020B / IVBA (Sieved Total)	180D 6020B / IVBA Extract	180D 6020B / Metals T	999D Grind / GrindSub	999D SM 2340 B / Hardness Calc	1	2	3	4	5	Remarks
1. CS-SD-1	6	10/5	1006		Soil	2		X			X								
2. CS-SD-2	7	10/3	1505		Soil	2		X			X								
3. CS-SD-3	8	10/3	0900		Soil	2		X			X								
4. CS-SD-4	9	10/3	1424		Soil	2		X			X								
5. CS-SD-5	10	10/4	0930		Soil	2		X			X								
6. CS-SD-6	11	10/4	1521		Soil	2		X			X								
7. CS-SD-7	12	10/4	1335		Soil	2		X			X								
8. CS-SD-7-DUP	13	10/4	1340		Soil	2		X			X								
9. CS-SD-8	14	10/5	1030		Soil	2		X			X								
10.																			

Report Requirements

___ I. Routine Report: Method Blank, Surrogate, as required

X II. Report Dup., MS, MSD as required

___ III. CLP Like Summary (no raw data)

___ IV. Data Validation Report

___ V. EDD

Invoice Information

P.O.#

Bill To: ap@terraphase.com

Turnaround Requirements

___ 24 hr. ___ 48 hr.

___ 5 Day

X Standard

Requested Report Date

Circle which metals are to be analyzed

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Special Instructions/Comments:

*Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other____ (Circle One)

	Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature						
Printed Name	Don Malkemus	Franklin LaBiche	Franklin LaBiche	Naomi Pedersen		
Firm	TEI	ALS	ALS	ALS		
Date/Time	10/8 1306	10/08/24 1306	10/08/24 1446	10/8/24 1445		

PM MH

Cooler Receipt and Preservation Form

Client Terraphase Service Request K24 10643

Received: 10/8/24 Opened: 10/8/24 By: AP Unloaded: 10/8/24 By: AP

1. Samples were received via? *USPS* *Fed Ex* *UPS* *DHL* *PDX* ***Courier*** *Hand Delivered*
2. Samples were received in: (circle) ***Cooler*** *~~Box~~* *Envelope* *Other* ____ *NA*
3. Were custody seals on coolers? NA Y **N** If yes, how many and where? ____

If present, were custody seals intact? Y N If present, were they signed and dated? Y N

Temp Blank	Sample Temp	IR Gun	Cooler #/COC ID / NA	Out of temp indicate with "X"	PM Notified If out of temp	Tracking Number NA	Filed
9.6	4.6	1801	140510				
16.8	5.7	↓					
6.0	4.4	↓					
9.4	4.5	↓					
18.3	4.5	↓					

4. Was a Temperature Blank present in cooler? NA **Y** N If yes, notate the temperature in the appropriate column above:

If no, take the temperature of a representative sample bottle contained within the cooler; notate in the column "Sample Temp":

5. Were samples received within the method specified temperature ranges? NA **Y** N

If no, were they received on ice and same day as collected? If not, notate the cooler # above and notify the PM. **NA** Y N

If applicable, tissue samples were received: *Frozen* *Partially Thawed* *Thawed*

6. Packing material: *Inserts* ***Baggies*** *Bubble Wrap* *Gel Packs* ***Wet Ice*** *Dry Ice* *Sleeves* ____
7. Were custody papers properly filled out (ink, signed, etc.)? NA **Y** N
8. Were samples received in good condition (unbroken) NA **Y** N
9. Were all sample labels complete (ie, analysis, preservation, etc.)? NA **Y** N
10. Did all sample labels and tags agree with custody papers? NA **Y** N
11. Were appropriate bottles/containers and volumes received for the tests indicated? NA **Y** N
12. Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* NA **Y** N
13. Were VOA vials received without headspace? *Indicate in the table below.* **NA** Y N
14. Was Cl2/Res negative? **NA** Y N
15. Were samples received within the method specified time limit? If not, notate the error below and notify the PM **NA** Y N
16. Were 100ml sterile microbiology bottles filled exactly to the 100ml mark? **NA** Y N Underfilled Overfilled

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count Bottle Type	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies, Resolutions: ____

ALS

Cooler Receipt and Preservation Form

Client Terraphase Service Request K24 10643

Temp Blank	Sample Temp	IR Gun	Cooler #/COC ID / NA	Out of temp indicate with "X"	PM Notified If out of temp	Tracking Number NA	Filed
~~8.~~ 7.8	3.8	IR01					
12.2	5.5	↓					

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count Bottle Type	Out of Temp	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies & Resolutions: Ice was at top of coolers on top of samples. Temp blank was under the samples, not indicative of sample temp

Miscellaneous Forms

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

Inorganic Data Qualifiers

- * The result is an outlier. See case narrative.
- # The control limit criteria is not applicable.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
- E The result is an estimate amount because the value exceeded the instrument calibration range.
- J The result is an estimated value.
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
  DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
- X See case narrative.
- Q See case narrative. One or more quality control criteria was outside the limits.
- H The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

- # The control limit criteria is not applicable.
- J The result is an estimated value.
- E The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
- M The duplicate injection precision was not met.
- N The Matrix Spike sample recovery is not within control limits. See case narrative.
- S The reported value was determined by the Method of Standard Additions (MSA).
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
  DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- W The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
- i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
- X See case narrative.
- \+ The correlation coefficient for the MSA is less than 0.995.
- Q See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

- * The result is an outlier. See case narrative.
- # The control limit criteria is not applicable. See case narrative.
- A A tentatively identified compound, a suspected aldol-condensation product.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
- C The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
- D The reported result is from a dilution.
- E The result is an estimated value over the calibration range.
- J The result is an estimated value between the MDL and the MRL.
- N The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
- P The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
  DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- i The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
- X See case narrative.
- Q See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

- F The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
- L The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
- H The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
- O The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
- Y The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
- Z The chromatographic fingerprint does not resemble a petroleum product.

ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso
State Certifications, Accreditations, and Licenses

Agency	Web Site	Number
Alaska DEH	http://dec.alaska.gov/eh/lab/cs/csapproval.htm	UST-040
Arizona DHS	http://www.azdhs.gov/lab/license/env.htm	AZ0339
Arkansas - DEQ	http://www.adeq.state.ar.us/techsvs/labcert.htm	88-0637
California DHS (ELAP)	http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx	2795
DOD ELAP	http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm	L16-58-R4
Florida DOH	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E87412
Hawaii DOH	http://health.hawaii.gov/	-
ISO 17025	http://www.pjlabs.com/	L16-57
Louisiana DEQ	http://www.deq.louisiana.gov/page/la-lab-accreditation	03016
Maine DHS	http://www.maine.gov/dhhs/	WA01276
Minnesota DOH	http://www.health.state.mn.us/accreditation	053-999-457
Nevada DEP	http://ndep.nv.gov/bsdw/labservice.htm	WA01276
New Jersey DEP	http://www.nj.gov/dep/enforcement/oqa.html	WA005
New York - DOH	https://www.wadsworth.org/regulatory/elap	12060
North Carolina DEQ	https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/laboratory-certification-branch/non-field-lab-certification	605
Oklahoma DEQ	http://www.deq.state.ok.us/CSDnew/labcert.htm	9801
Oregon – DEQ (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	WA100010
South Carolina DHEC	http://www.scdhec.gov/environment/EnvironmentalLabCertification/	61002
Texas CEQ	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704427
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C544
Wyoming (EPA Region 8)	https://www.epa.gov/region8-waterops/epa-region-8-certified-drinking-water-	-
Kelso Laboratory Website	www.alsglobal.com	NA

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.ALSGlobal.com or at the accreditation bodies web site.
Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/anlayte is offered by that state.

Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LOD	Limit of Detection
LOQ	Limit of Quantitation
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

ALS Group USA, Corp.
dba ALS Environmental

Analyst Summary report

Client: Terraphase Engineering Inc. **Service Request:** K2410643
Project: Upper Granite Creek Mines/0031.005.001

Sample Name: TL-WRA-0.5-3 **Date Collected:** 10/4/24
Lab Code: K2410643-001 **Date Received:** 10/8/24
Sample Matrix: Soil

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN

Sample Name: TL-WRB-0.5-4 **Date Collected:** 10/4/24
Lab Code: K2410643-002 **Date Received:** 10/8/24
Sample Matrix: Soil

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN

Sample Name: TL-WRA-0.5-1-DS-2 **Date Collected:** 10/4/24
Lab Code: K2410643-003 **Date Received:** 10/8/24
Sample Matrix: Soil

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN
6020B	MSOLADEY	JCHAN

Sample Name: SH-WRB-0.5-2 **Date Collected:** 10/4/24
Lab Code: K2410643-004 **Date Received:** 10/8/24
Sample Matrix: Soil

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN

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Analyst Summary report

Client: Terraphase Engineering Inc.
Project: Upper Granite Creek Mines/0031.005.001
Service Request: K2410643

Sample Name: SH-WRC-0.5-1
Lab Code: K2410643-005
Sample Matrix: Soil
Date Collected: 10/4/24
Date Received: 10/8/24

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN

Sample Name: CS-SD-1
Lab Code: K2410643-006
Sample Matrix: Soil
Date Collected: 10/5/24
Date Received: 10/8/24

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN
7471B	KLINN	KLINN

Sample Name: CS-SD-2
Lab Code: K2410643-007
Sample Matrix: Soil
Date Collected: 10/3/24
Date Received: 10/8/24

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN
7471B	KLINN	KLINN

Sample Name: CS-SD-3
Lab Code: K2410643-008
Sample Matrix: Soil
Date Collected: 10/3/24
Date Received: 10/8/24

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN
7471B	KLINN	KLINN

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Analyst Summary report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001		

Sample Name:	CS-SD-4	**Date Collected:**	10/3/24
Lab Code:	K2410643-009	**Date Received:**	10/8/24
Sample Matrix:	Soil		

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN
7471B	KLINN	KLINN

Sample Name:	CS-SD-5	**Date Collected:**	10/4/24
Lab Code:	K2410643-010	**Date Received:**	10/8/24
Sample Matrix:	Soil		

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN
7471B	KLINN	KLINN

Sample Name:	CS-SD-6	**Date Collected:**	10/4/24
Lab Code:	K2410643-011	**Date Received:**	10/8/24
Sample Matrix:	Soil		

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN
7471B	KLINN	KLINN

Sample Name:	CS-SD-7	**Date Collected:**	10/4/24
Lab Code:	K2410643-012	**Date Received:**	10/8/24
Sample Matrix:	Soil		

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN
7471B	KLINN	KLINN

Analyst Summary report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001		

Sample Name:	CS-SD-7-DUP	**Date Collected:**	10/4/24
Lab Code:	K2410643-013	**Date Received:**	10/8/24
Sample Matrix:	Soil		

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN
7471B	KLINN	KLINN

Sample Name:	CS-SD-8	**Date Collected:**	10/5/24
Lab Code:	K2410643-014	**Date Received:**	10/8/24
Sample Matrix:	Soil		

Analysis Method	Extracted/Digested By	Analyzed By
160.3 Modified		ZBIBI
6020B	KLAWSON	JCHAN
7471B	KLINN	KLINN

Sample Results

ALS Environmental—Kelso Laboratory
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Phone (360) 577-7222 Fax (360) 425-9096
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Metals

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 14:05
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	TL-WRA-0.5-3	**Basis:**	Dry
Lab Code:	K2410643-001		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**454**	mg/Kg	0.42	0.05	5	10/22/24 13:49	10/14/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 14:25
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	TL-WRB-0.5-4	**Basis:**	Dry
Lab Code:	K2410643-002		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**194**	mg/Kg	0.42	0.05	5	10/22/24 13:58	10/14/24	

Printed 10/23/2024 5:16:34 PM

Superset Reference:24-0000711615 rev 00

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 14:00
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	TL-WRA-0.5-1-DS-2	**Basis:**	Dry
Lab Code:	K2410643-003		

Total Metals – IVBA Analysis

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**550**	mg/Kg	4.9	0.6	50	10/22/24 16:11	10/17/24	
Lead	6020B	**218**	mg/Kg	0.49	0.19	50	10/22/24 16:11	10/17/24	

Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 14:00
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	TL-WRA-0.5-1-DS-2	**Basis:**	Dry
Lab Code:	K2410643-003		

IVBA Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**14.4**	mg/Kg	1.9	0.2	20	10/17/24 11:50	10/16/24	
Lead	6020B	**83.3**	mg/Kg	0.19	0.08	20	10/17/24 11:50	10/16/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 14:00
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	TL-WRA-0.5-1-DS-2	**Basis:**	Dry
Lab Code:	K2410643-003		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**267**	mg/Kg	0.44	0.05	5	10/22/24 14:00	10/14/24	

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Analytical Report

Client:	Terraphase Engineering Inc.		**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001		**Date Collected:**	10/04/24 10:05
Sample Matrix:	Soil		**Date Received:**	10/08/24 11:45
Sample Name:	SH-WRB-0.5-2		**Basis:**	Dry
Lab Code:	K2410643-004			

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**80.8**	mg/Kg	0.39	0.05	5	10/22/24 14:02	10/14/24	

Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 10:15
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	SH-WRC-0.5-1	**Basis:**	Dry
Lab Code:	K2410643-005		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**14.4**	mg/Kg	0.44	0.05	5	10/22/24 14:08	10/14/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 10:06
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-1	**Basis:**	Dry
Lab Code:	K2410643-006		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.26**	mg/Kg	0.13	0.05	5	10/22/24 14:10	10/14/24	
Arsenic	6020B	**5.8**	mg/Kg	1.3	0.2	5	10/22/24 14:10	10/14/24	
Cadmium	6020B	**0.234**	mg/Kg	0.053	0.019	5	10/22/24 14:10	10/14/24	
Chromium	6020B	**7.81**	mg/Kg	0.53	0.16	5	10/22/24 14:10	10/14/24	
Lead	6020B	**4.12**	mg/Kg	0.13	0.05	5	10/22/24 14:10	10/14/24	
Mercury	7471B	**0.031 J**	mg/Kg	0.053	0.005	1	10/15/24 12:21	10/14/24	
Silver	6020B	**0.282**	mg/Kg	0.053	0.011	5	10/22/24 14:10	10/14/24	
Zinc	6020B	**45.0**	mg/Kg	1.3	0.5	5	10/22/24 14:10	10/14/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 15:05
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-2	**Basis:**	Dry
Lab Code:	K2410643-007		

Total Metals

Analyte Name	Analysis Method	Result		Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.038**	**J**	mg/Kg	0.054	0.022	5	10/22/24 14:12	10/14/24	
Arsenic	6020B	**4.52**		mg/Kg	0.54	0.07	5	10/22/24 14:12	10/14/24	
Cadmium	6020B	**0.038**		mg/Kg	0.022	0.008	5	10/22/24 14:12	10/14/24	
Chromium	6020B	**2.49**		mg/Kg	0.22	0.07	5	10/22/24 14:12	10/14/24	
Lead	6020B	**0.927**		mg/Kg	0.054	0.022	5	10/22/24 14:12	10/14/24	
Mercury	7471B	ND	U	mg/Kg	0.024	0.002	1	10/15/24 12:22	10/14/24	
Silver	6020B	**0.043**		mg/Kg	0.022	0.004	5	10/22/24 14:12	10/14/24	
Zinc	6020B	**16.9**		mg/Kg	0.54	0.22	5	10/22/24 14:12	10/14/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 09:00
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-3	**Basis:**	Dry
Lab Code:	K2410643-008		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.069**	mg/Kg	0.063	0.025	5	10/22/24 14:14	10/14/24	
Arsenic	6020B	**11.7**	mg/Kg	0.63	0.08	5	10/22/24 14:14	10/14/24	
Cadmium	6020B	**0.062**	mg/Kg	0.025	0.009	5	10/22/24 14:14	10/14/24	
Chromium	6020B	**4.90**	mg/Kg	0.25	0.08	5	10/22/24 14:14	10/14/24	
Lead	6020B	**1.53**	mg/Kg	0.063	0.025	5	10/22/24 14:14	10/14/24	
Mercury	7471B	**0.923**	mg/Kg	0.027	0.003	1	10/15/24 12:24	10/14/24	
Silver	6020B	**0.112**	mg/Kg	0.025	0.005	5	10/22/24 14:14	10/14/24	
Zinc	6020B	**29.7**	mg/Kg	0.63	0.25	5	10/22/24 14:14	10/14/24	

Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 14:24
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-4	**Basis:**	Dry
Lab Code:	K2410643-009		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.892**	mg/Kg	0.058	0.023	5	10/22/24 14:16	10/14/24	
Arsenic	6020B	**32.7**	mg/Kg	0.58	0.07	5	10/22/24 14:16	10/14/24	
Cadmium	6020B	**1.09**	mg/Kg	0.023	0.008	5	10/22/24 14:16	10/14/24	
Chromium	6020B	**9.05**	mg/Kg	0.23	0.07	5	10/22/24 14:16	10/14/24	
Lead	6020B	**25.6**	mg/Kg	0.058	0.023	5	10/22/24 14:16	10/14/24	
Mercury	7471B	**0.011 J**	mg/Kg	0.029	0.003	1	10/15/24 12:26	10/14/24	
Silver	6020B	**0.961**	mg/Kg	0.023	0.005	5	10/22/24 14:16	10/14/24	
Zinc	6020B	**47.2**	mg/Kg	0.58	0.23	5	10/22/24 14:16	10/14/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 09:30
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-5	**Basis:**	Dry
Lab Code:	K2410643-010		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.146**	mg/Kg	0.051	0.020	5	10/22/24 14:18	10/14/24	
Arsenic	6020B	**14.1**	mg/Kg	0.51	0.06	5	10/22/24 14:18	10/14/24	
Cadmium	6020B	**0.169**	mg/Kg	0.020	0.007	5	10/22/24 14:18	10/14/24	
Chromium	6020B	**5.03**	mg/Kg	0.20	0.06	5	10/22/24 14:18	10/14/24	
Lead	6020B	**2.79**	mg/Kg	0.051	0.020	5	10/22/24 14:18	10/14/24	
Mercury	7471B	**0.056**	mg/Kg	0.025	0.002	1	10/15/24 12:27	10/14/24	
Silver	6020B	**0.582**	mg/Kg	0.020	0.004	5	10/22/24 14:18	10/14/24	
Zinc	6020B	**32.7**	mg/Kg	0.51	0.20	5	10/22/24 14:18	10/14/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 15:21
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-6	**Basis:**	Dry
Lab Code:	K2410643-011		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.147**	mg/Kg	0.045	0.018	5	10/22/24 14:20	10/14/24	
Arsenic	6020B	**16.6**	mg/Kg	0.45	0.05	5	10/22/24 14:20	10/14/24	
Cadmium	6020B	**0.146**	mg/Kg	0.018	0.006	5	10/22/24 14:20	10/14/24	
Chromium	6020B	**4.76**	mg/Kg	0.18	0.05	5	10/22/24 14:20	10/14/24	
Lead	6020B	**2.74**	mg/Kg	0.045	0.018	5	10/22/24 14:20	10/14/24	
Mercury	7471B	**0.033**	mg/Kg	0.021	0.002	1	10/15/24 12:29	10/14/24	
Silver	6020B	**0.200**	mg/Kg	0.018	0.004	5	10/22/24 14:20	10/14/24	
Zinc	6020B	**37.1**	mg/Kg	0.45	0.18	5	10/22/24 14:20	10/14/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 13:35
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-7	**Basis:**	Dry
Lab Code:	K2410643-012		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.355**	mg/Kg	0.048	0.019	5	10/22/24 14:21	10/14/24	
Arsenic	6020B	**24.2**	mg/Kg	0.48	0.06	5	10/22/24 14:21	10/14/24	
Cadmium	6020B	**0.538**	mg/Kg	0.019	0.007	5	10/22/24 14:21	10/14/24	
Chromium	6020B	**10.6**	mg/Kg	0.19	0.06	5	10/22/24 14:21	10/14/24	
Lead	6020B	**12.1**	mg/Kg	0.048	0.019	5	10/22/24 14:21	10/14/24	
Mercury	7471B	**0.097**	mg/Kg	0.023	0.002	1	10/15/24 12:30	10/14/24	
Silver	6020B	**1.10**	mg/Kg	0.019	0.004	5	10/22/24 14:21	10/14/24	
Zinc	6020B	**168**	mg/Kg	0.48	0.19	5	10/22/24 14:21	10/14/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 13:40
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-7-DUP	**Basis:**	Dry
Lab Code:	K2410643-013		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.334**	mg/Kg	0.054	0.022	5	10/22/24 14:23	10/14/24	
Arsenic	6020B	**24.3**	mg/Kg	0.54	0.06	5	10/22/24 14:23	10/14/24	
Cadmium	6020B	**0.446**	mg/Kg	0.022	0.008	5	10/22/24 14:23	10/14/24	
Chromium	6020B	**9.10**	mg/Kg	0.22	0.06	5	10/22/24 14:23	10/14/24	
Lead	6020B	**12.8**	mg/Kg	0.054	0.022	5	10/22/24 14:23	10/14/24	
Mercury	7471B	**0.099**	mg/Kg	0.024	0.002	1	10/15/24 12:35	10/14/24	
Silver	6020B	**1.62**	mg/Kg	0.022	0.004	5	10/22/24 14:23	10/14/24	
Zinc	6020B	**102**	mg/Kg	0.54	0.22	5	10/22/24 14:23	10/14/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 10:30
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-8	**Basis:**	Dry
Lab Code:	K2410643-014		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.406**	mg/Kg	0.058	0.023	5	10/22/24 14:25	10/14/24	
Arsenic	6020B	**35.2**	mg/Kg	0.58	0.07	5	10/22/24 14:25	10/14/24	
Cadmium	6020B	**0.316**	mg/Kg	0.023	0.008	5	10/22/24 14:25	10/14/24	
Chromium	6020B	**9.13**	mg/Kg	0.23	0.07	5	10/22/24 14:25	10/14/24	
Lead	6020B	**10.7**	mg/Kg	0.058	0.023	5	10/22/24 14:25	10/14/24	
Mercury	7471B	**0.096**	mg/Kg	0.026	0.003	1	10/15/24 12:37	10/14/24	
Silver	6020B	**1.26**	mg/Kg	0.023	0.005	5	10/22/24 14:25	10/14/24	
Zinc	6020B	**103**	mg/Kg	0.58	0.23	5	10/22/24 14:25	10/14/24	

General Chemistry

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 14:05
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	TL-WRA-0.5-3	**Basis:**	As Received
Lab Code:	K2410643-001		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**95.0**	Percent	-	1	10/10/24 15:28	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 14:25
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	TL-WRB-0.5-4	**Basis:**	As Received
Lab Code:	K2410643-002		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**95.5**	Percent	-	1	10/10/24 15:28	

Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 14:00
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	TL-WRA-0.5-1-DS-2	**Basis:**	As Received
Lab Code:	K2410643-003		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**93.4**	Percent	-	1	10/10/24 15:28	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 10:05
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	SH-WRB-0.5-2	**Basis:**	As Received
Lab Code:	K2410643-004		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**94.1**	Percent	-	1	10/10/24 15:28	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 10:15
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	SH-WRC-0.5-1	**Basis:**	As Received
Lab Code:	K2410643-005		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**92.3**	Percent	-	1	10/10/24 15:28	

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 10:06
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-1	**Basis:**	As Received
Lab Code:	K2410643-006		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**34.2**	Percent	-	1	10/10/24 15:28	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 15:05
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-2	**Basis:**	As Received
Lab Code:	K2410643-007		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**76.9**	Percent	-	1	10/10/24 15:28	

Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 09:00
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-3	**Basis:**	As Received
Lab Code:	K2410643-008		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**69.1**	Percent	-	1	10/10/24 15:28	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 14:24
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-4	**Basis:**	As Received
Lab Code:	K2410643-009		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**64.9**	Percent	-	1	10/10/24 15:28	

Analytical Report

Client: Terraphase Engineering Inc.
Project: Upper Granite Creek Mines/0031.005.001
Sample Matrix: Soil

Service Request: K2410643
Date Collected: 10/04/24 09:30
Date Received: 10/08/24 11:45

Sample Name: CS-SD-5
Lab Code: K2410643-010

Basis: As Received

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**71.1**	Percent	-	1	10/10/24 15:28	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 15:21
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-6	**Basis:**	As Received
Lab Code:	K2410643-011		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**82.1**	Percent	-	1	10/10/24 15:28	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 13:35
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-7	**Basis:**	As Received
Lab Code:	K2410643-012		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**80.2**	Percent	-	1	10/10/24 15:28	

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 13:40
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-7-DUP	**Basis:**	As Received
Lab Code:	K2410643-013		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**73.2**	Percent	-	1	10/10/24 15:28	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 10:30
Sample Matrix:	Soil	**Date Received:**	10/08/24 11:45
Sample Name:	CS-SD-8	**Basis:**	As Received
Lab Code:	K2410643-014		

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	**69.0**	Percent	-	1	10/10/24 15:28	

QC Summary Forms

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1317 South 13th Avenue, Kelso, WA 98626
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Metals

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Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	Dry
Lab Code:	KQ2416426-03		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Mercury	7471B	ND U	mg/Kg	0.02	0.002	1	10/15/24 09:02	10/14/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	Dry
Lab Code:	KQ2416427-03		

Total Metals

Analyte Name	Analysis Method	Result		Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	ND	U	mg/Kg	0.05	0.020	5	10/22/24 14:55	10/14/24	
Arsenic	6020B	ND	U	mg/Kg	0.5	0.06	5	10/22/24 14:55	10/14/24	
Cadmium	6020B	ND	U	mg/Kg	0.020	0.007	5	10/22/24 14:55	10/14/24	
Chromium	6020B	**0.06**	**J**	mg/Kg	0.20	0.06	5	10/22/24 14:55	10/14/24	
Lead	6020B	**0.036**	**J**	mg/Kg	0.05	0.020	5	10/22/24 14:55	10/14/24	
Silver	6020B	ND	U	mg/Kg	0.020	0.004	5	10/22/24 14:55	10/14/24	
Zinc	6020B	**0.27**	**J**	mg/Kg	0.5	0.20	5	10/22/24 14:55	10/14/24	

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	Dry
Lab Code:	KQ2416652-01		

Total Metals – IVBA Analysis

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	ND U	mg/Kg	0.5	0.06	5	10/22/24 15:43	10/17/24	
Lead	6020B	**0.043 J**	mg/Kg	0.05	0.020	5	10/22/24 15:43	10/17/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	Dry
Lab Code:	KQ2416789-01		

IVBA Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	ND U	mg/Kg	0.5	0.06	5	10/17/24 10:57	10/16/24	
Lead	6020B	ND U	mg/Kg	0.05	0.020	5	10/17/24 10:57	10/16/24	

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24
Sample Matrix:	Soil	**Date Received:**	10/08/24
		Date Analyzed:	10/22/24
		Date Extracted:	10/14/24

Matrix Spike Summary
Total Metals

Sample Name:	TL-WRA-0.5-3	**Units:**	mg/Kg
Lab Code:	K2410643-001	**Basis:**	Dry
Analysis Method:	6020B		
Prep Method:	EPA 3050B		

Matrix Spike
KQ2416427-02

Analyte Name	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Antimony	1.54	23.7	85.7	26 N	75-125
Arsenic	454	510	85.7	65 #	75-125
Cadmium	12.3	20.7	8.57	97	75-125
Chromium	2.38	38.0	34.3	104	75-125
Lead	183	244	85.7	71 N	75-125
Silver	2.80	11.4	8.57	101	75-125
Zinc	517	610	85.7	108 #	75-125

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.

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QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24
Sample Matrix:	Soil	**Date Received:**	10/08/24
		Date Analyzed:	10/22/24

Replicate Sample Summary
Total Metals

Sample Name:	TL-WRA-0.5-3	**Units:**	mg/Kg
Lab Code:	K2410643-001	**Basis:**	Dry

Analyte Name	Analysis Method	MRL	MDL	Sample Result	Duplicate Sample KQ2416427-01 Result	Average	RPD	RPD Limit
Antimony	6020B	0.043	0.017	1.54	1.76	1.65	13	20
Arsenic	6020B	0.43	0.05	454	453	454	<1	20
Cadmium	6020B	0.017	0.006	12.3	12.1	12.2	2	20
Chromium	6020B	0.17	0.05	2.38	2.33	2.36	2	20
Lead	6020B	0.043	0.017	183	177	180	4	20
Silver	6020B	0.017	0.003	2.80	3.57	3.19	24 *	20
Zinc	6020B	0.43	0.17	517	510	514	1	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

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Superset Reference:24-0000711615 rev 00

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QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Analyzed:**	10/15/24
Sample Matrix:	Soil		

Lab Control Sample Summary
Total Metals

Units: mg/Kg
Basis: Dry

Lab Control Sample
KQ2416426-04

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Mercury	7471B	0.520	0.500	104	80-120

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QA/QC Report

Client: Terraphase Engineering Inc.
Project: Upper Granite Creek Mines/0031.005.001
Sample Matrix: Soil

Service Request: K2410643
Date Analyzed: 10/22/24

Lab Control Sample Summary
Total Metals

Units: mg/Kg
Basis: Dry

Lab Control Sample
KQ2416427-04

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Antimony	6020B	99.4	100	99	80-120
Arsenic	6020B	105	100	105	80-120
Cadmium	6020B	10.3	10.0	103	80-120
Chromium	6020B	42.3	40.0	106	80-120
Lead	6020B	108	100	108	80-120
Silver	6020B	10.5	10.0	105	80-120
Zinc	6020B	105	100	105	80-120

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QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project:	Upper Granite Creek Mines/0031.005.001	**Date Analyzed:**	10/22/24
Sample Matrix:	Soil		

Lab Control Sample Summary
Total Metals – IVBA Analysis

Units: mg/Kg
Basis: Dry

Lab Control Sample
KQ2416652-02

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Arsenic	6020B	108	100	108	80-120
Lead	6020B	111	100	111	80-120

Client: Terraphase Engineering Inc.
Project: Upper Granite Creek Mines/0031.005.001
Sample Matrix: Soil

Service Request: K2410643
Date Analyzed: 10/17/24

Lab Control Sample Summary
IVBA Metals

Units: mg/Kg
Basis: Dry

Lab Control Sample
KQ2416789-02

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Arsenic	6020B	92.9	100	93	80-120
Lead	6020B	105	100	105	80-120

General Chemistry

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Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24
Sample Matrix:	Soil	**Date Received:**	10/08/24
		Date Analyzed:	10/10/24

Replicate Sample Summary
Inorganic Parameters

Sample Name:	TL-WRA-0.5-3	**Units:**	Percent
Lab Code:	K2410643-001	**Basis:**	As Received

Analyte Name	Analysis Method	MRL	Sample Result	Duplicate Sample K2410643-001DUP Result	Average	RPD	RPD Limit
Solids, Total	160.3 Modified	-	95.0	94.6	94.8	<1	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

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QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410643
Project	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24
Sample Matrix:	Soil	**Date Received:**	10/08/24
		Date Analyzed:	10/10/24

Replicate Sample Summary
Inorganic Parameters

Sample Name:	CS-SD-8	**Units:**	Percent
Lab Code:	K2410643-014	**Basis:**	As Received

Analyte Name	Analysis Method	MRL	Sample Result	Duplicate Sample K2410643-014DUP Result	Average	RPD	RPD Limit
Solids, Total	160.3 Modified	-	69.0	69.5	69.3	<1	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

October 22, 2024 Service Request No:K2410651

Don Malkemus
Terraphase Engineering Inc.
610 SW Broadway, Suite 405
Portland, OR 97205

Laboratory Results for: Upper Granite Creek Mines

Dear Don,

Enclosed are the results of the sample(s) submitted to our laboratory October 08, 2024
For your reference, these analyses have been assigned our service request number **K2410651.**

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please contact me if you have any questions. My extension is 3376. You may also contact me via email at Mark.Harris@alsglobal.com.

Respectfully submitted,

ALS Group USA, Corp. dba ALS Environmental

Mark Harris
Project Manager

ADDRESS 1317 S. 13th Avenue, Kelso, WA 98626
PHONE +1 360 577 7222 | FAX +1 360 636 1068
ALS Group USA, Corp.
dba ALS Environmental

Narrative Documents

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
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Client: Terraphase Engineering Inc.
Project: Upper Granite Creek Mines
Sample Matrix: Water

Service Request: K2410651
Date Received: 10/08/2024

CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples for the Tier II level requested by the client.

Sample Receipt:

Twelve water samples were received for analysis at ALS Environmental on 10/08/2024. Any discrepancies upon initial sample inspection are annotated on the sample receipt and preservation form included within this report. The samples were stored at minimum in accordance with the analytical method requirements.

Metals:

No significant anomalies were noted with this analysis.

Approved by ____________________ Date 10/22/2024

SAMPLE DETECTION SUMMARY

This form includes only detections above the reporting levels. For a full listing of sample results, continue to the Sample Results section of this Report.

CLIENT ID: CS-SW-1			Lab ID: K2410651-004			
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Antimony	0.036	J	0.020	0.050	ug/L	6020B
Arsenic	0.36	J	0.09	0.50	ug/L	6020B
Calcium	5590		6	20	ug/L	6020B
Chromium	0.11	J	0.03	0.20	ug/L	6020B
Hardness, Total as CaCO3	18.1		0.023	0.09	mg/L	SM 2340 B
Lead	0.013	J	0.006	0.020	ug/L	6020B
Magnesium	996		2	10	ug/L	6020B

CLIENT ID: CS-SW-2			Lab ID: K2410651-005			
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Antimony	0.025	J	0.020	0.050	ug/L	6020B
Arsenic	0.67		0.09	0.50	ug/L	6020B
Calcium	6070		6	20	ug/L	6020B
Chromium	0.11	J	0.03	0.20	ug/L	6020B
Hardness, Total as CaCO3	19.7		0.023	0.09	mg/L	SM 2340 B
Lead	0.012	J	0.006	0.020	ug/L	6020B
Magnesium	1110		2	10	ug/L	6020B

CLIENT ID: CS-SW-2-Dup			Lab ID: K2410651-006			
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Antimony	0.031	J	0.020	0.050	ug/L	6020B
Arsenic	0.61		0.09	0.50	ug/L	6020B
Calcium	5920		6	20	ug/L	6020B
Chromium	0.11	J	0.03	0.20	ug/L	6020B
Hardness, Total as CaCO3	19.3		0.023	0.09	mg/L	SM 2340 B
Lead	0.007	J	0.006	0.020	ug/L	6020B
Magnesium	1090		2	10	ug/L	6020B

CLIENT ID: CS-SW-3			Lab ID: K2410651-007			
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Antimony	0.038	J	0.020	0.050	ug/L	6020B
Arsenic	0.87		0.09	0.50	ug/L	6020B
Calcium	6490		6	20	ug/L	6020B
Chromium	0.12	J	0.03	0.20	ug/L	6020B
Hardness, Total as CaCO3	21.0		0.023	0.09	mg/L	SM 2340 B
Lead	0.012	J	0.006	0.020	ug/L	6020B
Magnesium	1170		2	10	ug/L	6020B

CLIENT ID: CS-SW-4			Lab ID: K2410651-008			
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Antimony	0.036	J	0.020	0.050	ug/L	6020B
Arsenic	0.92		0.09	0.50	ug/L	6020B

SAMPLE DETECTION SUMMARY

This form includes only detections above the reporting levels. For a full listing of sample results, continue to the Sample Results section of this Report.

CLIENT ID: CS-SW-4 — **Lab ID: K2410651-008**

Analyte	Results	Flag	MDL	MRL	Units	Method
Calcium	8410		6	20	ug/L	6020B
Chromium	0.14	J	0.03	0.20	ug/L	6020B
Hardness, Total as CaCO3	27.5		0.023	0.09	mg/L	SM 2340 B
Magnesium	1590		2	10	ug/L	6020B

CLIENT ID: CS-SW-5 — **Lab ID: K2410651-009**

Analyte	Results	Flag	MDL	MRL	Units	Method
Antimony	0.098		0.020	0.050	ug/L	6020B
Arsenic	1.78		0.09	0.50	ug/L	6020B
Cadmium	0.010	J	0.008	0.020	ug/L	6020B
Calcium	9550		6	20	ug/L	6020B
Chromium	0.11	J	0.03	0.20	ug/L	6020B
Hardness, Total as CaCO3	31.8		0.023	0.09	mg/L	SM 2340 B
Lead	0.018	J	0.006	0.020	ug/L	6020B
Magnesium	1930		2	10	ug/L	6020B
Zinc	1.8	J	0.5	2.0	ug/L	6020B

CLIENT ID: CS-SW-6 — **Lab ID: K2410651-010**

Analyte	Results	Flag	MDL	MRL	Units	Method
Antimony	0.076		0.020	0.050	ug/L	6020B
Arsenic	2.04		0.09	0.50	ug/L	6020B
Calcium	9710		6	20	ug/L	6020B
Chromium	0.11	J	0.03	0.20	ug/L	6020B
Hardness, Total as CaCO3	32.3		0.023	0.09	mg/L	SM 2340 B
Lead	0.013	J	0.006	0.020	ug/L	6020B
Magnesium	1960		2	10	ug/L	6020B
Zinc	0.7	J	0.5	2.0	ug/L	6020B

CLIENT ID: CS-SW-7 — **Lab ID: K2410651-011**

Analyte	Results	Flag	MDL	MRL	Units	Method
Antimony	0.104		0.020	0.050	ug/L	6020B
Arsenic	1.99		0.09	0.50	ug/L	6020B
Cadmium	0.019	J	0.008	0.020	ug/L	6020B
Calcium	10900		6	20	ug/L	6020B
Chromium	0.09	J	0.03	0.20	ug/L	6020B
Hardness, Total as CaCO3	36.3		0.023	0.09	mg/L	SM 2340 B
Lead	0.022		0.006	0.020	ug/L	6020B
Magnesium	2200		2	10	ug/L	6020B
Zinc	0.8	J	0.5	2.0	ug/L	6020B

SAMPLE DETECTION SUMMARY

This form includes only detections above the reporting levels. For a full listing of sample results, continue to the Sample Results section of this Report.

CLIENT ID: CS-SW-8			Lab ID: K2410651-012			
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Antimony	0.108		0.020	0.050	ug/L	6020B
Arsenic	2.21		0.09	0.50	ug/L	6020B
Cadmium	0.020	J	0.008	0.020	ug/L	6020B
Calcium	10900		6	20	ug/L	6020B
Chromium	0.11	J	0.03	0.20	ug/L	6020B
Hardness, Total as CaCO3	36.7		0.023	0.09	mg/L	SM 2340 B
Lead	0.084		0.006	0.020	ug/L	6020B
Magnesium	2310		2	10	ug/L	6020B
Zinc	0.8	J	0.5	2.0	ug/L	6020B

CLIENT ID: EB-2024 1003			Lab ID: K2410651-001			
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Arsenic	0.64		0.09	0.50	ug/L	6020B

CLIENT ID: EB-2024 1004			Lab ID: K2410651-002			
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Arsenic	3.12		0.09	0.50	ug/L	6020B

CLIENT ID: EB-2024 1005			Lab ID: K2410651-003			
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Arsenic	0.11	J	0.09	0.50	ug/L	6020B

Sample Receipt Information

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

Client: Terraphase Engineering Inc. **Service Request:** K2410651
Project: Upper Granite Creek Mines/0031.005.001

SAMPLE CROSS-REFERENCE

SAMPLE #	CLIENT SAMPLE ID	DATE	TIME
K2410651-001	EB-2024 1003	10/5/2024	0830
K2410651-002	EB-2024 1004	10/4/2024	0800
K2410651-003	EB-2024 1005	10/5/2024	0830
K2410651-004	CS-SW-1	10/5/2024	1004
K2410651-005	CS-SW-2	10/3/2024	1700
K2410651-006	CS-SW-2-Dup	10/3/2024	1701
K2410651-007	CS-SW-3	10/3/2024	1600
K2410651-008	CS-SW-4	10/3/2024	1419
K2410651-009	CS-SW-5	10/4/2024	0925
K2410651-010	CS-SW-6	10/4/2024	1523
K2410651-011	CS-SW-7	10/4/2024	1334
K2410651-012	CS-SW-8	10/5/2024	1035

ALS

140510

CHAIN OF CUSTODY

140510

001, 002, 003

SR# K2410651

COC Set 2 of 8

COC#

1317 South 13th Ave, Kelso, WA 98626 Phone (360) 577-7222 / 800-695-7222 / FAX (360) 636-1068
www.alsglobal.com

Project Name: Upper Bank Creek Mines | Project Number: 0831.005.001

Project Manager: Dan Malkemus

Company: Terraphase Engineering Inc.

Address, City, State: 610 SW Broadway Suite 405

Phone # (503) 948-0384 | email: dan.malkemus@terraphase.com

Sampler Signature: [signature] | Sampler Printed Name: Dan Malkemus

CLIENT SAMPLE ID	LABID	SAMPLING Date	Time	State	Matrix	NUMBER OF CONTAINERS	28D 7470A / Hg T	28D 7471B / Hg	180D 6020B / IVBA (Sieved Total)	180D 6020B / IVBA Extract	180D 6020B / Metals T	999D Grind / GrindSub	999D SM 2340 B / Hardness Calc	1	2	3	4	5	Remarks
EB-20241003		10/5	0830		H_2O	1					X								
EB-20241004		10/4	0800		H_2O	1					X								
EB-20241005		10/5	0830		H_2O	1					X								
UMM-WRB-0.5-4		10/2	1335		Soil	2													+ bag HOLD
UMM-WRB-0.5-2		10/2	1320		Soil	2					X								~~HOLD~~
UMM-WRB-0.5-2		10/3	1045		Soil	2													+ bag HOLD
UMM-WRB-0.5-2-DS		10/2	1325		Soil	2					X								+ bag
UMM-WRB-0.5-1		10/3	1035		Soil	2					X								+ bag ~~HOLD~~
UMM-WRB-0.5-3		10/3	1055		Soil	2													+ bag HOLD
UMM-WRB-0.5-1-DUP		10/3	1036		Soil	2					X								

Report Requirements

I. Routine Report: Method Blank, Surrogate, as required

II. Report Dup., MS, MSD as required

III. CLP Like Summary (no raw data)

IV. Data Validation Report

V. EDD

Invoice Information

P.O.#

Bill To: ap@terraphase.com

Turnaround Requirements

___ 24 hr. ___ 48 hr.

___ 5 Day

X Standard

Requested Report Date

Circle which metals are to be analyzed

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Special Instructions/Comments:

*Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other____(Circle One)

Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature [signature]	Signature [signature]	Signature [signature]	Signature Naomi Pedersen	Signature	Signature
Printed Name Dan Malkemus	Printed Name Franklin LaBiche	Printed Name Franklin LaBiche	Printed Name ALS	Printed Name	Printed Name
Firm TEI	Firm ALS	Firm ALS	Firm 10/8/24 1445	Firm	Firm
Date/Time 10/8 1300	Date/Time 10/08/24 1306	Date/Time 10/08/24 1445	Date/Time	Date/Time	Date/Time

ALS

140510

CHAIN OF CUSTODY

140510

001, 002, 003

SR# 1241065

COC Set 7 of 8

COC#

1317 South 13th Ave, Kelso, WA 98626 Phone (360) 577-7222 / 800-695-7222 / FAX (360) 636-1068
www.alsglobal.com

Project Name: Upper Granite Creek Mines | Project Number: 0031.005.001
Project Manager: Don Malkemus
Company: Terraphase Engineering Inc.
Address, City, State: 610 SW Broadway Suite 405
Phone #: (503) 943-0384 | email: don.malkemus@terraphase.com
Sampler Signature: [signature] | Sampler Printed Name: Don Malkemus

CLIENT SAMPLE ID	LABID	SAMPLING Date	Time	State	Matrix	NUMBER OF CONTAINERS	28D 7470A / Hg T	7471B / Hg	180D 6020B / IVBA (Sieved Total)	6020B / IVBA Extract	6020B / Metals T	999D Grind / GrindSub	SM 2340 B / Hardness Calc	1	2	3	4	5	Remarks
CS-SW-1		10/5	~~1035~~ 1004		H_2O	1	X				X		X						
CS-SW-2		10/3	1700		H_2O	1	X				X		X						
CS-SW-2-DUP		10/3	1701		H_2O	1	X				X		X						
CS-SW-3		10/3	1600		H_2O	1	X				X		X						
CS-SW-4		10/3	1419		H_2O	1	X				X		X						
CS-SW-5		10/4	0925		H_2O	1	X				X		X						
CS-SW-6		10/4	1523		H_2O	1	X				X		X						
CS-SW-7		10/4	1334		H_2O	1	X				X		X						
CS-SW-8		10/5	1035		H_2O	1	X				X		X						

Report Requirements

- I. Routine Report: Method Blank, Surrogate, as required
- II. Report Dup., MS, MSD as required
- III. CLP Like Summary (no raw data)
- IV. Data Validation Report
- V. EDD

Invoice Information

P.O.#
Bill To: ap@terraphase.com

Turnaround Requirements

___ 24 hr. ___ 48 hr.
___ 5 Day
X Standard

Requested Report Date

Circle which metals are to be analyzed

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Special Instructions/Comments:

*Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other____ (Circle One)

	Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature	[signature]	[signature]	[signature]	Naomi Pedersen		
Printed Name	Don Malkemus	Franklin LaBiche	Franklin LaBiche	ALS		
Firm	TEI	ALS	ALS	10/8/24 1445		
Date/Time	10/8 1306	10/08/24 1306	10/08/24 1445			

PM Mack

Cooler Receipt and Preservation Form

Client Terraphase Service Request K24 10651

Received: 10/8/24 Opened: 10/8/24 By: AP Unloaded: 10/8/24 By: AP

1. Samples were received via? *USPS* *Fed Ex* *UPS* *DHL* *PDX* ***Courier*** *Hand Delivered*
2. Samples were received in: (circle) ***Cooler*** *Box* *Envelope* *Other* ________ *NA*
3. Were custody seals on coolers? NA Y **N** If yes, how many and where? ________
   If present, were custody seals intact? Y N If present, were they signed and dated? Y N

Temp Blank	Sample Temp	IR Gun	Cooler #/COC ID / NA	Out of temp indicate with "X"	PM Notified If out of temp	Tracking Number NA	Filed
9.6	4.6	1801	140510				
16.8	5.7						
16.0	4.4						
9.4	4.5						
18.3	4.5						

4. Was a Temperature Blank present in cooler? NA **Y** N If yes, notate the temperature in the appropriate column above:
   If no, take the temperature of a representative sample bottle contained within the cooler; notate in the column "Sample Temp":
5. Were samples received within the method specified temperature ranges? NA **Y** N
   If no, were they received on ice and same day as collected? If not, notate the cooler # above and notify the PM. **NA** Y N
   If applicable, tissue samples were received: *Frozen* *Partially Thawed* *Thawed*
6. Packing material: *Inserts* ***Baggies*** *Bubble Wrap* *Gel Packs* ***Wet Ice*** *Dry Ice* *Sleeves* ________
7. Were custody papers properly filled out (ink, signed, etc.)? NA **Y** N
8. Were samples received in good condition (unbroken) NA **Y** N
9. Were all sample labels complete (ie, analysis, preservation, etc.)? NA **Y** N
10. Did all sample labels and tags agree with custody papers? NA **Y** N
11. Were appropriate bottles/containers and volumes received for the tests indicated? NA **Y** N
12. Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* NA **Y** N
13. Were VOA vials received without headspace? *Indicate in the table below.* **NA** Y N
14. Was C12/Res negative? **NA** Y N
15. Were samples received within the method specified time limit? If not, notate the error below and notify the PM **NA** Y N
16. Were 100ml sterile microbiology bottles filled exactly to the 100ml mark? **NA** Y N Underfilled Overfilled

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count Bottle Type	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies, Resolutions: ________

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Cooler Receipt and Preservation Form

Client Terraphase Service Request *K24*

Temp Blank	Sample Temp	IR Gun	Cooler #/COC ID / NA	Out of temp indicate with "X"	PM Notified If out of temp	Tracking Number NA	Filed
~~8.~~ 7.8	3.8	IR01					
12.2	5.5	↓					

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count Bottle Type	Out of Temp	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies & Resolutions: Ice was at top of coolers on top of samples. Temp blank was under the samples, not indicative of sample temp

Miscellaneous Forms

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

Inorganic Data Qualifiers

- * The result is an outlier. See case narrative.
- # The control limit criteria is not applicable.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
- E The result is an estimate amount because the value exceeded the instrument calibration range.
- J The result is an estimated value.
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
  DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
- X See case narrative.
- Q See case narrative. One or more quality control criteria was outside the limits.
- H The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

- # The control limit criteria is not applicable.
- J The result is an estimated value.
- E The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
- M The duplicate injection precision was not met.
- N The Matrix Spike sample recovery is not within control limits. See case narrative.
- S The reported value was determined by the Method of Standard Additions (MSA).
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
  DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- W The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
- i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
- X See case narrative.
- + The correlation coefficient for the MSA is less than 0.995.
- Q See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

- * The result is an outlier. See case narrative.
- # The control limit criteria is not applicable. See case narrative.
- A A tentatively identified compound, a suspected aldol-condensation product.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
- C The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
- D The reported result is from a dilution.
- E The result is an estimated value over the calibration range.
- J The result is an estimated value between the MDL and the MRL.
- N The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
- P The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
  DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- i The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
- X See case narrative.
- Q See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

- F The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
- L The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
- H The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
- O The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
- Y The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
- Z The chromatographic fingerprint does not resemble a petroleum product.

ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso
State Certifications, Accreditations, and Licenses

Agency	Web Site	Number
Alaska DEH	http://dec.alaska.gov/eh/lab/cs/csapproval.htm	UST-040
Arizona DHS	http://www.azdhs.gov/lab/license/env.htm	AZ0339
Arkansas - DEQ	http://www.adeq.state.ar.us/techsvs/labcert.htm	88-0637
California DHS (ELAP)	http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx	2795
DOD ELAP	http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm	L16-58-R4
Florida DOH	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E87412
Hawaii DOH	http://health.hawaii.gov/	-
ISO 17025	http://www.pjlabs.com/	L16-57
Louisiana DEQ	http://www.deq.louisiana.gov/page/la-lab-accreditation	03016
Maine DHS	http://www.maine.gov/dhhs/	WA01276
Minnesota DOH	http://www.health.state.mn.us/accreditation	053-999-457
Nevada DEP	http://ndep.nv.gov/bsdw/labservice.htm	WA01276
New Jersey DEP	http://www.nj.gov/dep/enforcement/oqa.html	WA005
New York - DOH	https://www.wadsworth.org/regulatory/elap	12060
North Carolina DEQ	https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/laboratory-certification-branch/non-field-lab-certification	605
Oklahoma DEQ	http://www.deq.state.ok.us/CSDnew/labcert.htm	9801
Oregon – DEQ (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	WA100010
South Carolina DHEC	http://www.scdhec.gov/environment/EnvironmentalLabCertification/	61002
Texas CEQ	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704427
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C544
Wyoming (EPA Region 8)	https://www.epa.gov/region8-waterops/epa-region-8-certified-drinking-water-	-
Kelso Laboratory Website	www.alsglobal.com	NA

Analyses were performed according to our laboratory’s NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.ALSGlobal.com or at the accreditation bodies web site.
Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/anlayte is offered by that state.

Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LOD	Limit of Detection
LOQ	Limit of Quantitation
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

Analyst Summary report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001		

Sample Name:	EB-2024 1003	**Date Collected:**	10/5/24
Lab Code:	K2410651-001	**Date Received:**	10/8/24
Sample Matrix:	Water		

Analysis Method	Extracted/Digested By	Analyzed By
6020B	MCHATTICK	ABOYER

Sample Name:	EB-2024 1004	**Date Collected:**	10/4/24
Lab Code:	K2410651-002	**Date Received:**	10/8/24
Sample Matrix:	Water		

Analysis Method	Extracted/Digested By	Analyzed By
6020B	MCHATTICK	ABOYER

Sample Name:	EB-2024 1005	**Date Collected:**	10/5/24
Lab Code:	K2410651-003	**Date Received:**	10/8/24
Sample Matrix:	Water		

Analysis Method	Extracted/Digested By	Analyzed By
6020B	MCHATTICK	ABOYER

Sample Name:	CS-SW-1	**Date Collected:**	10/5/24
Lab Code:	K2410651-004	**Date Received:**	10/8/24
Sample Matrix:	Water		

Analysis Method	Extracted/Digested By	Analyzed By
6020B	MCHATTICK	ABOYER
7470A	KLINN	KLINN

Client: Terraphase Engineering Inc. **Service Request:** K2410651
Project: Upper Granite Creek Mines/0031.005.001

Sample Name: CS-SW-2 **Date Collected:** 10/3/24
Lab Code: K2410651-005 **Date Received:** 10/8/24
Sample Matrix: Water

Analysis Method	**Extracted/Digested By**	**Analyzed By**
6020B	MCHATTICK	ABOYER
7470A	KLINN	KLINN

Sample Name: CS-SW-2-Dup **Date Collected:** 10/3/24
Lab Code: K2410651-006 **Date Received:** 10/8/24
Sample Matrix: Water

Analysis Method	**Extracted/Digested By**	**Analyzed By**
6020B	MCHATTICK	ABOYER
7470A	KLINN	KLINN

Sample Name: CS-SW-3 **Date Collected:** 10/3/24
Lab Code: K2410651-007 **Date Received:** 10/8/24
Sample Matrix: Water

Analysis Method	**Extracted/Digested By**	**Analyzed By**
6020B	MCHATTICK	ABOYER
7470A	KLINN	KLINN

Sample Name: CS-SW-4 **Date Collected:** 10/3/24
Lab Code: K2410651-008 **Date Received:** 10/8/24
Sample Matrix: Water

Analysis Method	**Extracted/Digested By**	**Analyzed By**
6020B	MCHATTICK	ABOYER
7470A	KLINN	KLINN

ALS Group USA, Corp.
dba ALS Environmental

Analyst Summary report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001		

Sample Name:	CS-SW-5	**Date Collected:**	10/4/24
Lab Code:	K2410651-009	**Date Received:**	10/8/24
Sample Matrix:	Water		

Analysis Method	Extracted/Digested By	Analyzed By
6020B	MCHATTICK	ABOYER
7470A	KLINN	KLINN

Sample Name:	CS-SW-6	**Date Collected:**	10/4/24
Lab Code:	K2410651-010	**Date Received:**	10/8/24
Sample Matrix:	Water		

Analysis Method	Extracted/Digested By	Analyzed By
6020B	MCHATTICK	ABOYER
7470A	KLINN	KLINN

Sample Name:	CS-SW-7	**Date Collected:**	10/4/24
Lab Code:	K2410651-011	**Date Received:**	10/8/24
Sample Matrix:	Water		

Analysis Method	Extracted/Digested By	Analyzed By
6020B	MCHATTICK	ABOYER
7470A	KLINN	KLINN

Sample Name:	CS-SW-8	**Date Collected:**	10/5/24
Lab Code:	K2410651-012	**Date Received:**	10/8/24
Sample Matrix:	Water		

Analysis Method	Extracted/Digested By	Analyzed By
6020B	MCHATTICK	ABOYER
7470A	KLINN	KLINN

Sample Results

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

Metals

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 08:30
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	EB-2024 1003	**Basis:**	NA
Lab Code:	K2410651-001		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**0.64**	ug/L	0.50	0.09	1	10/21/24 16:32	10/18/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 08:00
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	EB-2024 1004	**Basis:**	NA
Lab Code:	K2410651-002		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**3.12**	ug/L	0.50	0.09	1	10/21/24 16:34	10/18/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 08:30
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	EB-2024 1005	**Basis:**	NA
Lab Code:	K2410651-003		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	6020B	**0.11 J**	ug/L	0.50	0.09	1	10/21/24 16:36	10/18/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 10:04
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-1	**Basis:**	NA
Lab Code:	K2410651-004		

Hardness by ICP-AES Calculation 20th Ed.

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Q
Hardness, Total as $CaCO_3$	SM 2340 B	**18.1**	mg/L	0.09	0.023	1	10/21/24 16:39	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 10:04
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-1	**Basis:**	NA
Lab Code:	K2410651-004		

Total Metals

Analyte Name	Analysis Method	Result		Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.036**	**J**	ug/L	0.050	0.020	1	10/21/24 16:39	10/18/24	
Arsenic	6020B	**0.36**	**J**	ug/L	0.50	0.09	1	10/21/24 16:39	10/18/24	
Cadmium	6020B	ND	U	ug/L	0.020	0.008	1	10/21/24 16:39	10/18/24	
Calcium	6020B	**5590**		ug/L	20	6	1	10/21/24 16:39	10/18/24	
Chromium	6020B	**0.11**	**J**	ug/L	0.20	0.03	1	10/21/24 16:39	10/18/24	
Lead	6020B	**0.013**	**J**	ug/L	0.020	0.006	1	10/21/24 16:39	10/18/24	
Magnesium	6020B	**996**		ug/L	10	2	1	10/21/24 16:39	10/18/24	
Mercury	7470A	ND	U	ug/L	0.20	0.02	1	10/15/24 09:17	10/14/24	
Silver	6020B	ND	U	ug/L	0.020	0.009	1	10/21/24 16:39	10/18/24	
Zinc	6020B	ND	U	ug/L	2.0	0.5	1	10/21/24 16:39	10/18/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 17:00
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-2	**Basis:**	NA
Lab Code:	K2410651-005		

Hardness by ICP-AES Calculation 20th Ed.

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Q
Hardness, Total as CaCO3	SM 2340 B	**19.7**	mg/L	0.09	0.023	1	10/21/24 16:53	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 17:00
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-2	**Basis:**	NA
Lab Code:	K2410651-005		

Total Metals

Analyte Name	Analysis Method	Result		Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.025**	**J**	ug/L	0.050	0.020	1	10/21/24 16:53	10/18/24	
Arsenic	6020B	**0.67**		ug/L	0.50	0.09	1	10/21/24 16:53	10/18/24	
Cadmium	6020B	ND	U	ug/L	0.020	0.008	1	10/21/24 16:53	10/18/24	
Calcium	6020B	**6070**		ug/L	20	6	1	10/21/24 16:53	10/18/24	
Chromium	6020B	**0.11**	**J**	ug/L	0.20	0.03	1	10/21/24 16:53	10/18/24	
Lead	6020B	**0.012**	**J**	ug/L	0.020	0.006	1	10/21/24 16:53	10/18/24	
Magnesium	6020B	**1110**		ug/L	10	2	1	10/21/24 16:53	10/18/24	
Mercury	7470A	ND	U	ug/L	0.20	0.02	1	10/15/24 09:22	10/14/24	
Silver	6020B	ND	U	ug/L	0.020	0.009	1	10/21/24 16:53	10/18/24	
Zinc	6020B	ND	U	ug/L	2.0	0.5	1	10/21/24 16:53	10/18/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 17:01
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-2-Dup	**Basis:**	NA
Lab Code:	K2410651-006		

Hardness by ICP-AES Calculation 20th Ed.

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Q
Hardness, Total as CaCO3	SM 2340 B	**19.3**	mg/L	0.09	0.023	1	10/21/24 16:55	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 17:01
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-2-Dup	**Basis:**	NA
Lab Code:	K2410651-006		

Total Metals

Analyte Name	Analysis Method	Result		Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.031**	**J**	ug/L	0.050	0.020	1	10/21/24 16:55	10/18/24	
Arsenic	6020B	**0.61**		ug/L	0.50	0.09	1	10/21/24 16:55	10/18/24	
Cadmium	6020B	ND	U	ug/L	0.020	0.008	1	10/21/24 16:55	10/18/24	
Calcium	6020B	**5920**		ug/L	20	6	1	10/21/24 16:55	10/18/24	
Chromium	6020B	**0.11**	**J**	ug/L	0.20	0.03	1	10/21/24 16:55	10/18/24	
Lead	6020B	**0.007**	**J**	ug/L	0.020	0.006	1	10/21/24 16:55	10/18/24	
Magnesium	6020B	**1090**		ug/L	10	2	1	10/21/24 16:55	10/18/24	
Mercury	7470A	ND	U	ug/L	0.20	0.02	1	10/15/24 09:23	10/14/24	
Silver	6020B	ND	U	ug/L	0.020	0.009	1	10/21/24 16:55	10/18/24	
Zinc	6020B	ND	U	ug/L	2.0	0.5	1	10/21/24 16:55	10/18/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 16:00
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-3	**Basis:**	NA
Lab Code:	K2410651-007		

Hardness by ICP-AES Calculation 20th Ed.

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Q
Hardness, Total as CaCO3	SM 2340 B	**21.0**	mg/L	0.09	0.023	1	10/21/24 16:57	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 16:00
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-3	**Basis:**	NA
Lab Code:	K2410651-007		

Total Metals

Analyte Name	Analysis Method	Result		Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.038**	**J**	ug/L	0.050	0.020	1	10/21/24 16:57	10/18/24	
Arsenic	6020B	**0.87**		ug/L	0.50	0.09	1	10/21/24 16:57	10/18/24	
Cadmium	6020B	ND	U	ug/L	0.020	0.008	1	10/21/24 16:57	10/18/24	
Calcium	6020B	**6490**		ug/L	20	6	1	10/21/24 16:57	10/18/24	
Chromium	6020B	**0.12**	**J**	ug/L	0.20	0.03	1	10/21/24 16:57	10/18/24	
Lead	6020B	**0.012**	**J**	ug/L	0.020	0.006	1	10/21/24 16:57	10/18/24	
Magnesium	6020B	**1170**		ug/L	10	2	1	10/21/24 16:57	10/18/24	
Mercury	7470A	ND	U	ug/L	0.20	0.02	1	10/15/24 09:25	10/14/24	
Silver	6020B	ND	U	ug/L	0.020	0.009	1	10/21/24 16:57	10/18/24	
Zinc	6020B	ND	U	ug/L	2.0	0.5	1	10/21/24 16:57	10/18/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 14:19
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-4	**Basis:**	NA
Lab Code:	K2410651-008		

Hardness by ICP-AES Calculation 20th Ed.

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Q
Hardness, Total as CaCO3	SM 2340 B	**27.5**	mg/L	0.09	0.023	1	10/21/24 16:59	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/03/24 14:19
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-4	**Basis:**	NA
Lab Code:	K2410651-008		

Total Metals

Analyte Name	Analysis Method	Result		Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.036**	**J**	ug/L	0.050	0.020	1	10/21/24 16:59	10/18/24	
Arsenic	6020B	**0.92**		ug/L	0.50	0.09	1	10/21/24 16:59	10/18/24	
Cadmium	6020B	ND	U	ug/L	0.020	0.008	1	10/21/24 16:59	10/18/24	
Calcium	6020B	**8410**		ug/L	20	6	1	10/21/24 16:59	10/18/24	
Chromium	6020B	**0.14**	**J**	ug/L	0.20	0.03	1	10/21/24 16:59	10/18/24	
Lead	6020B	ND	U	ug/L	0.020	0.006	1	10/21/24 16:59	10/18/24	
Magnesium	6020B	**1590**		ug/L	10	2	1	10/21/24 16:59	10/18/24	
Mercury	7470A	ND	U	ug/L	0.20	0.02	1	10/15/24 09:27	10/14/24	
Silver	6020B	ND	U	ug/L	0.020	0.009	1	10/21/24 16:59	10/18/24	
Zinc	6020B	ND	U	ug/L	2.0	0.5	1	10/21/24 16:59	10/18/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 09:25
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-5	**Basis:**	NA
Lab Code:	K2410651-009		

Hardness by ICP-AES Calculation 20th Ed.

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Q
Hardness, Total as CaCO3	SM 2340 B	**31.8**	mg/L	0.09	0.023	1	10/21/24 17:01	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 09:25
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-5	**Basis:**	NA
Lab Code:	K2410651-009		

Total Metals

Analyte Name	Analysis Method	Result		Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.098**		ug/L	0.050	0.020	1	10/21/24 17:01	10/18/24	
Arsenic	6020B	**1.78**		ug/L	0.50	0.09	1	10/21/24 17:01	10/18/24	
Cadmium	6020B	**0.010**	**J**	ug/L	0.020	0.008	1	10/21/24 17:01	10/18/24	
Calcium	6020B	**9550**		ug/L	20	6	1	10/21/24 17:01	10/18/24	
Chromium	6020B	**0.11**	**J**	ug/L	0.20	0.03	1	10/21/24 17:01	10/18/24	
Lead	6020B	**0.018**	**J**	ug/L	0.020	0.006	1	10/21/24 17:01	10/18/24	
Magnesium	6020B	**1930**		ug/L	10	2	1	10/21/24 17:01	10/18/24	
Mercury	7470A	ND	U	ug/L	0.20	0.02	1	10/15/24 09:28	10/14/24	
Silver	6020B	ND	U	ug/L	0.020	0.009	1	10/21/24 17:01	10/18/24	
Zinc	6020B	**1.8**	**J**	ug/L	2.0	0.5	1	10/21/24 17:01	10/18/24	

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 15:23
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-6	**Basis:**	NA
Lab Code:	K2410651-010		

Hardness by ICP-AES Calculation 20th Ed.

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Q
Hardness, Total as CaCO3	SM 2340 B	**32.3**	mg/L	0.09	0.023	1	10/21/24 17:03	

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 15:23
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-6	**Basis:**	NA
Lab Code:	K2410651-010		

Total Metals

Analyte Name	Analysis Method	Result		Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.076**		ug/L	0.050	0.020	1	10/21/24 17:03	10/18/24	
Arsenic	6020B	**2.04**		ug/L	0.50	0.09	1	10/21/24 17:03	10/18/24	
Cadmium	6020B	ND	U	ug/L	0.020	0.008	1	10/21/24 17:03	10/18/24	
Calcium	6020B	**9710**		ug/L	20	6	1	10/21/24 17:03	10/18/24	
Chromium	6020B	**0.11**	**J**	ug/L	0.20	0.03	1	10/21/24 17:03	10/18/24	
Lead	6020B	**0.013**	**J**	ug/L	0.020	0.006	1	10/21/24 17:03	10/18/24	
Magnesium	6020B	**1960**		ug/L	10	2	1	10/21/24 17:03	10/18/24	
Mercury	7470A	ND	U	ug/L	0.20	0.02	1	10/15/24 09:33	10/14/24	
Silver	6020B	ND	U	ug/L	0.020	0.009	1	10/21/24 17:03	10/18/24	
Zinc	6020B	**0.7**	**J**	ug/L	2.0	0.5	1	10/21/24 17:03	10/18/24	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 13:34
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-7	**Basis:**	NA
Lab Code:	K2410651-011		

Hardness by ICP-AES Calculation 20th Ed.

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Q
Hardness, Total as CaCO3	SM 2340 B	**36.3**	mg/L	0.09	0.023	1	10/21/24 17:05	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/04/24 13:34
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-7	**Basis:**	NA
Lab Code:	K2410651-011		

Total Metals

Analyte Name	Analysis Method	Result		Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.104**		ug/L	0.050	0.020	1	10/21/24 17:05	10/18/24	
Arsenic	6020B	**1.99**		ug/L	0.50	0.09	1	10/21/24 17:05	10/18/24	
Cadmium	6020B	**0.019**	**J**	ug/L	0.020	0.008	1	10/21/24 17:05	10/18/24	
Calcium	6020B	**10900**		ug/L	20	6	1	10/21/24 17:05	10/18/24	
Chromium	6020B	**0.09**	**J**	ug/L	0.20	0.03	1	10/21/24 17:05	10/18/24	
Lead	6020B	**0.022**		ug/L	0.020	0.006	1	10/21/24 17:05	10/18/24	
Magnesium	6020B	**2200**		ug/L	10	2	1	10/21/24 17:05	10/18/24	
Mercury	7470A	ND	U	ug/L	0.20	0.02	1	10/15/24 09:35	10/14/24	
Silver	6020B	ND	U	ug/L	0.020	0.009	1	10/21/24 17:05	10/18/24	
Zinc	6020B	**0.8**	**J**	ug/L	2.0	0.5	1	10/21/24 17:05	10/18/24	

Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 10:35
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-8	**Basis:**	NA
Lab Code:	K2410651-012		

Hardness by ICP-AES Calculation 20th Ed.

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Q
Hardness, Total as CaCO3	SM 2340 B	**36.7**	mg/L	0.09	0.023	1	10/21/24 17:07	

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Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24 10:35
Sample Matrix:	Water	**Date Received:**	10/08/24 14:45
Sample Name:	CS-SW-8	**Basis:**	NA
Lab Code:	K2410651-012		

Total Metals

Analyte Name	Analysis Method	Result		Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	**0.108**		ug/L	0.050	0.020	1	10/21/24 17:07	10/18/24	
Arsenic	6020B	**2.21**		ug/L	0.50	0.09	1	10/21/24 17:07	10/18/24	
Cadmium	6020B	**0.020**	**J**	ug/L	0.020	0.008	1	10/21/24 17:07	10/18/24	
Calcium	6020B	**10900**		ug/L	20	6	1	10/21/24 17:07	10/18/24	
Chromium	6020B	**0.11**	**J**	ug/L	0.20	0.03	1	10/21/24 17:07	10/18/24	
Lead	6020B	**0.084**		ug/L	0.020	0.006	1	10/21/24 17:07	10/18/24	
Magnesium	6020B	**2310**		ug/L	10	2	1	10/21/24 17:07	10/18/24	
Mercury	7470A	ND	U	ug/L	0.20	0.02	1	10/15/24 09:36	10/14/24	
Silver	6020B	ND	U	ug/L	0.020	0.009	1	10/21/24 17:07	10/18/24	
Zinc	6020B	**0.8**	**J**	ug/L	2.0	0.5	1	10/21/24 17:07	10/18/24	

QC Summary Forms

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

Metals

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	NA
Sample Matrix:	Water	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	NA
Lab Code:	KQ2416479-01		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Antimony	6020B	ND U	ug/L	0.050	0.020	1	10/21/24 17:13	10/18/24	
Arsenic	6020B	ND U	ug/L	0.50	0.09	1	10/21/24 17:13	10/18/24	
Cadmium	6020B	ND U	ug/L	0.020	0.008	1	10/21/24 17:13	10/18/24	
Calcium	6020B	ND U	ug/L	20	6	1	10/21/24 17:13	10/18/24	
Chromium	6020B	ND U	ug/L	0.20	0.03	1	10/21/24 17:13	10/18/24	
Lead	6020B	ND U	ug/L	0.020	0.006	1	10/21/24 17:13	10/18/24	
Magnesium	6020B	ND U	ug/L	10	2	1	10/21/24 17:13	10/18/24	
Silver	6020B	ND U	ug/L	0.020	0.009	1	10/21/24 17:13	10/18/24	
Zinc	6020B	ND U	ug/L	2.0	0.5	1	10/21/24 17:13	10/18/24	

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	NA
Sample Matrix:	Water	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	NA
Lab Code:	KQ2416532-01		

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	MDL	Dil.	Date Analyzed	Date Extracted	Q
Mercury	7470A	ND U	ug/L	0.20	0.02	1	10/15/24 09:14	10/14/24	

ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24
Sample Matrix:	Water	**Date Received:**	10/08/24
		Date Analyzed:	10/21/24
		Date Extracted:	10/18/24

Matrix Spike Summary
Total Metals

Sample Name:	CS-SW-1	**Units:**	ug/L
Lab Code:	K2410651-004	**Basis:**	NA
Analysis Method:	6020B		
Prep Method:	EPA CLP ILM04.0		

Matrix Spike
KQ2416479-04

Analyte Name	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Antimony	0.036 J	9.93	10.0	99	75-125
Arsenic	0.36 J	51.1	50.0	101	75-125
Cadmium	ND U	25.8	25.0	103	75-125
Calcium	5590	15900	10300	100	75-125
Chromium	0.11 J	10.6	10.0	105	75-125
Lead	0.013 J	51.9	50.0	104	75-125
Magnesium	996	11700	10300	104	75-125
Silver	ND U	13.4	12.5	107	75-125
Zinc	ND U	24.9	25.0	100	75-125

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.

ALS Group USA, Corp.
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QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24
Sample Matrix:	Water	**Date Received:**	10/08/24
		Date Analyzed:	10/15/24
		Date Extracted:	10/14/24

Matrix Spike Summary
Total Metals

Sample Name:	CS-SW-1	**Units:**	ug/L
Lab Code:	K2410651-004	**Basis:**	NA
Analysis Method:	7470A		
Prep Method:	Method		

Matrix Spike
KQ2416532-04

Analyte Name	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Mercury	ND U	4.91	5.00	98	75-125

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.

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QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24
Sample Matrix:	Water	**Date Received:**	10/08/24
		Date Analyzed:	10/21/24

Replicate Sample Summary
Total Metals

Sample Name:	CS-SW-1	**Units:**	ug/L
Lab Code:	K2410651-004	**Basis:**	NA

Analyte Name	Analysis Method	MRL	MDL	Sample Result	Duplicate Sample KQ2416479-03 Result	Average	RPD	RPD Limit
Antimony	6020B	0.050	0.020	0.036 J	0.027 J	0.032	29 #	20
Arsenic	6020B	0.50	0.09	0.36 J	0.33 J	0.35	9	20
Cadmium	6020B	0.020	0.008	ND U	ND U	ND	-	20
Calcium	6020B	20	6	5590	5530	5560	1	20
Chromium	6020B	0.20	0.03	0.11 J	0.12 J	0.12	9	20
Lead	6020B	0.020	0.006	0.013 J	0.008 J	0.011	48 #	20
Magnesium	6020B	10	2	996	1020	1010	2	20
Silver	6020B	0.020	0.009	ND U	ND U	ND	-	20
Zinc	6020B	2.0	0.5	ND U	ND U	ND	-	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

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ALS Group USA, Corp.
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QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project	Upper Granite Creek Mines/0031.005.001	**Date Collected:**	10/05/24
Sample Matrix:	Water	**Date Received:**	10/08/24
		Date Analyzed:	10/15/24

Replicate Sample Summary
Total Metals

Sample Name:	CS-SW-1	**Units:**	ug/L
Lab Code:	K2410651-004	**Basis:**	NA

Analyte Name	Analysis Method	MRL	MDL	Sample Result	Duplicate Sample KQ2416532-03 Result	Average	RPD	RPD Limit
Mercury	7470A	0.20	0.02	ND U	ND U	ND	-	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

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ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Analyzed:**	10/21/24
Sample Matrix:	Water		

Lab Control Sample Summary
Total Metals

Units:ug/L
Basis:NA

Lab Control Sample
KQ2416479-02

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Antimony	6020B	9.49	10.0	95	80-120
Arsenic	6020B	50.1	50.0	100	80-120
Cadmium	6020B	25.3	25.0	101	80-120
Calcium	6020B	10000	10300	98	80-120
Chromium	6020B	10.2	10.0	102	80-120
Lead	6020B	51.0	50.0	102	80-120
Magnesium	6020B	10600	10300	103	80-120
Silver	6020B	12.9	12.5	103	80-120
Zinc	6020B	25.4	25.0	101	80-120

ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client:	Terraphase Engineering Inc.	**Service Request:**	K2410651
Project:	Upper Granite Creek Mines/0031.005.001	**Date Analyzed:**	10/15/24
Sample Matrix:	Water		

Lab Control Sample Summary
Total Metals

Units:ug/L
Basis:NA

Lab Control Sample
KQ2416532-02

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Mercury	7470A	4.68	5.00	94	80-120

Appendix D

Data Validation Reports

Data Validation Report

Project Name: Upper Granite Creek Mines	Lab Reference Number: K2410639
Project Number: 0031.005.001	**Laboratory:** ALS Environmental Laboratory
Validated by: Marie Mueller	**Matrix:** Soil
Sampling Date: 10/2/2024 & 10/3/2024	**Number of Samples:** 20
Data Validation Report Date: 11/13/2024	**Analytical Report Date:** 10/23/2024

The quality control (QC) elements that were reviewed are listed below.

Data Package Completeness	√	Surrogate Compound Recovery	NA
Verification of EDD to Hardcopy Data Package	√	Sample Duplicate Analysis	1
Chain-of-Custody and Sample Preservation	1	Blank Spike/Blank Spike Duplicate Sample Analyses	NA
Holding Times	√	Matrix Spike/Matrix Spike Duplicate Sample Analyses	1
Retention Time Windows	NE	Trip Blank Sample Analysis	NA
Initial Calibration	NE	Equipment Blank Sample Analysis	1
Initial Calibration Verification	NE	Field Duplicate Sample Analysis	1
Continuing Calibration	NE	Reference Material Analysis	NE
Method Blank Analysis	1	Compound Quantitation	√
Laboratory Control Samples	√		

√ – Method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed.

1 – Quality control results are discussed below, but no data were qualified.

2 – Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed in this Data Validation Report.

NA – Not applicable

NE – Not evaluated

P – Pending

Overall Assessment

All data, as qualified, are acceptable for use.

Data Package Completeness

The data package included the required elements: chain-of-custody, sample receipt checklist, case narrative, results, and QC results.

Verification of EDD to Hardcopy Data Package

Sample results and related quality control data were received in both an electronic and hardcopy format. Electronic data were verified against the laboratory report; no errors were found.

Chain-of-Custody

All sample identification (ID) numbers listed on the chain-of-custody record are consistent with the sample ID reported in the EDD and hardcopy data package. Several samples listed in the chain-of-custody report include samples that were held and not analyzed by the laboratory.

Chain-of-custody 140510 includes sample IDs for laboratory reports K2410639, K2410642, K2410643, and K2410651.

Chain-of-custody 140510 erroneously notes that equipment blank sample, EB-2024 1003, was sampled on 10/5/2024, however it was sampled on 10/3/2024.

Sample Preservation

Samples were received intact, at temperatures of 4.6, 5.7, 4.4, 4.5, and 4.5 degrees Celsius. Proper preservation includes samples chilled to ≤6.0 degrees Celsius.

Laboratory staff observed temperature blanks at 9.6, 16.8, 6.0, 9.4, and 18.3 degrees Celsius. In the Cooler Receipt Form, laboratory staff noted that ice was at the top of coolers on top of samples and that the temperature blank was under the samples and is not necessarily indicative of sample temperature.

Holding Times

All samples were analyzed within the holding time.

Retention Time Windows

Not evaluated.

Initial Calibration

Not evaluated.

Initial Calibration Verification

Not evaluated.

Continuing Calibration

Not evaluated.

Method Blank Analysis

The method blank sample (lab code KQ2416652-01) had a lead detection of 0.043 mg/kg between the method detection limit (MDL) and the method reporting limit (MRL); the detection was flagged "J" because it was between the MDL and MRL, but project sample data was not qualified.

No other target compounds were detected in the method blank samples.

Laboratory Control Samples

All percent recovery values and relative percent differences (RPDs) for laboratory control samples were within acceptable criteria established by the laboratory for the respective testing methods.

Surrogate Compound Recovery

Surrogate compound recovery was not performed for this sample batch.

Sample Duplicate Analysis

The RPD for sample duplicate of UUMM-WRA-0.5-2 (lab code K2410639-002) analyte lead was calculated by the lab to be above the laboratory limits, and the RPD result was flagged with "*" indicating values were outside control criteria. The laboratory noted in the case narrative that, "the variability in the results was attributed to the heterogeneous character of the sample. Standard mixing techniques were used but were not sufficient for complete homogenization of this sample."

The RPD for sample duplicate of UMM-WRB-0.5-1 (lab code K2410639-002) analyte mercury was calculated by the lab to be above the laboratory limits, and the RPD result was flagged with "*" indicating values were outside control criteria. The laboratory noted in the case narrative that, "the variability in the results was attributed to the heterogeneous character of the sample. Standard mixing techniques were used but were not sufficient for complete homogenization of this sample."

All other RPDs for sample duplicates were within acceptable criteria established by the laboratory for the respective testing methods.

Blank Spike/Blank Spike Duplicate Sample Analyses

Blank spike and blank spike duplicate sample analyses were not performed for this sample batch.

Matrix Spike/Matrix Spike Duplicate Sample Analyses

All percent recoveries and RPDs for matrix spikes (MSs) and matrix spike duplicates (MSDs) were within acceptable criteria established by the laboratory for the respective testing methods, except for the following:

- High recovery was observed for Arsenic in the MS (sample UUMM-WRA-0.5-2 lab code K2410639-002 test batch ID 446350). The result was flagged "#" indicating the control criteria was not applicable.

The laboratory report notes that "Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits."

Trip Blank Sample Analysis

A trip blank sample was not collected for this sample batch.

Equipment Blank Sample Analysis

Equipment blank sample "EB-2024 1003" was collected on October 3, 2024 and is associated with all samples collected in this sample delivery group. This equipment blank sample was analyzed in report K2410651.The following analyte was detected in the equipment blank sample:

Equipment Blank Analysis

Analyte	Detection	Discussion
Arsenic	0.64 µg/L	Arsenic was detected in project samples at concentrations greater than 5 times the associated blank; therefore no results were qualified.

Field Duplicate Analyses

Samples UUMM-WRA-0.5-3-DUP, LMM-WRA-0.5-4-DUP, and LMM-WRB-0.5-1-DUP were collected as field duplicates of UUMM-WRA-0.5-3, LMM-WRA-0.5-4, and LMM-WRB-0.5-1, respectively. All RPDs were within the accepted 50% limit except for the following:

- Lead, in analysis of Total Metals – IVBA was detected in UUMM-WRA-0.5-3 and UUMM-WRA-0.5-3-DUP at concentrations of 12.6 and 7.14 mg/Kg, respectively. The calculated RPD is 55.5%.

Reference Material Analysis

No reference material analysis was performed.

Compound Quantitation

The laboratory did not apply any flags to project samples in this sample batch.

Sample Index

Sample Name	Lab ID	Matrix	Date Collected
LMM-WRB-0.5-3-DS	K2410639-001	Soil	10/3/2024
UUMM-WRA-0.5-2	K2410639-002	Soil	10/2/2024
UUMM-WRF-0.5-1	K2410639-003	Soil	10/2/2024
UUMM-WRD-0.5-1	K2410639-004	Soil	10/2/2024
UUMM-WRA-0.5-3	K2410639-005	Soil	10/2/2024
UUMM-WRA-0.5-3-DUP	K2410639-006	Soil	10/2/2024
UUMM-WRA-0.5-3-DS	K2410639-007	Soil	10/2/2024
UMM-WRB-0.5-2	K2410639-008	Soil	10/2/2024
UMM-WRB-0.5-2-DS	K2410639-009	Soil	10/2/2024
LMM-WRB-0.5-1	K2410639-010	Soil	10/3/2024
LMM-WRB-0.5-1-DUP	K2410639-011	Soil	10/3/2024
CM-WRC-0.5-4	K2410639-012	Soil	10/3/2024
UMM-WRA-0.5-1	K2410639-013	Soil	10/2/2024

Sample Name	Lab ID	Matrix	Date Collected
UMM-WRA-0.5-3	K2410639-014	Soil	10/2/2024
UMM-WRA-0.5-1-DS	K2410639-015	Soil	10/2/2024
LMM-WRA-0.5-3	K2410639-016	Soil	10/3/2024
LMM-WRA-0.5-3-DS	K2410639-017	Soil	10/3/2024
LMM-WRA-0.5-4	K2410639-018	Soil	10/3/2024
LMM-WRA-0.5-4-DUP	K2410639-019	Soil	10/3/2024
UMM-WRB-0.5-1	K2410639-020	Soil	10/2/2024

END OF REPORT

Data Validation Report

Project Name: Upper Granite Creek Mines	Lab Reference Number: K2410642
Project Number: 0031.005.001	Laboratory: ALS Environmental Laboratory
Validated by: Marie Mueller	Matrix: Soil
Sampling Date: 10/2/2024 - 10/5/2024	Number of Samples: 20
Data Validation Report Date: 11/13/2024	Analytical Report Date: 11/01/2024

The quality control (QC) elements that were reviewed are listed below.

Data Package Completeness	√	Surrogate Compound Recovery	NA
Verification of EDD to Hardcopy Data Package	√	Sample Duplicate Analysis	√
Chain-of-Custody and Sample Preservation	1	Blank Spike/Blank Spike Duplicate Sample Analyses	NA
Holding Times	√	Matrix Spike/Matrix Spike Duplicate Sample Analyses	1
Retention Time Windows	NE	Trip Blank Sample Analysis	NA
Initial Calibration	NE	Equipment Blank Sample Analysis	1
Initial Calibration Verification	NE	Field Duplicate Sample Analysis	NA
Continuing Calibration	NE	Reference Material Analysis	NE
Method Blank Analysis	1	Compound Quantitation	√
Laboratory Control Samples	√		

√ – Method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed.

1 – Quality control results are discussed below, but no data were qualified.

2 – Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed in this Data Validation Report.

NA – Not applicable

NE – Not evaluated

P – Pending

Overall Assessment

All data, as qualified, are acceptable for use.

Data Package Completeness

The data package included the required elements: chain-of-custody, sample receipt checklist, case narrative, results, and QC results.

Verification of EDD to Hardcopy Data Package

Sample results and related quality control data were received in both an electronic and hardcopy format. Electronic data were verified against the laboratory report; no errors were found.

Chain-of-Custody

All sample identification (ID) numbers listed on the chain-of-custody record are consistent with the sample ID reported in the EDD and hardcopy data package. Several samples listed in the chain-of-custody report include samples that were held and not analyzed by the laboratory.

Chain-of-custody 140510 includes sample IDs for laboratory reports K2410639, K2410642, K2410643, and K2410651.

Chain-of-custody 140510 erroneously notes that equipment blank sample, EB-2024 1003, was sampled on 10/5/2024, however it was sampled on 10/3/2024.

Sample Preservation

Samples were received intact, at temperatures of 4.6, 5.7, 4.4, 4.5, and 4.5 degrees Celsius. Proper preservation includes samples chilled to ≤6.0 degrees Celsius.

Laboratory staff observed temperature blanks at 9.6, 16.8, 6.0, 9.4, and 18.3 degrees Celsius. In the Cooler Receipt Form, laboratory staff noted that ice was at the top of coolers on top of samples and that the temperature blank was under the samples and is not necessarily indicative of sample temperature.

Holding Times

All samples were analyzed within the holding time.

Retention Time Windows

Not evaluated.

Initial Calibration

Not evaluated.

Initial Calibration Verification

Not evaluated.

Continuing Calibration

Not evaluated.

Method Blank Analysis

Arsenic and Lead were detected between the MDL and the RL in the method blank in lab codes KQ2416652-01 and KQ2416391-03. This analyte was detected in project samples at a level at least 10 times that of the method blank therefore no data as qualified.

No other target compounds were detected in the method blank samples.

Laboratory Control Samples

All percent recovery values and relative percent differences (RPDs) for laboratory control samples (LCSs) were within acceptable criteria established by the laboratory for the respective testing methods.

Surrogate Compound Recovery

Surrogate compound recovery was not performed for this sample batch.

Sample Duplicate Analysis

All RPDs for sample duplicates were within acceptable criteria established by the laboratory for the respective testing methods.

Blank Spike/Blank Spike Duplicate Sample Analyses

Blank spike and blank spike duplicate sample analyses were not performed for this sample batch.

Matrix Spike/Matrix Spike Duplicate Sample Analyses

All percent recoveries and RPDs for matrix spikes (MSs) and matrix spike duplicates (MSDs) were within acceptable criteria established by the laboratory for the respective testing methods, except for the following:

- High recovery was observed for arsenic and lead in the MS (sample UMM-TLA-0.5-6 lab code K2410642-005. The results were flagged "#" indicating the control criteria was not applicable.
- Recovery outside of the laboratory criteria was observed for arsenic and lead in the MS (sample UMM-TLB-0.5-1 lab code K2410642-001. The results were flagged "#" indicating the control criteria was not applicable.

The laboratory report notes that "Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits."

Trip Blank Sample Analysis

A trip blank sample was not collected for this sample batch.

Equipment Blank Sample Analysis

Equipment blank samples EB-2024 1003, EB-2024 1004 and EB-2024 1005 were collected on October 3, 4, and 5, 2024 and are associated with all samples collected on those dates. These equipment blank samples were analyzed in report K2410651.The following analyte was detected in the equipment blank samples:

Equipment Blank Analysis

Equipment Blank ID	Analyte	Detection	Discussion
EB-2024 1003	Arsenic	0.64 µg/L	Arsenic was detected in project samples at concentrations greater than 5 times the associated blank; therefore no results were qualified.
EB-2024 1004	Arsenic	3.12 µg/L	Arsenic was detected in project samples at concentrations greater than 5 times the associated blank; therefore no results were qualified.
EB-2024 1005	Arsenic	0.11 µg/L	Arsenic was detected in project samples at concentrations greater than 5 times the associated blank; therefore no results were qualified.

Field Duplicate Analyses

A field duplicate sample was not collected for this sample batch.

Reference Material Analysis

No reference material analysis was performed.

Compound Quantitation

The laboratory did not apply any flags to project samples in this sample batch.

Sample Index

Sample Name	Lab ID	Matrix	Date Collected
UMM-TLB-0.5-1	K2410642-001	Soil	10/2/2024
UMM-TLB-0.5-4	K2410642-002	Soil	10/2/2024
UMM-TLC-0.5-1	K2410642-003	Soil	10/2/2024
UMM-TLC-0.5-2	K2410642-004	Soil	10/2/2024
UMM-TLA-0.5-6	K2410642-005	Soil	10/2/2024
CEM-WRA-0.5-4-DS	K2410642-006	Soil	10/5/2024
CEM-WRB-0.5-1	K2410642-007	Soil	10/5/2024
CEM-WRA-0.5-2	K2410642-008	Soil	10/5/2024
CEM-WRC-0.5-1	K2410642-009	Soil	10/5/2024
GF-WRA-0.5-1	K2410642-010	Soil	10/5/2024
GF-WRD-0.5-6	K2410642-011	Soil	10/5/2024
GF-WRD-0.5-4-DS	K2410642-012	Soil	10/5/2024
GF-DR-0.5-1	K2410642-013	Soil	10/5/2024
GC5-WRA-0.5-3	K2410642-014	Soil	10/4/2024
GC5-WRA-0.5-4	K2410642-015	Soil	10/4/2024
GC5-WRA-0.5-4-DS	K2410642-016	Soil	10/4/2024
GC6-WRA-0.5-2	K2410642-017	Soil	10/4/2024
GC6-WRA-0.5-1	K2410642-018	Soil	10/4/2024
GC7-WRA-0.5-3	K2410642-019	Soil	10/4/2024

END OF REPORT

Data Validation Report

Project Name: Upper Granite Creek Mines	**Lab Reference Number:** K2410643
Project Number: 0031.005.001	**Laboratory:** ALS Environmental Laboratory
Validated by: Marie Mueller	**Matrix:** Soil
Sampling Date: 10/3/2024 - 10/5/2024	**Number of Samples:** 14
Data Validation Report Date: 11/13/2024	**Analytical Report Date:** 10/23/2024

The quality control (QC) elements that were reviewed are listed below.

Data Package Completeness	√	Surrogate Compound Recovery	NA
Verification of EDD to Hardcopy Data Package	√	Sample Duplicate Analysis	1
Chain-of-Custody and Sample Preservation	1	Blank Spike/Blank Spike Duplicate Sample Analyses	NA
Holding Times	√	Matrix Spike/Matrix Spike Duplicate Sample Analyses	1
Retention Time Windows	NE	Trip Blank Sample Analysis	NA
Initial Calibration	NE	Equipment Blank Sample Analysis	1
Initial Calibration Verification	NE	Field Duplicate Sample Analysis	√
Continuing Calibration	NE	Reference Material Analysis	NE
Method Blank Analysis	1	Compound Quantitation	2
Laboratory Control Samples	√		

√ – Method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed.

1 – Quality control results are discussed below, but no data were qualified.

2 – Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed in this Data Validation Report.

NA – Not applicable

NE – Not evaluated

P – Pending

Overall Assessment

All data, as qualified, are acceptable for use.

Data Package Completeness

The data package included the required elements: chain-of-custody, sample receipt checklist, case narrative, results, and QC results.

Verification of EDD to Hardcopy Data Package

Sample results and related quality control data were received in both an electronic and hardcopy format. Electronic data were verified against the laboratory report; no errors were found.

Chain-of-Custody

All sample identification (ID) numbers listed on the chain-of-custody record are consistent with the sample ID reported in the EDD and hardcopy data package. Several samples listed in the chain-of-custody report include samples that were held and not analyzed by the laboratory.

Chain-of-custody 140510 includes sample IDs for laboratory reports K2410639, K2410642, K2410643, and K2410651.

Chain-of-custody 140510 erroneously notes that equipment blank sample, EB-2024 1003, was sampled on 10/5/2024, however it was sampled on 10/3/2024.

Sample Preservation

Samples were received intact, at temperatures of 4.6, 5.7, 4.4, 4.5, and 4.5 degrees Celsius. Proper preservation includes samples chilled to ≤6.0 degrees Celsius.

Laboratory staff observed temperature blanks at 9.6, 16.8, 6.0, 9.4, and 18.3 degrees Celsius. In the Cooler Receipt Form, laboratory staff noted that ice was at the top of coolers on top of samples and that the temperature blank was under the samples and is not necessarily indicative of sample temperature.

Holding Times

All samples were analyzed within the holding time.

Retention Time Windows

Not evaluated.

Initial Calibration

Not evaluated.

Initial Calibration Verification

Not evaluated.

Continuing Calibration

Not evaluated.

Method Blank Analysis

The method blank sample (lab code KQ2416427-03) had chromium, lead, and zinc detections of 0.06, 0.036, and 0.27 mg/kg which were flagged "J" between the corresponding method detection limit (MDL) and the method reporting limit (MRL); project sample data was not qualified.

The method blank sample (lab code KQ2416652-01) had a lead detection of 0.043 mg/kg between the MDL and the MRL; the detection was flagged “J” because it was between the MDL and MRL, but project sample data was not qualified.

No other target compounds were detected in the method blank samples.

Laboratory Control Samples

All percent recovery values and relative percent differences (RPDs) for laboratory control samples (LCSs) were within acceptable criteria established by the laboratory for the respective testing methods.

Surrogate Compound Recovery

Surrogate compound recovery was not performed for this sample batch.

Sample Duplicate Analysis

All RPDs for sample duplicates were within acceptable criteria established by the laboratory for the respective testing methods except for the following:

- Sample TL-WRA-0.5-3, sample code K2410643-001, RPD for Duplicate Sample KQ2416427-01 analyte silver was flagged “*” indicating the RPD is outside of the laboratory criteria.

Blank Spike/Blank Spike Duplicate Sample Analyses

Blank spike and blank spike duplicate sample analyses were not performed for this sample batch.

Matrix Spike/Matrix Spike Duplicate Sample Analyses

All percent recoveries and RPDs for matrix spikes (MSs) and matrix spike duplicates (MSDs) were within acceptable criteria established by the laboratory for the respective testing methods, except for the following:

- Low recovery was observed for arsenic and zinc in the MS of KQ2416427-02 (sample TL-WRA-0.5-3 lab code K2410643-001. The result was flagged “#” indicating the control criteria was not applicable.

The laboratory report notes that “Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.”

Trip Blank Sample Analysis

A trip blank sample was not collected for this sample batch.

Equipment Blank Sample Analysis

Equipment blank samples EB-2024 1003, EB-2024 1004 and EB-2024 1005 were collected on October 3, 4, and 5, 2024 and are associated with all samples collected on those dates. These equipment blank samples were analyzed in report K2410651.The following analyte was detected in the equipment blank samples:

Equipment Blank Analysis

Equipment Blank ID	Analyte	Detection	Discussion
EB-2024 1003	Arsenic	0.64 µg/L	Arsenic was detected in project samples at concentrations greater than 5 times the associated blank; therefore no results were qualified.
EB-2024 1004	Arsenic	3.12 µg/L	Arsenic was detected in project samples at concentrations greater than 5 times the associated blank; therefore no results were qualified.
EB-2024 1005	Arsenic	0.11 µg/L	Arsenic was detected in project samples at concentrations greater than 5 times the associated blank; therefore no results were qualified.

Field Duplicate Analyses

Sample CS-SD-7-DUP was collected as a field duplicate of CS-SD-7, respectively. All RPDs were within the accepted 50% limit.

Reference Material Analysis

No reference material analysis was performed.

Compound Quantitation

The laboratory applied the following flags:

J Estimated value

Results for the following samples were J-flagged:

Sample Name	Analyte
CS-SD-1	Mercury
CS-SD-2	Antimony
CS-SD-4	Mercury

Sample Index

Sample Name	Lab ID	Matrix	Date Collected
TL-WRA-0.5-3	K2410643-001	Soil	10/4/2024
TL-WRB-0.5-4	K2410643-002	Soil	10/4/2024
TL-WRA-0.5-1-DS-2	K2410643-003	Soil	10/4/2024
SH-WRB-0.5-2	K2410643-004	Soil	10/4/2024
SH-WRC-0.5-1	K2410643-005	Soil	10/4/2024
CS-SD-1	K2410643-006	Soil	10/5/2024
CS-SD-2	K2410643-007	Soil	10/3/2024
CS-SD-3	K2410643-008	Soil	10/3/2024
CS-SD-4	K2410643-009	Soil	10/3/2024
CS-SD-5	K2410643-010	Soil	10/4/2024
CS-SD-6	K2410643-011	Soil	10/4/2024
CS-SD-7	K2410643-012	Soil	10/4/2024
CS-SD-7-DUP	K2410643-013	Soil	10/4/2024
CS-SD-8	K2410643-014	Soil	10/5/2024

END OF REPORT

Data Validation Report

Project Name: Upper Granite Creek Mines	Lab Reference Number: K2410651
Project Number: 0031.005.001	**Laboratory:** ALS Environmental Laboratory
Validated by: Marie Mueller	**Matrix:** Water
Sampling Date: 10/3/2024 - 10/5/2024	**Number of Samples:** 12
Data Validation Report Date: 11/13/2024	**Analytical Report Date:** 10/22/2024

The quality control (QC) elements that were reviewed are listed below.

Data Package Completeness	√	Surrogate Compound Recovery	NA
Verification of EDD to Hardcopy Data Package	√	Sample Duplicate Analysis	1
Chain-of-Custody and Sample Preservation	1	Blank Spike/Blank Spike Duplicate Sample Analyses	NA
Holding Times	√	Matrix Spike/Matrix Spike Duplicate Sample Analyses	√
Retention Time Windows	NE	Trip Blank Sample Analysis	NA
Initial Calibration	NE	Equipment Blank Sample Analysis	NA
Initial Calibration Verification	NE	Field Duplicate Sample Analysis	1
Continuing Calibration	NE	Reference Material Analysis	NE
Method Blank Analysis	√	Compound Quantitation	2
Laboratory Control Samples	√		

√ – Method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed.

1 – Quality control results are discussed below, but no data were qualified.

2 – Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed in this Data Validation Report.

NA – Not applicable

NE – Not evaluated

P – Pending

Overall Assessment

All data, as qualified, are acceptable for use.

Data Package Completeness

The data package included the required elements: chain-of-custody, sample receipt checklist, case narrative, results, and QC results.

Verification of EDD to Hardcopy Data Package

Sample results and related quality control data were received in both an electronic and hardcopy format. Electronic data were verified against the laboratory report; no errors were found.

Chain-of-Custody

All sample identification (ID) numbers listed on the chain-of-custody record are consistent with the sample ID reported in the EDD and hardcopy data package. Several samples listed in the chain-of-custody report include samples that were held and not analyzed by the laboratory.

Chain-of-custody 140510 includes sample IDs for laboratory reports K2410639, K2410642, K2410643, and K2410651.

Chain-of-custody 140510 erroneously notes that equipment blank sample, EB-2024 1003, was sampled on 10/5/2024, however it sampled on 10/3/2024.

Sample Preservation

Samples were received intact, at temperatures of 4.6, 5.7, 4.4, 4.5, and 4.5 degrees Celsius. Proper preservation includes samples chilled to ≤6.0 degrees Celsius.

Laboratory staff observed temperature blanks at 9.6, 16.8, 6.0, 9.4, and 18.3 degrees Celsius. In the Cooler Receipt Form, laboratory staff noted that ice was at the top of coolers on top of samples and that the temperature blank was under the samples and is not necessarily indicative of sample temperature.

Holding Times

All samples were analyzed within the holding time.

Retention Time Windows

Not evaluated.

Initial Calibration

Not evaluated.

Initial Calibration Verification

Not evaluated.

Continuing Calibration

Not evaluated.

Method Blank Analysis

No target compounds were detected in the method blank samples.

Laboratory Control Samples

All percent recovery values and relative percent differences (RPDs) for laboratory control samples were within acceptable criteria established by the laboratory for the respective testing methods.

Surrogate Compound Recovery

Surrogate compound recovery was not performed for this sample batch.

Sample Duplicate Analysis

All RPDs for sample duplicates were within acceptable criteria established by the laboratory for the respective testing methods, except for the following:

- Sample Duplicate RPDs for sample name CS-SW-1 and lab code K2410651-004 analytes antimony and lead RPDs were calculated to be above the acceptable criteria established by the laboratory for the respective testing methods.
- Sample Duplicate RPDs for sample name CS-SW-1 and lab code K2410651-004 analytes Cadmium, Silver, Zinc and Mercury could not be calculated because results were below reporting limits.

Blank Spike/Blank Spike Duplicate Sample Analyses

Blank spike and blank spike duplicate sample analyses were not performed for this sample batch.

Matrix Spike/Matrix Spike Duplicate Sample Analyses

All percent recoveries and RPDs for matrix spikes and matrix spike duplicates were within acceptable criteria established by the laboratory for the respective testing methods.

The laboratory report notes that “Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.”

Trip Blank Sample Analysis

A trip blank sample was not collected for this sample batch.

Equipment Blank Sample Analysis

Equipment blank samples EB-2024 1003, EB-2024 1004 and EB-2024 1005 collected on October 3, 4, and 5, 2024 were not associated with the samples analyzed in this report.

Field Duplicate Analyses

Sample CS-SW-2-DUP was collected as a field duplicate of CS-SW-2, respectively. All RPDs were within the accepted 30% limit, except:

- Lead was detected in CS-SW-2 and CS-SW-2-DUP at concentrations of 0.012 and 0.007 µg/L, respectively. The calculated RPD is 52.6%.

Reference Material Analysis

No reference material analysis was performed.

Compound Quantitation

The laboratory applied the following flags:

J Estimated value

Results for the following samples were J-flagged:

Sample Name	Analytes
EB-2024 1005	Arsenic
CS-SW-1	Antimony, Arsenic, Chromium, Lead
CS-SW-2	Antimony, Chromium, Lead
CS-SW-2-DUP	Antimony, Chromium, Lead
CS-SW-3	Antimony, Chromium, Lead
CS-SW-4	Antimony, Chromium
CS-SW-5	Cadmium, Chromium, Lead, Zinc
CS-SW-6	Chromium, Lead, Zinc
CS-SW-7	Cadmium, Chromium, Zinc
CS-SW-8	Cadmium, Chromium, Zinc

Sample Index

Sample Name	Lab ID	Matrix	Date Collected
EB-2024 1003	K2410642-001	Water	10/3/2024
EB-2024 1004	K2410642-002	Water	10/4/2024
EB-2024 1005	K2410642-003	Water	10/5/2024
CS-SW-1	K2410642-004	Water	10/5/2024
CS-SW-2	K2410642-005	Water	10/3/2024
CS-SW-2-DUP	K2410642-006	Water	10/3/2024
CS-SW-3	K2410642-007	Water	10/3/2024
CS-SW-4	K2410642-008	Water	10/3/2024
CS-SW-5	K2410642-009	Water	10/4/2024
CS-SW-6	K2410642-010	Water	10/4/2024
CS-SW-7	K2410642-011	Water	10/4/2024
CS-SW-8	K2410642-012	Water	10/5/2024

END OF REPORT

Appendix C

Human Health and Ecological Risk Assessment

Human Health and Ecological Risk Assessment
Upper Granite Creek Mines
Wallowa-Whitman National Forest

May 2011

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Cascade Earth Sciences
12720 E. Nora Avenue, Suite A
Spokane, WA 99216
(509) 921-0290
www.cascade-earth.com

Human Health and Ecological Risk Assessment
Upper Granite Creek Mines
Wallowa-Whitman National Forest

Prepared for:	USDA Forest Service Wallowa-Whitman National Forest
Site Location:	Granite Creek Mines Wallowa Whitman National Forest Grant County, Oregon
Prepared by:	Cascade Earth Sciences 12720 E. Nora Avenue, Suite A Spokane, Washington 99216 (509) 921-0290
Principal Author and Investigator:	Rone Brewer, Senior Ecologist, CES Associate Regina Skarzinskas, Senior Toxicologist, CES Associate
Reviewed By:	Dustin G. Wasley, PE, Principal Engineer
Report Date:	May 2011
Project Number:	2723018

Cover Photo: Monumental Mine Millsite

CONTENTS

FIGURES

APPENDICES

ACRONYMS

CEEM	conceptual ecological exposure model
COI	chemical of interest
COPC	chemical of potential concern for human health
COPEC	chemical of potential ecological concern
ODEQ	Oregon Department of Environmental Quality
ERA	ecological risk assessment
ERBSC	ecological risk-based screening concentration
HHRA	human health risk assessment
PRG	Preliminary Remediation Goals
SI	Site Inspection
RTE	rare, threatened, or endangered
90UCL	90th percentile upper confidence limit on the arithmetic mean
USEPA	United States Environmental Protection Agency

1.0 INTRODUCTION

- Potential human health and ecological risks associated with mining-related contamination at the Monumental, Cap Martin, Sheridan, Tillicum, Central Mines, Golden Fraction; and Granite Creek (GC)-5, GC-6, and GC-7 (unnamed) Mines (collectively referred to as the Granite Creek Mines) within the Upper Granite Creek Watershed (Site) were assessed through a streamlined risk assessment process.
- The mines are located in the upper portion of the Granite Creek watershed, approximately 5 to 8 aerial miles north of Granite, Oregon in Grant County in the Wallowa-Whitman National Forest (WWNF).
- The risk assessment process follows Oregon Department of Environmental Quality (ODEQ) and U.S. Environmental Protection Agency (USEPA) guidelines.
- Potential risks and hazards were evaluated using site-specific concentrations of chemicals of interest (COIs), selected human and ecological receptors and respective exposure pathways, and appropriate risk-based screening concentrations.

2.0 RISK ASSESSMENT DATA AND INITIAL SCREENING

- This section describes the data set used in this risk analysis and the initial screening for the human health risk assessment (HHRA) and ecological risk assessment (ERA).
- Data were selectively collected in areas where contamination was known or suspected to occur; therefore, the data set is skewed towards an understanding of the magnitude of contamination on Site rather than a full characterization of the Site.
- The data used in the risk assessment are from soil, vegetation, waste rock, surface water, pore water, and sediment samples collected during the Site Inspection (SI) conducted by EA Engineering, Science, and Technology, Inc. (EA) in January 2004 (EA, 2004) and the 2007 data gap investigation conducted by Cascade Earth Sciences (CES). The following samples were collected from five mines within the watershed:
    - 12 background soil samples
    - 48 surface and subsurface waste rock samples
        - 35 surface soil samples for the HHRA at 0-1.5 feet below the ground surface,
        - 38 surface soil samples for the ERA at 0-3 feet below the ground surface, and
        - 10 subsurface soil samples at greater than 1.5 feet below the ground surface for the HHRA.
    - 4 background vegetation samples
    - 6 vegetation samples
    - 3 background surface water samples
    - 17 surface water samples
    - 3 background pore water samples
    - 14 pore water samples
    - 3 background sediment samples
    - 27 sediment samples
- Overall, the data are likely to overestimate the concentrations found across the Site because samples were located to represent the areas of highest chemical of interest (COI) concentrations, not areas representative of overall human and ecological receptor exposure at and surrounding the Site. This is a conservative approach that is appropriate for screening level risk assessments.
- Initially, all data collected during the SI and deemed appropriate for use in the risk assessment were used to calculate the 90^{th} percentile upper confidence level on the arithmetic mean (90UCL) for each medium:

- The 90UCL is an upper-bound (i.e., conservative) estimate of mean chemical concentration and is specified as an appropriate exposure point concentration (EPC) in Oregon's Revised Cleanup Rules (OAR 340-122-084).
  - If fewer than 10 samples are available in a given medium, it is inappropriate to calculate a 90UCL (USEPA, 2003b). In these cases and if an appropriately calculated 90UCL exceeded the maximum detected concentration, the maximum detected concentrations was used as a substitute for the 90UCL.
- The data were screened using the ODEQ's Guidance for Conduct of Deterministic Risk Assessments (1998), which allows for prescreening of COIs based on the following criteria:
  - **Essential Nutrients:** calcium, magnesium, potassium, and sodium were removed from further assessment because they are considered to be essential nutrients.
  - **Frequency of Detection:** COIs in each medium that were detected in 5% or less of the samples Site-wide were removed from further assessment.
  - **Background:** 90UCL or maximum (as described above) concentrations of naturally-occurring chemicals that were present at concentrations less than maximum background concentrations were eliminated from further assessment.
- The results of these initial screening procedures for each potential exposure medium are also shown in Appendices A1 through A7. These appendices also show a sample reporting limit screening to ensure that undetected chemicals had reporting limits below background and below the lowest applicable medium-specific risk-based screening concentrations. If they did not, then that COI was conservatively included for further assessment at one-half the maximum sample reporting limit.
- The selected COIs for the HHRA and ERA are shown in Table 2-1.

Table 2-1. Chemicals of Interest Remaining Following the Initial Screening

COI	Soil/ Waste Material		Vegetation	Surface Water		Pore Water	Sediment	
	HHRA	ERA	ERA	HHRA	ERA	ERA	HHRA	ERA
Aluminum				X	X	X	X	X
Antimony	X	X		X	X		X	X
Arsenic, total	X	X	X	X	X	X	X	X
Barium	X	X		X	X	X	X	X
Beryllium			X				X	X
Cadmium	X	X	X	X	X		X	X
Chromium, total			X	X	X		X	X
Cobalt							X	X
Copper	X	X	X	X	X		X	X
Iron	X	X	X	X	X		X	X
Lead	X	X	X	X	X	X	X	X
Manganese	X	X		X	X		X	X
Mercury	X	X	X	X	X	X	X	X
Nickel							X	X
Selenium	X	X		X	X	X		
Silver	X	X		X	X	X	X	X
Thallium	X	X				X	X	X
Vanadium	X	X	X				X	X
Zinc	X	X	X	X	X	X	X	X

NOTE: X = COI selected for further screening

3.0 HUMAN HEALTH RISK ASSESSMENT

- A HHRA is an analysis of the potential adverse health effects that could result from current or future exposures to hazardous substances released from a site, in the absence of any action to control or mitigate these releases.
- The objective of this HHRA is to incorporate analytical data and information on potential human exposure to the COIs in order to provide a baseline assessment of the potential for human health risks to be realized due to Site-related contamination.
- The following are primary elements of the HHRA:
  - **Hazard Identification and Selection of Contaminants of Potential Concern:** Evaluation of site data and identification of elevated concentrations of COIs in human exposure media, resulting in a list of contaminants of potential concern (COPCs) for the HHRA.
  - **Exposure assessment**: Identification of areas that pose human health risks under current or potential future site uses and conservative estimation of exposure.
  - **Toxicity assessment:** Quantification of the relationship between chemical exposure and adverse effects.
  - **Risk characterization:** Development of quantitative risk estimates using exposure and toxicity information previously developed for the COPCs.

3.1 Hazard Identification and Selection of COPCS

- This section presents the rationale for the selection of the COPCs; prescreening of the COIs was described in Section 2.0.
- The media of interest for human health included soil, waste rock, surface water, and sediment.
- The COIs retained for further assessment following the initial screening included aluminum, antimony, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, selenium, silver, thallium, vanadium and zinc as shown in Appendices A1, A2, A4, and A6 for surface soil, subsurface soil, surface water, and sediment, respectively.
- Maximum concentrations of these COIs were screened against USEPA Region IX Preliminary Remediation Goals (PRGs).
  - Industrial PRGs were selected as most appropriate screening criteria for soils and sediment.
  - Tap water PRGs represent a very conservative screen for surface water.
  - Appendix B1 presents the preliminary remediation goal (PRG) screening and results.
- Arsenic and lead were identified as COPCs for the Site.

3.2 Exposure Assessment

Assessing the exposure at a given site includes the identification of potentially exposed populations, the selection of relevant exposure pathways, and the calculation of exposure point concentrations and chronic daily intakes.

3.2.1 Potentially Exposed Population

- Maps and Figures of the Site are provided in the SI report (EA, 2004). The following is a brief summary of the rational for the potentially exposed population:
  - The Site consists of five mines located within the Granite Creek watershed.

Monumental Mine

- Monumental Mine, located near the headwaters of Granite Creek, includes two open adits, a shaft, three settling ponds, three waste rock piles, and a former mill site. Access to the mine is by way of FR 7345.
- The mine is situated on moderate to steep hillsides at the headwaters of Granite Creek.

- Water flows from an upper seep into a series of three settling ponds, all of which are connected by surface water flow. In addition, water seeps from the lower adit through a constructed ditch to the lower settling pond. No outlet for the settling pond was observed during SI activities.

Cap Martin Mine

- The Cap Martin Mine is situated approximately 1.4 miles downstream from the headwaters of Granite Creek and contains two observed collapsed adits, one additional reported adit, three waste rock piles, and an outwash fan from the south waste rock pile.
- The mine is located on both sides of Granite Creek and is accessed via FR 7345.

GC-7 Mine

- The GC-7 Mine is situated approximately 0.25 miles downstream from the Cap Martin Mine at the confluence with an unnamed tributary originating from the monumental Mine.
- The mine contains one observed collapsed adit and two waste rock piles.
- A former canal or placer ditch is located just upslope from the mine.
- The mine is located on moderately steep hillsides on the north side of Granite Creek and is accessed via FR 680.

Sheridan Mine

- Sheridan Mine is located about 0.40 miles downstream of the Cap Martin Mine, east of the bank of an unnamed tributary of Granite Creek. The mine includes two possible adits, one of which is collapsed at the portal and contains a seep that discharges into a marshy area. No acid mine drainage (AMD) was observed in the seep. In addition, there is one waste rock pile downgradient from the collapsed adit.
- The mine is situated on moderately steep slopes on the south side of Granite Creek and is accessed by way of FR 7345.

GC-6 Mine

- The GC-6 Mine is situated approximately 0.10 miles downstream from the Sheridan Mine, on the north side of Granite Creek, and contains one partially collapsed adit, and a waste rock pile.
- The mine is located on moderately steep hillsides on the north side of Granite Creek and is accessed via FR 680.

Tillicum Mine

- The Tillicum Mine is located approximately 0.25 miles downstream of the Sheridan Mine along Granite Creek and contains two primary collapsed adits and associated waste rock piles, and reportedly several additional adits. No water emanated from the adits during SI field activities.
- The Mine is situated on moderately steep slopes along the north bank of Granite Creek and is accessed by way of FR 7345.

GC-5 Mine

- The GC-5 Mine is located about 0.25 miles downstream of the Tillicum Mine, and contains one collapsed adit and two waste rock piles.
- FR 680, which accesses the mine, is cut through the larger waste rock pile adjacent to Granite Creek.
- Water was observed flowing from the collapsed adit during the CES data gap field investigation.
- The mine is situated on a moderately steep slope north of Granite Creek.

Golden Fraction Mine

- The Golden Fraction Mine is located about 0.125 miles downstream of the GC-5 Mine.
- The upper portion of the mine, situated just downslope from FR 7345, has an open adit, shaft, collapsed cabin, one large waste rock pile, and four smaller waste rock piles.
- The lower portion of the mine, just upslope from FR 680 along Granite Creek, contains one collapsed adit and two waste rock piles.
- FR 680, which accesses the mine, is cut through the larger waste rock pile adjacent to Granite Creek.
- Water was observed flowing from the collapsed lower adit during the CES data gap field investigation.
- The mine is situated on a moderately steep slope north of Granite Creek.

Central Mine

- The Central Mine is located about 0.125 miles downstream of the Golden Fraction Mine, southeast of the intersection of FR 73 (Elkhorn Drive Scenic Byway) and FR 7345.
- The mine contains two observed adits and one reported adit. The adits did not have water emanating from them at the time of the SI field investigation. Additionally, three waste rock piles are located at the mine. A waste rock berm, created as a result of hydraulic mining activities, runs in east-west direction about 75 to 100 feet upslope of Granite Creek.
- The mine is situated on a moderately steep slope north of Granite Creek.
- Given the types of human uses expected, the potential for long-term exposure to Site-related contaminants is considered very low.
- There are no onsite workers, or occupied structures on the Site or within 200 feet of the Site.
- Access is currently not restricted by fencing, nor were any "No Trespassing" signs observed. In general, land uses in this area are limited to recreation (hiking, fishing, camping, hunting, etc.) and possibly some minerals prospecting on nearby claims.
- The ingestion, dermal contact, and air exposure pathways are considered complete, because hikers, hunters, and campers have the potential to access the Site.
- The most likely pathway of exposure at the Site is inhalation of particulates.
- Fish consumption was eliminated as a potential pathway of concern because, with the exception of tribal fishing, all recreational fishing in Granite Creek and its tributaries was prohibited by the Oregon Department of Fish and Wildlife in 1997 (EA, 2004). The number and size of fish present also severely limits any potential for a recreational or subsistence fishing scenario.

3.2.2 Identification of Potential Exposure Pathways

- The conceptual human exposure model is presented in Figure 3-1.
- Exposures to COPCs were evaluated for all complete pathways for which there was a receptor. These pathways were determined to be:
  - Inhalation of soil/waste rock particulates,
  - Dermal contact with soil/waste rock,
  - Incidental ingestion of surface soil/waste rock,
  - Dermal contact with surface water
  - Incidental ingestion of surface water
  - Dermal contact with sediment, and
  - Incidental ingestion of sediment by current and future recreational receptors.

3.2.3 Current and Potential Future Receptors

- The Site is not currently occupied, nor is it expected to be occupied in the future.
- The only likely current and future receptors identified for the Site are hikers, campers, and hunters.

- Based on the Site topography and its isolated location within the WWNF, it is highly unlikely that recreational users would engage in activities at the Site that could result in significant ingestion or contact with soil, sediment or surface water. Therefore, the most likely pathway of exposure at the Site is inhalation of particulates.

3.2.4 Exposure Assumptions

- Exposure assumptions include factors such as body weight, averaging time, exposure frequency, exposure duration, and chemical bioavailability.
- Separate assumptions are made for both average or central tendency exposure (CTE) and reasonable maximum exposure (RME).
- In general, CTE represents a less conservative model of the Site risk, using exposure factors that are more indicative of the average recreational user rather than a maximally exposed user.
    - o The exposure factors and assumptions used in this risk assessment are presented in Appendix B2.

3.2.5 Exposure Point Concentrations

- An EPC is used in coordination with the exposure factors to calculate the Average Daily Dose (ADD) of a chemical of potential concern (COPC).
- The EPC can be the maximum concentration detected or a statistical average.
- It is not reasonable to assume long-term contact with the maximum concentration.
- When sufficient data exists, an upper-bound estimate of average concentrations (i.e., the 90UCL) are used because an average concentration is most representative of the concentration contacted over this time period.
- As per the USEPA (1997), when data for a particular exposure medium were limited to less than 10 samples, the maximum detected concentration was used as the EPC. Where the data set contained greater than 10 samples, 90UCL was calculated and used as the EPC.
- The EPCs are presented in Table 3-1 and Appendix B3.

Table 3-1. Exposure Point Concentrations

COPC	N	Maximum	Central Tendency Exposure[1]	Reasonable Maximum Exposure[2]	Comments
Surface Soil (mg/kg)					
Total Arsenic	35	11,400	853	2,250	90UCL
Sediment (mg/kg)					
Total Arsenic	27	303	54.4	73.9	90UCL
Surface Water (mg/L)					
Total Arsenic	17	0.0818	0.00988	0.0188	90UCL

NOTES:
[1] Average concentration
[2] 90UCL if greater than 10 data points; Maximum concentration if less than 10 data points.
Abbreviations: EPC = Exposure point concentration, mg/kg = milligrams per kilogram, mg/L = milligrams per liter, N = Number of samples, UCL = Upper confidence Limit.

3.2.6 Exposure Doses

- The EPCs are then entered into exposure dose calculations to calculate the ADD of a contaminant for each receptor type. While presented individually in the equations, USEPA Region X allows for the calculation of Summary Intake Factors (Intake Factors) as follows:

- o Intake Factors represent the sum lifetime exposure to contaminated soil, water, or air through the pathway. The Intake Factors are presented in Appendix B4.
- o Dermal absorption factors are required to calculate dermal exposures to surface water and these are shown in Appendices B5 and B6.
- o The Intake Factors when multiplied by the EPC provide the ADD for each chemical.

3.3 Toxicity Assessment

- The purpose of the toxicity assessment is to present the critical toxicity values for the COPCs. Toxicity is defined as the ability of a chemical to induce adverse effects at some dosage in biological systems. The purpose of the toxicity assessment is twofold:
  - o To identify the carcinogenic (cancer) and non-carcinogenic (non-cancer) effects that may arise from direct or indirect exposure of humans to the COPCs; and
  - o To provide an estimate of the quantitative relationship between the magnitude and duration of exposure, and the probability or severity of adverse effects.

3.3.1 Toxicity Values

- Toxicity values are used to quantitatively describe the relationship between the extent of exposure to a COPC and the potential increased likelihood, or severity, of adverse effects.
- Where toxicity values are available, the following USEPA sources have been used to obtain this information.
  - o Integrated Risk Information System (IRIS) computer database (USEPA, 2004b)
  - o Health Effects Assessment Summary Table (USEPA, 1997)
- Both carcinogenic and non-carcinogenic effects were quantitatively evaluated as noted below:
  - o The endpoints for these two different types of effects are assessed differently because the mechanisms by which chemicals cause cancer are assumed to be fundamentally different from the processes that cause non-carcinogenic effects.
  - o The principal difference reflects the assumption that non-carcinogenic effects are assumed to exhibit a threshold dose below which no adverse effects occur, where USEPA assumes no such threshold exists for carcinogenic effects.
  - o Because exposure to some chemicals may result in both carcinogenic and non-carcinogenic effect, both endpoints associated with a COPC were evaluated quantitatively when sufficient toxicity data are available.

3.3.2 Categorization of Chemicals as Non-Carcinogens or Carcinogen

- Chemicals are classified into those that cause cancer (carcinogens) and those that cause other, non-cancer, health effects (non-carcinogens).
- The methods for assessing the potential for these two different types of health effects are different. Where a chemical can cause both cancer and non-cancer health effects, the risk evaluation calculates the potential for both types of effects.
- The following sections provide background information on the toxicity values for carcinogenic and non-carcinogenic chemicals, how they are determined, and how they are used in the risk analysis.

Potential Adverse Non-carcinogenic Health Effect

- The following summarizes the purpose and usage of reference doses (RfDs):
  - o Reference doses are critical toxicity factors for chemicals that can cause non-carcinogenic health effects.
  - o An RfD represents an estimated intake rate that is unlikely to produce measurable adverse effects over a lifetime of exposure (USEPA, 1989).

- RfDs are determined by the USEPA RfD Work Group or from the health effects assessment documents developed by the USEPA Office of Research and Development.
- An RfD, expressed in units of milligrams per kilogram per day (mg/kg-day), assumes a threshold for adverse non-carcinogenic effects. An ADD below the RfD is considered unlikely to cause adverse health effects.
- RfDs are route-specific; that is, RfDs may be different for ingestion, inhalation, or other routes of exposure.
- RfDs are derived using uncertainty factors and modifying factors.
- The Critical Toxicity Factors for the non-carcinogenic COPCs are presented in Table 3-2 and Appendix B7.

Table 3-2. Critical Toxicity Values for the Non-carcinogenic COPCs

COPC	Oral Chronic Reference Dose* (mg/kg-day)	Confidence in Reference Dose	Endpoint
Arsenic	0.0003	Medium	hyperpigmentation, vascular

NOTE: * Reference Dose value from Region IX PRG Tables.

Potential Carcinogenic Effects

- Carcinogenic toxicity is not assumed to have a threshold concentration below which adverse effects do not occur; therefore, carcinogenic risk from exposure to a COPC is expressed in terms of the probability that an exposed receptor will develop cancer over their lifetime.
- Contaminant-specific dose response curves are used to establish slope factors that represent an upper-bound excess cancer risk from a lifetime exposure.
- Dose response curves for human carcinogens are developed from tumorgenic and laboratory studies; the slope factor is generated from the 90UCL of the extrapolated dose curve using probabilistic methods and represents a conservative upper-bound estimate of the potential risk associated with exposure.
- Based on USEPA guidelines documents, critical toxicity data for arsenic and chromium are presented in Table 3-3 and Appendix B8 (refer to USEPA 1999 for additional information).

Table 3-3. Critical Toxicity Values for the Carcinogenic COPCs

COPC	Slope Factor (mg/kg-day)-1		Weight of Evidence Classification *	Type of Cancer	Basis of Slope Factor
	Oral	Inhalation	Ingestion/Inhalation	Ingestion/ Inhalation	Oral/Inhalation
Arsenic	1.5E+00	1.5E+01	A	Skin	Epidemiologic Studies

NOTE: A = Known human carcinogen.

Lead Critical Toxicity Values

- Meaningful oral and inhalation critical toxicity values have not been developed for lead.
- Many of the non-carcinogenic effects associated with lead may not exhibit a threshold, especially in young children.
- USEPA considers lead to be a probable human carcinogen based on sufficient animal data (i.e., a class B2 carcinogen). In lieu of a reference dose or slope factor, USEPA has developed the Integrated Exposure Uptake/Biokinetic Model (IEUBK) and the Adult Lead Model (ALM) which correlate dose with blood lead levels.
- The Federal Action Level for Lead in drinking water is 0.015 mg/L.

- Lead exposure levels are as follows:
  - The lowest-observed adverse effect level (LOAEL) of lead is considered to be 10 micrograms per deciliter (μg/dl) in children and fetuses and 30 μg/dl in adults.
  - Empirically-derived ratios of 0.16 and 0.04 μg/dl per micrograms per day (μg/day) ingested by children and adults respectively, recommended by USEPA (1986) and FDA (1990), are used to predict concentrations in young children and adults.
  - Applying an uncertainty factor of 10 results in provisional tolerable intake levels of 6 μg/day for children six or less, 15 μg/day for children over six, 25 μg/day for pregnant women, and 75 μg/day for men.

3.4 Risk Characterization

- Potential human health impacts associated with exposure to COPCs at the Site were evaluated by estimating the potential for both non-carcinogenic and carcinogenic health effects.
- The following sections discuss the assessment of non-carcinogenic hazards, carcinogenic risks, and lead risk associated with exposure to COPCs at the Site.
- The sampling locations were selected as locations where levels of concentrations were suspected to be the highest.
- Targeted sampling identifies the worst-case situations and is intended to be a conservative data set that is sufficient for the specific purposes of risk assessment.

3.4.1 Non-Carcinogenic Hazard Assessment

- Non-carcinogenic hazard is estimated as the ratio of the ADD of the non-carcinogenic chemical through a specific exposure route to the chronic (or subchronic) RfD for that exposure route.
- For example, intakes from the ingestion route are compared to oral RfDs.
- The assessment is done as follows:
  - The ADD divided by the RfD for an individual chemical is termed the Hazard Quotient (HQ).
  - HQs greater than 1.0 indicate the potential for adverse health effects because the intake exceeds the RfD (USEPA, 1989).
  - An HQ is calculated for each chemical that elicits a non-carcinogenic health effect if an RfD is available for the chemical and exposure route.
  - The sum of all individual chemical-specific HQs is termed the Hazard Index (HI) and is calculated under each exposure pathway.
  - The HI considers exposure to a mixture of chemicals having non-carcinogenic effects based on the assumption that the effects of chemical mixtures are additive (USEPA, 1986b).
  - An HI greater than 1.0 indicates the potential for adverse non-carcinogenic effects. When the HI is greater than 1.0, the USEPA guidance allows for segregating HIs by critical effect categories. Major categories of critical effects include neurotoxicity, developmental effects, and effects on target organs to name a few.

3.4.2 Excess Cancer Risk Assessment

- Carcinogenic risk is an estimate of the probability that a COPC will produce a carcinogenic effect.
- The excess lifetime carcinogenic risk is the incremental increase in the probability of developing cancer compared to the background incremental probability of developing cancer with no exposure to site contaminants.
- An excess cancer risk (ECR) of 1×10^{-6}, represents an increase of one additional case of cancer (above background) in one million people exposed to a carcinogen over their lifetime (70 years).
- Estimates of carcinogenic risk using the slope factors developed by USEPA are generally upper-bound estimates; actual risks from exposures to chemical constituents at the Sites would likely be lower than the risks estimated herein.

- For estimating carcinogenic risk from exposure to more than one carcinogenic chemical from a single exposure route, risks from each individual chemical are summed to estimate total ECR.

3.4.3 Potential Non-carcinogenic Hazards and Excess Cancer Risks

Discussion of Non-carcinogenic Hazards

- Soils/Waste Rock
  - Arsenic and lead were identified as COPCs.
  - Arsenic is the only COPC that can be quantitatively evaluated.
  - The average concentration and the 90UCL concentration was used as the EPC.
  - None of the individual constituents exceeded the regulatory standard of 1.0 under CTE and RME exposure conditions (Appendix B9).
- Sediments
  - Arsenic and lead were identified as the COPCs.
  - Arsenic is the only COPC that can be quantitatively evaluated
  - The HQs are below the regulatory standard of 1.0 for both the RME and CTE exposure scenarios (Appendix B9).
- Surface water
  - Arsenic and lead identified as COPCs.
  - No toxicity values are available for lead in surface water, groundwater, or drinking water.
  - The EPC for lead in surface water, which is also the maximum concentration detected is 0.009 mg/L.
  - The Federal Action Level for lead in drinking water is 0.015 mg/L.
  - The HQs are below the regulatory standard of 1.0 for both the RME and CTE exposure scenarios (ppendix B9).

Discussion of Potential Excess Cancer Risks

- Soil/Waste Rock
  - The only carcinogenic constituent identified was arsenic.
  - The average concentration and the 90UCL concentration were used as the EPCs for the CTE and RME exposures, respectively.
  - The ECR exceeded the regulatory standard of 1×10^{-6} under both CTE and RME exposure conditions (Appendix B10).
  - For the CTE exposure conditions, ECRs for ingestion (2×10^{-6}) did not exceed the EPA risk range of 1×10^{-4} to 1×10^{-6} but did exceed Oregon's regulatory standard of 1×10^{-6}.
  - For the RME exposure condition, ECRs for ingestion (2×10^{-5}) and dermal contact (2×10^{-5}) did not exceed the EPA risk range of 1×10^{-4} to 1×10^{-6} but did exceed Oregon's regulatory standard of 1×10^{-6}.
  - Therefore, a carcinogenic risk is possible for exposure to arsenic impacted soil/waste rock under the CTE and the RME exposure scenarios.
  - Inhalation of particulates did not exceed the regulatory standard 1×10^{-6} under both CTE and RME exposure conditions (Appendix B10).
- Sediments
  - The only carcinogenic constituent identified in sediment is arsenic.
  - The ECRs for arsenic in sediment did not exceed the regulatory standard 1×10^{-6} under both CTE and RME exposure conditions (Appendix B10).
- Surface Water
  - Arsenic was the only carcinogenic constituent identified in surface water, for which exposure could be quantified.

- The ECRs for arsenic in surface water did not exceed the regulatory stand 1 x 10^{-6} under both the CTE and the RME exposure conditions (Appendix B10).
- Lead was identified as a COPC in surface water on the basis of no PRG, and is considered to be carcinogenic, but no toxicity values are available. Therefore it cannot be quantitatively addressed in the same manner as arsenic and is addressed qualitatively below.

Estimation of Potential Human Health Impacts from Exposure to Lead

- The USEPA's lead models simulate soil lead exposures at a single location. Two models have been developed, the IEUBK model and the ALM:
  - These models require a minimum of three months of continuous exposure of at least one day per week.
  - Three months exposure is the minimum to produce a quasi-steady-state lead concentration.
  - The reliability of the models for predicting lead concentrations for exposure durations shorter than three months has not been assessed.
  - In order to address non-continuous exposures, the USEPA Office of Solid Waste and Emergency Response has developed a guidance document for evaluating intermittent exposures to lead for scenarios such as recreational users and trespassers.
  - Since the exposure frequency is less than three months, predicted intake values were compared with the provisional values discussed in Section 3.3.2.3.
  - Table 3-5 present the results of the lead intake calculations and lead screening. Only the ingestion pathway is quantified.

Table 3-5. Lead Intake Screening

Exposure Point Concentrations		Intake		Predicted Intake		USEPA Provisional Intake Value	USEPA Provisional Intake Value
mg/kg		kg/day		µg/day			
CTE	RME	CTE	RME	CTE	RME	Men	Children <6
Soil							
375.8143	661.61739	6.7E-07	2.7E-06	0.25	1.786	75	6
Sediment							
24.24	39.3502	2.6E-07	2.1E-06	.006	0.083	75	6
			TOTAL INTAKE	0.256	1.869	**75**	**6**

- Summary of Lead Risks:
  - Soil and Waste Rock: The predicted intake was calculated to be 0.25 µg/day (CTE) and 1.786 µg/day (RME). The USEPA provisional ingestion intake value for men (most likely receptor) is 75 µg/day and children under six (least likely receptor) is 6 µg/day. If you assume that the total intake from dermal exposure and inhalation is equal to the intake from ingestion, no risk is expected for exposure to lead in soil and waste rock.
  - Sediment: The predicted intake was calculated to be 0.006 µg/day (CTE) and 0.083 µg/day (RME). Using the USEPA provisional ingestion intake listed above, no risk is expected for exposure to lead in sediment for the most likely recreational receptor (men), but a risk is possible for exposure to children under six using the RME EPC. Given the steep terrain and remote nature of the Site, children less than six are not expected to spend extended periods of time at the Site; therefore, a risk is not expected from exposure to lead impacted sediment.
  - Surface Water: The maximum concentration of lead in surface water was 9 micrograms per liter (µg/L), which is less than the USEPA National Primary Drinking Water Standard, Maximum

Containment Level of 15 μg/L (USEPA, 2003b). Therefore, exposure to lead in drinking water is not expected to be a risk.

3.5 Calculation of Cleanup Goals

- Site specific cleanup goals protective of the RME recreational users were calculated for soil/waste rock and sediment based on the regulatory standard of 1×10^{-6} ECR.
- The site-specific cleanup goals were calculated to be 143 mg/kg for soil/waste rock
- These clean-up goals are used to calculate hot spot concentrations in soil/waste rock

3.6 Determination of Potential Hot Spots

- The 1995 amendments to Oregon Revised Statute [ORS 465.315] and 1997 amendments to the Hazardous Substance Remedial Action Rules [OAR 340-122], commonly referred to as the Environmental Cleanup Rules, require that certain actions be taken for "hot spots" of contamination. These actions are:
    - The identification of hot spots as part of the Remedial Investigation and Feasibility Study, and
    - The treatment of hot spots, to the extent feasible, as part of a remedial action selected or approved by the Director of the ODEQ.
- The intent of the hot spot rule is to require treatment only for the worst contamination, as opposed to preferring treatment for all contamination at the Site.
- A hot spot in soil is generically defined as an area where the contamination is highly concentrated, highly mobile or cannot be reliably contained. The assessment of "highly concentrated" hot spots is performed by comparing the concentration of each individual site contaminant to its "highly concentrated" hot spot level as follows:
    - The "highly concentrated" hot spot levels correspond to a lifetime ECR of 1×10^{-4} for carcinogens and a hazard quotient of 10 for non-carcinogens.
    - Arsenic in surface soil/waste rock exceeded the regulatory standards for carcinogenic health effects.
    - The results of the hot spot evaluations are presented in Appendix B11. Using an ECR of 1×10^{-4} a hot spot concentration for arsenic in soil/waste rock was calculated to be 14,330 mg/kg.

3.7 Summary of Human Health Risks

- Arsenic was identified as the only COPCs in surface soil/waste rock, surface water, and sediment for non-carcinogenic effects.
- Lead was identified as a COPCs in surface water because there is no PRG for lead in this medium.
- Based on current and future land use, hunters, hikers, and campers were identified as potential receptors.
- No unacceptable non-carcinogenic health effects are anticipated from contact with sediment or soil/waste rock, nor from contact with surface water under CTE conditions.
- Arsenic was the only carcinogenic COPC identified at the Site.
- Risks due to ingestion under CTE exposure conditions, and due to ingestion and dermal contact with arsenic impacted soil under the RME exposure conditions exceeded the ODEQ's regulatory standard of 1×10^{-6} ECR.
- Based on the Site topography and its isolated location within the Wallowa Whitman National Forest, it is highly unlikely that recreational users would engage in activities at the Site that could result in significant ingestion of soil, thus, the most likely pathway of exposure at the Site is inhalation of particulates.
- The quantitative risk assessment determined that the inhalation pathway did not result in unacceptable health impacts.
- No hot spots were identified at the Site.

4.0 ECOLOGICAL RISK ASSESSMENT

- The goal of the ERA is to provide an understanding of the potential for ecological risks due to Site-related contamination and to allow a determination of whether remediation or more detailed ecological risk assessment are warranted. This ERA report consists of:
  - Description of the Site ecology and likely ecological receptors (including rare, threatened or endangered [RTE] species) at or near the Site;
  - Presentation of the conceptual ecological exposure model (CEEM), which provides a summary of potential and likely exposure media and pathways;
  - Delineation of assessment endpoints and measures;
  - Ecological risk-based screening; and
  - Risk characterization to assess the potential for ecological effects due to Site related COIs.
- An ecological survey was conducted as part of the SI (EA, 2004), which documented ecological features and conditions at and near the Site.
- The potential for Site-related ecological impacts were also assessed via an examination of stream benthic macroinvertebrate abundance and diversity.
- The ecological information collected during the SI has been incorporated into this risk assessment as appropriate.
- An ODEQ ecological scoping checklist was completed for this ERA, based on the SI ecological survey, and is provided in Appendix C.

4.1 Problem Formulation

- Problem formulation was completed as follows:
  - The physical and chemical characteristics of the Site and the important ecological habitats, plants, invertebrates, fish, and wildlife that exist are described.
  - This information is utilized to identify the COIs, the ecological receptors of concern, exposure pathways, and the exposure media.
  - This in turn, allows development of the CEEM which graphically depicts the expected fate and transport of chemicals at the Site, the potential exposure media, and likely exposure pathways for ecological receptor types of concern.
  - The problem formulation concludes with identification of the ecological endpoints that delineate the objectives of the remainder of the ERA.
  - Generally, problem formulation includes a description of the Site and summary of previous investigations; however, this information is provided in the SI, and is not repeated herein.

4.1.1 Ecological Stressors

- Ecological receptors may be affected through exposure to chemicals (i.e., toxicity), physical stresses (i.e., destruction of habitat), and biological stresses (i.e., viruses and bacteria).
- Biological stressors were assessed as follows:
  - While biological stressors may affect ecological receptors, they are more frequently associated with waste food or human waste and in areas where wildlife congregate in large numbers. Because the remote nature of the Site limits human presence and wastes, they are not considered to pose a threat to ecological receptors. Because of the lack of suitable habitat, ecological receptors are also unlikely to congregate in the vicinity of the Site in numbers that could result in significant biological infection or passage of wildlife diseases. Thus, biological stressors are unlikely to be a significant factor and are not considered further.
- Physical stressors were assessed as follows:
  - Past physical disturbances include development and operation of the mines and supporting structures, and possibly historic as well as current logging operations. Because the Site has been abandoned for decades, current physical disturbance is reduced to a relatively low number of

recreational users that visit or drive by the Site. Given the relatively remote nature of the Site within the Wallowa Whitman National Forest, the ecological impacts of ongoing current physical disturbances are limited.

4.1.2 Ecological Setting

- The regional and Site-specific ecology are briefly described in this section to provide an understanding of the climate, plants, invertebrates, wildlife, and fish that may inhabit the Site and surrounding region:
  - Other than RTE species that must be considered on an individual level, a particular species must be potentially present on or utilize the Site in numbers adequate to allow an exposure level that may result in effects to the species' population. Such significant exposure to Site related COIs will only occur for those species known or expected to use the Site on a regular basis and in high numbers or that bioaccumulated metals to a significant degree.
  - More detailed information on the regional and Site ecology, sensitive environments, and RTE species is presented in the SI.
  - Bull trout (*Salvelinus confluentus*) and the mid-Columbia steelhead (*Oncorhynchus mykiss*) were the only threatened or endangered (i.e., protected) species observed or expected at or in the vicinity of the Site (EA, 2005). Bull trout were identified in Granite Creek. Steelhead are expected primarily downstream of the site.
  - Four distinct habitat types were observed at the Site by EA. These include; drier south facing slopes, moister north facing slopes, riparian zones along Granite Creek, and spruce forest at Monumental Mine.
  - A lack of understory ground species was noted during SI activities and logging, fire, and insect infestations have likely occurred in areas surrounding the Site. Waste Rock piles typically contained early-successional coniferous species.
  - Overall, the relatively large number of species identified during this limited ecological survey suggested that numerous species are present in the vicinity of the Site and that they utilize varied habitat and foraging methods.
  - Granite Creek flows throughout the Site and is generally less than one meter wide, with a riparian area less than 20 meters wide. EA described the riparian vegetation as being dominated by red alder (EA, 2004), although it is more likely mountain alder that was observed.

4.1.3 Conceptual Ecological Exposure Model

- The CEEM (Figure 4-1) graphically depicts the sources of contamination, contaminant release and transport mechanisms, impacted exposure media, and exposure routes for ecological receptor types observed or expected at the Site. Based on current understanding of Site conditions, the potentially contaminated exposure media for ecological receptors include:
  - Surface soil/waste rock in the vicinity of the Site;
  - Vegetation at the Site;
  - Surface water in Granite Creek, adit and waste rock seep drainages;
  - Pore water within Granite Creek; and
  - Sediment in Granite Creek.
- Given these exposure media, the possible and likely ecological receptor groups include:
  - Terrestrial plants exposed to COIs in soil/waste rock;
  - Terrestrial invertebrates exposed to COIs in soil/waste rock;
  - Terrestrial and semi-aquatic wildlife (including birds, mammals, and reptiles) exposed to COIs in soil/waste rock, surface/adit water, pore water, and sediment;
  - Aquatic life (including aquatic plants, aquatic invertebrates, fish, and amphibians) exposed to COIs in surface/adit water, and pore water; and
  - Benthic invertebrates, birds, and mammals exposed to COIs in sediment.

4.1.4 Assessment Endpoints and Measures

Assessment Endpoints

- Assessment endpoints represent the ecological aspects to be protected at a site and link the ERA to risk management decisions.
- Within a screening level ERA, assessment endpoints are generalized to reflect the risk-based screening process and protective ecological risk-based screening concentrations (ERBSCs). The assessment endpoints for this ERA include:
  - Protection of the reproduction and survival of plants, terrestrial invertebrates, birds, mammals, and reptiles exposed to COIs in surface soil/waste rock and vegetation at the Site;
  - Protection of aquatic life reproduction survival exposed to COIs in water within the adit/seep drainages and Granite Creek;
  - Protection of the reproduction and survival of birds and mammals that may drink water from adit/seep drainages and Granite creek;
  - Protection of the reproduction and survival of aquatic life exposed to COIs in pore water within Granite Creek;
  - Protection of reproduction and survival of benthic macroinvertebrates exposed to COIs in sediment within Granite Creek; and
  - Protection of reproduction and survival of birds and mammals exposed via the aquatic/benthic food chain to COIs in sediment within Granite Creek.

Assessment Measures

- Assessment measures are characteristics of the Site, selected ecological receptors, or ecosystem aspects that are measured through monitoring or sampling activities and then related qualitatively or quantitatively to the selected assessment endpoint(s) to determine whether an ecological effect is occurring. For this ERA, the assessment measures are comprised of the following:
  - Measured concentrations in soil/waste rock, surface water, pore water, and sediment; and
  - Readily-available ERBSCs.

4.2 Ecological Risk-Based Screening

- Ecological risk-based screening begins with a list of COIs in the media of concern, a determination of EPCs, and a comparison of the EPCs to ERBSCs with consideration of exposure to multiple chemicals and media, reporting limit adequacy, and the inordinate contribution of individual chemicals to the overall receptor group risk.
- The result is a list of Site-related chemicals of potential ecological concern (COPECs) with the potential to pose risks to ecological receptors at the Site.
- The initial screening was completed in Section 2.0 and the chemicals retained as ecological COIs were presented in Table 2-1.
- The ERBSCs used in the risk-based screening were provided by ODEQ (ODEQ, 2001).
  - When a screening level value was not available for a given COI, then an alternative ecological risk-based screening concentration (ERBSC) was selected from peer-reviewed literature or a surrogate chemical ERBSC was substituted.
  - The ERBSCs are presented in Appendix D1.
- As per ODEQ guidance (2001), the EPCs for each medium were compared to the ERBSCs for each chemical and receptor group in each medium, resulting in chemical/receptor group-specific risk ratios (R_{ij} in Appendices D2 through D5). Assessment of risk ratios was as follows:
  - Risk ratios were summed for all chemicals within a receptor group to obtain receptor group-specific risk ratios (R_j in Appendices D2 through D5).
  - The potential for bioaccumulation of each COI was assessed, reporting limit adequacy was checked for undetected COIs, and the inordinate contribution of any given chemical to the overall receptor

group risk was determined. Risk ratios greater than 1 were considered unacceptable and indicative of potential risks for protected ecological receptors (bull trout and steelhead), aquatic life, and benthic macroinvertebrates.
  - Risk ratios greater than 5 were considered unacceptable for other ecological receptors.
  - The COIs for which potential ecological risks were indicated became COPECs for the Site.
  - No ERBSCs are available for vegetation, so a risk-based screening was not conducted for vegetation. The potential for COPECs in vegetation to result in ecological risks is discussed further in the risk characterization section below.
- The risk ratios for receptor groups exposed to COPECs are shown in Tables 4-1 through 4-4.

Table 4-1. Chemicals of Potential Ecological Concern and Risk Ratios for Surface Soil/Waste Rock

COPEC	Terrestrial Plants (R_{ij})	n*	Terrestrial Invertebrates (R_{ij})	n*	Birds (R_{ij})	n*	Mammals (R_{ij})	n*
Antimony	**8**	4	0.5	0	No ERBSC	0	3	0
Total Arsenic	**99**	25	**30**	9	**42**	25	**39**	16
Cadmium	1	0	0.2	0	0.8 Bioaccumulation	0	0.04 Bioaccumulation	0
Iron	**2,782**	17	**139**	17	No ERBSC	0	No ERBSC	0
Lead	**12**	6	1	0	**37**	12	0.1	0
Manganese	1	0	**6**	8	0.1	0	0.05	0
Mercury	**208**	4	**625**	5	**42**	2	0.9	0
Selenium	0.7	0	0.01	0	0.4 Bioaccumulation	0	0.03 Bioaccumulation	0
Silver	**23**	7	0.9	0	No ERBSC	0	No ERBSC	0
Vanadium	**22**	5	No ERBSC	0	1	0	2	0
Zinc	**7**	11	2	1	**6**	8	0.02	0
Total Receptor Group Risk (R_j)	**3,168**		**807**		**131**		**46**	

NOTES:
Bold = COPEC with risk ratio greater than acceptable levels; (>1 for protected species - none are expected; >5 for unprotected species)
Non-bold = selected as COPECs for reasons other than exceedance of an ERBSC.
* n = number of stations with an unacceptable risk ratio.

Table 4-2. Chemicals of Potential Ecological Concern and Risk Ratios For Surface Water

COPEC	Aquatic Life (R_{ij})	n*	Birds (R_{ij})	n*	Mammals (R_{ij})	n*
Antimony	0.0006	0	No ERBSC		0.0009	0
Arsenic, Total	0.1	0	0.001 Bioaccumulation	0	0.003 Bioaccumulation	0
Barium	**16**	13	0.0004	0	0.002	0
Cadmium	0.2	0	0.00004 Bioaccumulation	0	0.00006 Bioaccumulation	0
Iron	0.6	0	No ERBSC		No ERBSC	
Lead	0.9	0	0.00008 Bioaccumulation	0	0.000007 Bioaccumulation	0
Mercury	0.1	0	0.00002 Bioaccumulation	0	0.000008 Bioaccumulation	0
Selenium	0.3	0	0.0003 Bioaccumulation	0	0.0008 Bioaccumulation	0
Silver	0.8 Reporting Limit Too High	0	No ERBSC		No ERBSC	
Zinc	2	1	0.002	0	0.0002	0
Total Receptor Group Risk (R_j)	**22**		0.004		0.01	

NOTES:
Bold = COPEC with risk ratio greater than acceptable levels (>1 for aquatic life; >5 for other species).
Non-bold = selected as COPECs for reasons other than exceedance of an ERBSC.
* n = number of stations with an unacceptable risk ratio.

Table 4-3. Chemicals of Potential Ecological Concern and Risk Ratios for Pore Water

COPEC	Aquatic Life (R_{ij})	n*
Arsenic, Total	0.04 Bioaccumulation	0
Barium	**12**	11
Lead	0.5 Bioaccumulation	0
Mercury	0.07 Bioaccumulation	0
Selenium	0.3 Bioaccumulation	0
Silver	Reporting Limit Too High	0
Total Receptor Group Risk (R_j)	**13**	

NOTES:
Bold = COPEC with risk ratio greater than acceptable levels (>1 for aquatic life; >5 for other species).
Non-bold = selected as COPECs for reasons other than exceedance of an ERBSC.
* n = number of stations with an unacceptable risk ratio.

Table 4-4. Chemicals of Potential Ecological Concern in Sediment

COPEC	Benthic Macroinvertebrates (R_{ij})	n*	Birds and Mammals (R_{ij})	n*
Aluminum	No ERBSC		No ERBSC	
Arsenic, Total	**13**	8	**19**	8
Barium	No ERBSC		No ERBSC	
Cadmium	1	0	**216**	9
Cobalt	No ERBSC		No ERBSC	
Iron	No ERBSC		No ERBSC	
Mercury	0.5	0	No ERBSC Bioaccumulation	
Selenium	No ERBSC	0	5	0
Thallium	No ERBSC		1	0
Vanadium	No ERBSC		No ERBSC	
Zinc	0.7	1	**28**	19
Total Receptor Group Risk (R_j)	**18**		**265**	

NOTES:
Bold = COPEC with risk ratio greater than acceptable levels (>1 for benthic invertebrates; >5 for other species).
Non-bold = selected as COPECs for reasons other than exceedance of an ERBSC.
* n = number of stations with an unacceptable risk ratio.

4.3 Ecological Risk Characterization

4.3.1 Risk Description

- Risk description involves examining the predicted risks in each medium to determine whether they are likely, or artifacts of the risk assessment process.

Surface Soil/Waste Rock

- The COPECs for soil/waste rock were listed in Table 4-1.
- Nine of 11 COPECs had at least one exceedance of an ERBSC but only 6 COPECs had exceedances at more than 5 sample locations. Total arsenic was the only COPEC with ERBSC exceedances at more than half of the sample locations. This suggests that other than total arsenic, the COPECs are not at consistently elevated concentrations across all of the mines.
  - Cadmium and selenium were selected as COPECs solely due to their potential to bioaccumulate. However, the synthetic precipitation leaching procedure results for these two COPECs (EA, 2005) suggest that they are strongly bound to soil/waste rock particles, and thus, are not readily bioavailable. As such, it is unlikely they will bioaccumulate to any significant degree in birds or mammals. Given this argument and the lack of an exceedance of ERBSCs at the EPC, cadmium and selenium are not considered to present a significant risk to ecological receptors.
  - Total arsenic, iron, and mercury risk ratios were inordinately high for at least one receptor group. Mercury only exceeded ERBSCs at 5 out of 38 sample locations. The highest three of these exceedances were in samples collected at the Monumental Mine. The largest exceedances of ERBSCs by mercury were for plants and invertebrates with the only other exceedances being for birds at two sample locations and mammals at one sample location, all at the Monumental Mine. While iron exceeded ERBSCs at 17 sample locations, it exceeded 2 times its background concentration in only one sample (GF-WR-2). Overall, predicted risks for total arsenic are spread across receptor groups and sampling locations, whereas predicted risks for mercury and iron are limited primarily to plants and invertebrates at the Monumental Mine.

- Total arsenic, iron, lead, manganese, silver, vanadium, and zinc had unacceptable risk ratios at more than five sample locations. Potential risks due to iron were discussed above. Total arsenic had multiple unacceptable risk ratios for multiple receptors at all the mines with a majority at the Monumental Mine, but the Tillicum and Golden Fraction Mines also had unacceptable risk ratios for all receptors. Lead had unacceptable risk ratios (six for plants and 12 for birds) an 12 sample locations at five of the mines. Manganese had exceedances of ERBSCs for invertebrates at six Monumental and Tillicum Mine sample locations and in two samples (WR-01 and WR-02) collected at GC-5, but did not exceed its background concentration by more than a factor of two. Silver had only eight unacceptable risk ratios (seven plant and one invertebrate) in four samples collected at the Monumental Mine and one each at GC-7, GC-3, and Golden Fraction Mine (GF-WR-2). Vanadium had five unacceptable risk ratios for plants spread across the Monumental, Tillicum, Cap Martin, Central, and Sheridan mines but only exceeded its background concentration by more than a factor of two in one sample from the Central Mine. Zinc had 19 unacceptable risk ratios (11 for plants, one for invertebrates, and 8 for birds), in samples located at the Monumental, Tillicum, Cap Martin, Central and Golden Fraction Mines, and at GC-3.

- Based on the magnitude of the risk ratio and the number and locations of samples where the unacceptable exceedances of ERBSCs and background concentrations occurred, the results of the risk-based screening suggest that:
  - Total arsenic, lead, and zinc are the COPECs with the highest predicted potential to present risks at more than a few localized areas. The majority of risks were predicted for samples collected at the Monumental and Tillicum Mines. Mercury may also present a relatively high risk to plants and invertebrates in a few very limited areas.
- As discussed above, individual birds or small mammals that inhabit or feed within the waste rock piles have been indicated to be at risk due to exposure to the COPECs. However, given the small size of the waste rock piles in comparison to the surrounding high quality habitat, and the relatively large home range of most wildlife species, populations of mobile and wide-ranging wildlife are unlikely to spend large amounts of time on or around any one mine area. Thus, other than for their possible exposure to total arsenic, which has elevated concentrations at all the mines, wildlife species are considered unlikely to be impacted by the COPECs.

Vegetation

- Vegetation samples were collected from four background and six locations likely to be impacted by Site-related COPECs.
- The COPECs present in vegetation above background concentrations were total arsenic, beryllium, cadmium, total chromium, copper, iron, lead, mercury, vanadium, and zinc (See Appendix A4).
- The maximum ratios of on-Site concentrations to background concentrations were total arsenic, (10), beryllium (1), cadmium (7), total chromium (5), copper (1), iron (2), lead (2), mercury (2), vanadium (1), and zinc (3).
- Beryllium, copper, iron, lead, mercury, and vanadium are present at less than or approximately equivalent to two times the background concentration, and thus are not considered to present a significant potential for ecological impacts.
- Zinc is a essential nutrient in the environment that only moderately elevated in vegetation compared to its background concentrations. This diminishes the predicted potential for impacts due to zinc.
- Total arsenic and cadmium significantly exceeded background concentrations at the Monumental Mine, while total chromium significantly exceeded background concentrations at the Central Mine.
- Overall, total arsenic, cadmium, and total chromium are the COPECs of most concern in vegetation.
- There is a very limited amount of vegetation on or near the waste rock piles at the Site. This also significantly reduces the potential exposure of herbivores to site-related contamination.

Surface Water

- The COPECs for surface water are listed in Table 4-2. The only exceedance of ERBSCs was for barium. No background concentrations were determined for barium. Given that the differences between the highest and lowest detected barium concentrations was less than a factor of three, barium is not considered to be significantly elevated at the Site.
- Antimony and iron were selected as a COPECs due solely to a lack of ERBSCs. Iron concentrations exceeded background by a factor of more than two at four adit seep sample locations (CMM-AS-01, 02, GC5-AS-01, and GF-AS-01). Antimony was not detected (0.4 µg/L) in background samples but was detected in only two adit seep samples (GC5-AS-01 and GF-AS-01) at concentrations less than 2 times the background detection limit. Silver also had no ERBSCs for birds and mammals, and for data collected in 2003 had elevated reporting limits compared to the ERBSC for aquatic life. However, new data with adequate detection limits were collected in 2007 and none of these new samples had concentrations that exceeded the ERBSCs and were very near the detection limits for background samples. Given these arguments, antimony, iron, and silver are not considered to present a significant risk in surface water at the Site.
- Total arsenic, lead, mercury, and selenium concentrations did not exceed ERBSCs, but were selected as COPECs due solely to their potential to bioaccumulate. Out of 17 total samples, total arsenic was detected in 7 samples; lead was detected in 6 samples; mercury in 6 samples; and selenium in 2 samples. These detections occurred primarily in two adit seeps (GC5-AS-01 and GF-AS-01), at the Monumental Mine (MM-SP-SFW-18, MM-SP-SFW-19, and MM-SP-SFW-51), downstream in Granite Creek (GC-ST-SFW-53 and 54). These represent some of the farthest upstream and/or the farthest downstream samples. While the limited number of detections suggests that these COPECs are not widespread and thus, are not likely to bioaccumulate significantly, the fact that they are present at the Monumental Mine area and then reappear downstream of the last mine suggests a potential for the Monumental Mine and Central Mine to be sources of these COPECs to Granite Creek.
- Overall, slightly elevated concentrations of a few COPECs were noted primarily at upstream and downstream stations, but are not consistently elevated, suggesting that widespread (i.e., significant population level) direct or bioaccumulation-related ecological impacts are unlikely due to COPECs in surface water.

Pore Water

- The COPECs for pore water were listed above in Table 4-3. Barium was the only detected COPEC that exceeded an ERBSC. Similar to surface water, barium was not analyzed in background pore water and so, did not have a respective background concentration determined. However, the difference between the lowest and highest detected concentrations was less than a factor of 2 across the 11 samples, all of which had detected concentrations of barium. Thus, barium is not considered to be significantly elevated at the Site.
- Total arsenic, lead, mercury, and selenium concentrations did not exceed ERBSCs, but were selected as COPECs due solely to their potential to bioaccumulate. However, similar to surface water, their presence in only a few sample locations at very low concentrations strongly suggests their presence is not likely to result in population level ecological impacts. However, the highest detected total arsenic concentrations were at the two farthest downstream stations.
- Silver was not detected in pore water at the site, but one-half the maximum reporting limit exceeds the ERBSC by a maximum factor of 12. Given that silver was not detected in any surface water nor pore water samples and the detection limits are still relatively low (2.9 µg/L), it is deemed unlikely that silver contributes to ecological risks at the site.

Sediment

- The COPECs for sediment were listed above in Table 4-4. Total arsenic, cadmium, and zinc were the only COPECs with unacceptable risk ratios. Concentrations of total arsenic, cadmium, and zinc exceeded background concentration by more than a factor of 2 at 5, 8, 7, and 10 samples (out of 27 possible), respectively. Most of the concentrations of these COPECS that exceeded ERBSCs were downstream from the Cap Martin Mine, with the highest concentrations at or downstream of the Tillicum Mine.
- Hazard quotients for aluminum (3), barium (4), cobalt (5), iron (7), thallium (14), and vanadium (12) were selected solely due to a lack of ERBSCs. Iron was the only one of these COPECs with a respective background concentrations and exceeded this by more than a factor of two in only four samples, including a maximum background exceedences factor of three at GC-ABS-3. With no background concentrations for comparison, the difference between the highest detection and lowest detection limit was examined for the remaining COPECs. Aluminum, barium, cobalt, and iron all had differences of less than a factor of 10. Thallium and vanadium had differences that were factors of 14 and 12, respectively. Three stations (SM-ST-PSD-06, TM-ST-PSD-08, and TM-ST-RSD-07) had high concentrations of aluminum, barium, and cobalt. Aluminum was also high at GC-ST-RSD-53 and GC-ST-PSD-53. Three different stations (CMM-ST-PSD-03, SM-ST-RSD-06, and CM-ST-RSD-10) contained the highest concentrations of thallium and vanadium. However, these 6 stations do not correspond to the locations of the highest concentrations of total arsenic and cadmium which are more likely related to past mining activities.
- Mercury was selected as a COPEC due to the lack of a bird/mammal ERBSC and its potential for bioaccumulation. The maximum mercury detection is approximately 34 times higher than the lowest detection at station GC-ST-PSD-54 and 24 times higher at GC-ABS-1. The remainder of the highest detected concentrations were approximately a factor of 4 greater than the lowest detected concentrations, located at or downstream from the Tillicum Mine.
- Overall, iron, selenium, thallium, vanadium, and zinc had a few elevated concentrations that were spread along Granite Creek, while elevated concentrations of total arsenic and cadmium and mercury were detected primarily at multiple downstream locations. Aluminum, barium, and cobalt had elevated concentrations in the vicinity of the Sheridan and Tillicum Mines.

4.3.2 Ecological Hot Spots

- For this ERA, hot spot levels corresponded to a chemical concentrations that exceed both ERBSCs and background concentrations by a factor of 10 or more. For COPECs without corresponding background concentrations, the hot spot analysis is based solely upon exceedance of the ERBSC by a factor of 10 or more.
- There are ecological hot spots in waste rock for antimony, total arsenic, copper, lead, mercury, silver, and zinc. Hot spot concentrations for these were 50, 180, 500, 160, 3, 20, and 905 mg/kg, respectively for waste rock.
- Ecological hot spots were identified for barium and silver in surface water and pore water. A hot spots for zinc also was identified in surface water. The hot spot concentrations (based on exceedance of the ERBSC only) for barium and silver were 40 and 1.2 µg/L, respectively. The hot spot screening for these two COPECs in these two media should not be used for removal action decisions without prior consideration for the lack of background concentrations. A hot spot was also identified for zinc in surface water, with a hot spot concentration of 1,200 µg/L.
- One ecological hot spot was identified for cadmium in sediment. The hot spot concentration for cadmium was 2.2 mg/kg. Aluminum, barium, cobalt, and vanadium could not be assessed for hot spots because no background concentrations were determined for them and no sediment ERBSCs were available.

Table 4-5. Locations of Ecological Hot Spots

Soil	Surface Water	Pore Water	Sediment
MM-ML-SS-12	See text above prior to using surface water or pore water hot spots for removal action decision making.		GC-ST-PSD-54
MM-ML-SSS-16	MM-SP-SFW-18	TM-ST-PWP-07	
MM-ML-SSS-38	MM-SP-SFW-19	TM-ST-PWP-08	
MM-WP-SSS-13	MM-SP-SFW-51	CM-ST-PWP-09	
MM-WP-SSS-14	SM-ST-SFW-06	CM-ST-PWP-10	
MM-WP-SSS-15	TM-ST-SFW-07	CM-ST-PWR-10	
MM-WP-SSS-17	TM-ST-SFW-08	GC-ST-PWP-53	
CMM-WP-SUS-21	CM-ST-SFW-09	GC-ST-PWP-54	
CM-WP-SSS-31	CM-ST-SFW-10		
GF-WR-2	GC-ST-SFW-53		
TILL-WR-1	GC-ST-SFW-54		
CMM-WR4-1	CMM-AS-01		
GC3-WR-01			
GC7-WR-03			

4.3.3 Uncertainty Analysis

- The uncertainty analysis lists the common uncertainties associated with ecological risk-based screening and assesses whether they are likely to over- or underestimate the potential for ecological risks to be realized at the Site.
- This information is combined with that provided above in the risk description section to present conclusions regarding ecological risks. The primary uncertainties associated with this ecological risk-based screening and the impacts on the prediction of the potential for ecological risks are discussed below:
    - The lack of background concentrations for some COIs in surface water, pore water, and sediment, may result in the inclusion of COIs as COPECs that would otherwise be excluded, and increases the number of chemicals and sample locations predicted as hot spots.
    - The risk-based screening assumes the receptors are constantly exposed to the chemical at a concentration equal to the EPC. While this may be true for immobile species such as plants and some terrestrial invertebrates, unless the contamination is widely and evenly spread, it is not realistic for wildlife species. Because the metals are primarily located around waste rock piles and small centers of mining activity, the risks calculated above overestimate the actual risks posed to wildlife.
    - The use of maximum detected concentration or 90UCL as the EPC is a conservative approach that is purposefully designed to result in some overestimation of the potential for ecological risks. Because of this, the risks predicted are likely to overestimate actual ecological risks.
    - Including a sample reporting limit screening is a conservative approach that includes COIs as COPECs when they are actually not detected. Because the undetected COI is likely present at concentrations less than the reporting limit, possibly much less, including the COI as a COPEC result in an overestimation of the potential for ecological risks.
    - The lack of site specific bioavailability data does not allow for a formal assessment of risks due to some COPECs for upper trophic level receptors (i.e., birds and mammals). However, the fact that many metals, especially those that have been exposed to the surface for many years, tend to bind strongly to soil and sediment particles suggesting that many of the metals may not be readily bioavailable. Given this evidence, risks due to the bioaccumulation of COPECs are likely overestimated.
    - Except for aquatic life and benthic macroinvertebrates, the ERBSCs used for this ERA are intended to be no-observed-adverse-effect-levels (NOAELs). Because actual ecological effects occur at an unknown concentration somewhere between the NOAEL and the LOAEL, simply exceeding an

ERBSC does not necessarily indicate the potential for significant ecological effects. Thus, the use of NOAEL-based ERBSCs likely results in an overestimation of the potential for ecological risk.
  - The lack of ERBSCs for some receptors precludes the calculation of risk for those receptors. This may result in an over- or underestimation of the potential for ecological risks. The use of a bioaccumulation screening is a conservative measure used to assess the potential for risks posed to upper trophic level ecological receptors when appropriate ERBSCS are missing.
  - Within this ERA, predictions are made regarding the significance of ecological exposures under current conditions at the Site. Overall, the risk-based screening is designed to overestimate the potential for ecological risks.

4.4 Summary Of Ecological Risks

- Predicted risks due to total arsenic in waste rock piles were predicted at all nine mines, but are especially prevalent at the Monumental, Tillicum, and Golden Fraction Mines, and in waste rock sample collected along Granite Creek. Antimony, lead, mercury, silver, and zinc also contributed notably to the overall predicted risks, but to a lesser extent than total arsenic. It is likely that immobile receptors such as terrestrial plants and invertebrates are adversely impacted within and near waste rock piles. Individual birds and small mammals are likely to be exposed to COPECs in the waste rock piles and may be impacted, but population level impacts are not expected to these terrestrial species because of the relatively limited distribution of the COPECs compared to the home ranges of these more wide-ranging species. The most hot spots were noted for total arsenic at the Monumental Mine. Antimony, lead, mercury, and silver also had hot spots spread primarily across the Monumental Mine, but also present at the Tillicum, Golden Fraction, Cap Martin, and Central Mines and in a couple sample collected from waste rock along Granite Creek.
- Total arsenic, cadmium, and total chromium in vegetation were the only COPECs present at concentrations greater than five times higher than in background vegetation. Only total arsenic was elevated more than 10 times higher than background.
- The only elevated risk ratios for COPECs in surface water and pore water were for barium and zinc. Silver also had elevated risk ratios in pore water. The risks attributed to barium and silver likely would not have been as pronounced if background COPEC concentrations were available for these media. All other COPECs other than barium were selected solely due to their potential to bioaccumulate or a lack of ERBSCs. While barium and silver were indicated as having hot spots in both surface water and pore water, these hot spots may be solely related to the lack of background concentrations for barium and the elevated detection limits for silver. The farthest upstream and farthest downstream stations have the highest concentrations of several COPECs in surface water and pore water. This suggests Monumental Mine and Tillicum Mine (or other downstream source) may be contributing a majority of the COPECs to the Creek.
- Total arsenic, cadmium, and zinc in sediment had elevated risk ratios. These appear likely to have the potential to impact immobile receptors or those that are frequently exposed to COPECs in sediment. Cadmium was the only COPEC that had a hot spot that exceeded both the ERBSC and background concentrations by a factor of more than 10.

5.0 CONCLUSIONS

- The following conclusions were developed from the human health risk assessment:
  - The risk assessment determined that there are no unacceptable non-carcinogenic human health risks from exposure to waste rock, and sediment.
  - Ingestion of arsenic in waste rock exceeded the regulatory standard for ECR under CTE exposure conditions.
  - Risks from ingestion and dermal contact with arsenic impacted soil under the RME exposure conditions exceeded the ODEQ's regulatory standard of 1×10^{-6}.

- o Based on the Site topography and its isolated location within the WWNF, it is highly unlikely that recreational users would engage in activities at the Site that could result in significant ingestion of soil, thus, the most likely pathway of exposure at the Site is inhalation of particulates. The quantitative risk assessment determined that the inhalation pathway did not result in unacceptable health impacts.
  - o No hot spots were identified at the Site.
- The following conclusions were developed from the ecological risk assessment:
  - o Ecological impacts were predicted primarily for terrestrial plants and terrestrial invertebrates (i.e., immobile species), due to COPECs in soil/waste rock at several of the mines. Local and regional populations of these and other terrestrial species are unlikely to be significantly impacted.
  - o Likely insignificant ecological impacts were predicted for aquatic life and wildlife exposed to COPECs in surface water and pore water. However, the lack of background concentrations for some COPECs in these media made it difficult to predict the potential for impacts.
  - o Benthic invertebrates and wildlife appear to have the potential to be impacted due primarily to total arsenic, cadmium, and zinc, which are present at elevated concentrations in many sediment sample locations, but are particularly prevalent in the downstream portions of the creek.
  - o The Monumental and Tillicum Mines appear to have more locations with elevated COPEC concentrations in waste rock than the other mines and, in general, the sediment sample locations near and downstream of the Tillicum Mine had the highest COPEC concentrations.

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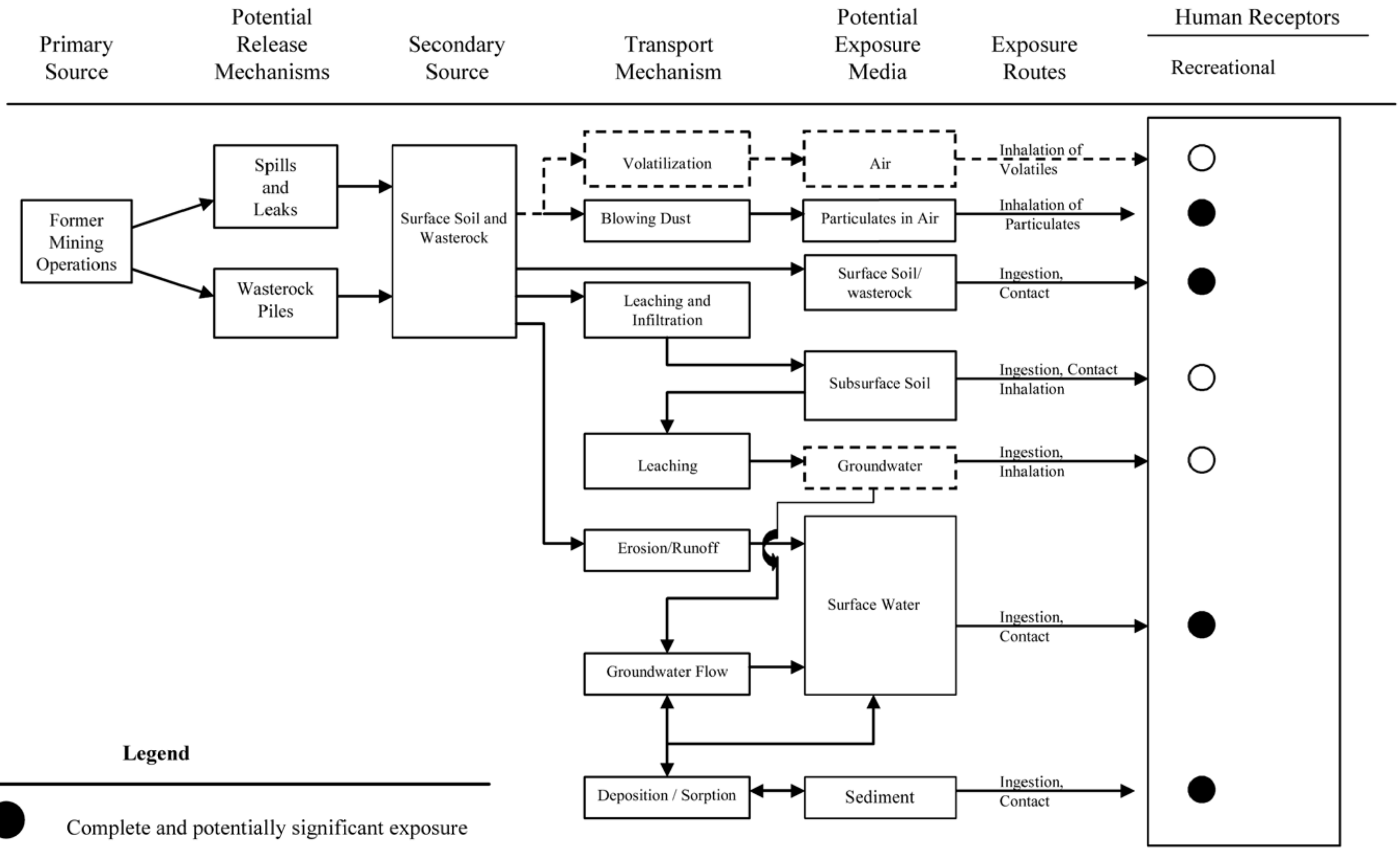
Figure 3-1. Conceptual Human Health Exposure Model



Legend

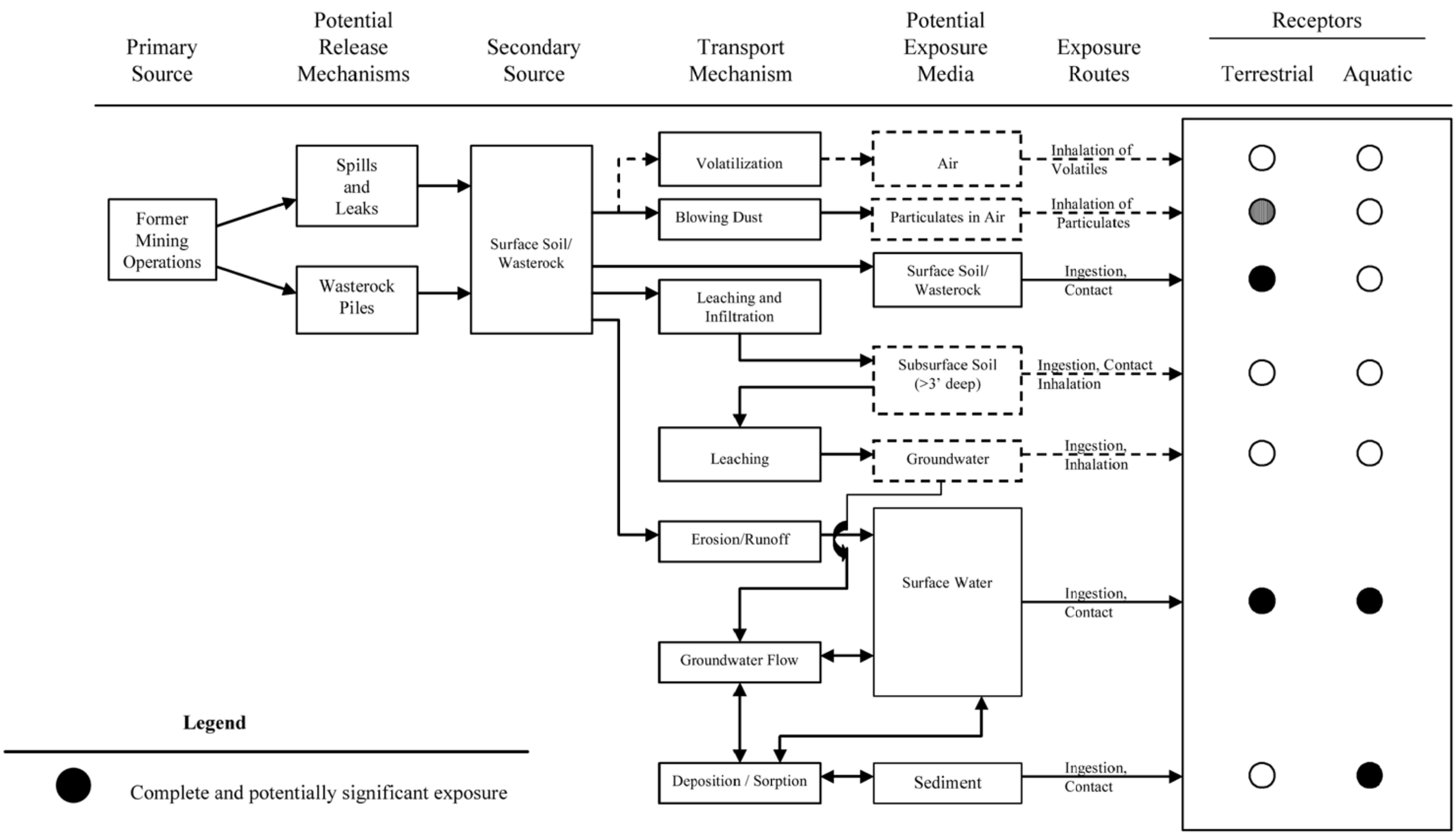
- ● Complete and potentially significant exposure
- ◍ Potentially Complete but insignificant exposure (not to be quantified)
- ○ Incomplete Exposure (not to be quantified)
- - - Insignificant or Incomplete Pathway or Medium
- — Complete and/or Significant Pathway or Medium

(SOURCE: TAS, 1/30/06)

Figure 3-1. Conceptual Human Exposure Model

PROJECT NUMBER: 2523046	RISK ASSESSMENT
DATE: 04/08/06	
DWG. DGW / DWG NO: 2523046F1.dwg	GRANITE CREEK TRIBUTARY WALLOWA WHITMAN NATIONAL FOREST
PROJECT MANAGER: DGW	
REVISED:	CASCADE EARTH SCIENCES A Valmont Industries Company

Figure 4-1. Conceptual Ecological Exposure Model



Legend

- ● Complete and potentially significant exposure
- ◐ Potentially Complete but insignificant exposure (not to be quantified)
- ○ Incomplete Exposure (not to be quantified)
- - - Insignificant or Incomplete Pathway or Medium
- — Complete and/or Significant Pathway or Medium

Figure 4-1. Conceptual Ecological Exposure Model

(SOURCE: TAS, 1/30/06)

PROJECT NUMBER: 2523046	RISK ASSESSMENT
DATE: 04/08/06	
DWG. DGW / DWG NO: 2523046F2.dwg	GRANITE CREEK TRIBUTARY WALLOWA WHITMAN NATIONAL FOREST
PROJECT MANAGER: DGW	
REVISED:	CASCADE EARTH SCIENCES A Valmont Industries Company

Appendix A. Data Summary and Initial Screening

Appendix A1. Data Summary and Initial Ecological Screening for Surface Soil
Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

Chemical of Interest	Number of Analyses	Number of Detections	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	90% Upper Confidence Limit	Exposure Point Concentration [1]	Half of Minimum Sample Reporting Limit	Half of Maximum Sample Reporting Limit	Minimum Soil Ecological Risk-Based Screening Concentration	Minimum Human Health Risk-Based Screening Concentration	Maximum Background Concentration [1]	Exceeds 5% Frequency of Detection?	Reporting Limit Too High For Ecological Receptors?	Reporting Limit Too High for Human Health?	Maximum Concentration Exceeds Background?	Ecological Chemical of Interest?	Human Health Chemical of Interest?
				mg/kg														
Metals																		
Aluminum	17	17	100%	1.11E+03	1.75E+04	1.06E+04	1.06E+04	NA	NA	5.00E+01	1.00E+05	3.12E+04	Yes	No	No	No	No	No
Antimony	38	31	82%	3.00E-01	3.68E+02	4.11E+01	4.11E+01	1.00E-01	5.00E-01	5.00E+00	4.09E+02	8.40E-01	Yes	No	No	Yes	Yes	Yes
Arsenic, total	38	38	100%	1.70E+00	1.14E+04	1.79E+03	1.79E+03	NA	NA	1.00E+01	1.59E+00	4.35E+01	Yes	No	No	Yes	Yes	Yes
Barium	17	17	100%	3.28E+01	3.22E+02	1.82E+02	1.82E+02	NA	NA	8.50E+01	6.66E+04	3.19E+02	Yes	No	No	Yes	Yes	Yes
Beryllium	38	31	82%	3.30E-02	7.00E-01	3.40E-01	3.40E-01	1.00E-01	1.00E-01	1.00E+01	1.94E+03	1.20E+00	Yes	No	No	No	No	No
Cadmium	38	34	89%	1.70E-01	2.34E+01	4.77E+00	4.77E+00	1.25E-02	3.20E-02	4.00E+00	4.51E+02	2.03E+00	Yes	No	No	Yes	Yes	Yes
Chromium, Total	38	37	97%	1.40E+00	2.00E+01	8.64E+00	8.64E+00	5.00E-01	5.00E-01	4.00E-01	4.48E+02	7.00E+01	Yes	No	No	No	No	No
Cobalt	17	17	100%	6.00E-01	1.05E+01	7.49E+00	7.49E+00	NA	NA	2.00E+01	1.92E+03	1.13E+01	Yes	No	No	No	No	No
Copper	38	38	100%	3.00E+00	6.98E+02	5.21E+01	5.21E+01	NA	NA	5.00E+01	4.09E+04	6.70E+01	Yes	No	No	Yes	Yes	Yes
Iron	38	38	100%	2.65E+03	9.73E+04	2.78E+04	2.78E+04	NA	NA	1.00E+01	1.00E+05	3.53E+04	Yes	No	No	Yes	Yes	Yes
Lead	38	38	100%	8.50E-01	2.43E+03	5.95E+02	5.95E+02	NA	NA	1.60E+01	8.00E+02	8.40E+00	Yes	No	No	Yes	Yes	Yes
Manganese	38	38	100%	2.53E+01	1.26E+03	5.85E+02	5.85E+02	NA	NA	1.00E+02	1.95E+04	1.06E+03	Yes	No	No	Yes	Yes	Yes
Mercury	38	33	87%	4.80E-02	7.84E+02	6.25E+01	6.25E+01	2.00E-02	2.50E-02	1.00E-01	3.07E+02	1.40E-01	Yes	No	No	Yes	Yes	Yes
Nickel	38	37	97%	4.00E-01	9.60E+00	4.97E+00	4.97E+00	5.00E-01	5.00E-01	3.00E+01	2.04E+04	7.00E+01	Yes	No	No	No	No	No
Selenium	38	38	100%	1.70E-01	3.26E+00	7.21E-01	7.21E-01	NA	NA	1.00E+00	5.11E+03	7.60E-01	Yes	No	No	Yes	Yes	Yes
Silver	38	37	97%	8.00E-02	3.19E+02	4.70E+01	4.70E+01	1.05E-01	1.05E-01	2.00E+00	5.11E+03	6.30E-01	Yes	No	No	Yes	Yes	Yes
Thallium	17	13	76%	3.40E-01	3.30E+00	1.52E+00	1.52E+00	1.15E-01	2.30E-01	1.00E+00	6.75E+01	9.70E-01	Yes	No	No	Yes	Yes	Yes
Vanadium	17	17	100%	5.10E+00	9.61E+01	4.49E+01	4.49E+01	NA	NA	2.00E+00	1.02E+03	4.78E+01	Yes	No	No	Yes	Yes	Yes
Zinc	38	38	100%	4.00E+00	2.41E+03	3.67E+02	3.67E+02	NA	NA	5.00E+01	1.00E+05	1.45E+02	Yes	No	No	Yes	Yes	Yes

NOTES:
Abbreviations: mg/kg = milligrams per kilogram, NA = not applicable.
1 90th percentile upper confidence limit on the mean or maximum (whichever is lower).

Appendix A2. Data Summary and Initial Human Health Screening for Surface Soil
Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

Chemical of Interest	Number of Analyses	Number of Detections	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	90% Upper Confidence Limit	Exposure Point Concentration [1]	Half of Minimum Sample Reporting Limit	Half of Maximum Sample Reporting Limit	Minimum Soil Ecological Risk-Based Screening Concentration	Minimum Human Health Risk-Based Screening Concentration	Maximum Background Concentration [1]	Exceeds 5% Frequency of Detection?	Reporting Limit Too High For Ecological Receptors?	Reporting Limit Too High for Human Health?	Maximum Concentration Exceeds Background?	Ecological Chemical of Interest?	Human Health Chemical of Interest?
				mg/kg														
Metals																		
Aluminum	14	14	100%	1.11E+03	1.75E+04	1.03E+04	1.03E+04	NA	NA	5.00E+01	1.00E+05	3.12E+04	Yes	No	No	No	No	No
Antimony	35	28	80%	3.00E-01	3.68E+02	4.44E+01	4.44E+01	1.00E-01	5.00E-01	5.00E+00	4.09E+02	8.40E-01	Yes	No	No	Yes	Yes	Yes
Arsenic, total	35	35	100%	1.70E+00	1.14E+04	2.25E+03	2.25E+03	NA	NA	1.00E+01	1.59E+00	4.35E+01	Yes	No	No	Yes	Yes	Yes
Barium	14	14	100%	3.28E+01	3.22E+02	1.86E+02	1.86E+02	NA	NA	8.50E+01	6.66E+04	3.19E+02	Yes	No	No	Yes	Yes	Yes
Beryllium	35	28	80%	3.30E-02	7.00E-01	3.33E-01	3.33E-01	1.00E-01	1.00E-01	1.00E+01	1.94E+03	1.20E+00	Yes	No	No	No	No	No
Cadmium	35	32	91%	1.70E-01	2.34E+01	4.51E+00	4.51E+00	1.35E-02	3.20E-02	4.00E+00	4.51E+02	2.03E+00	Yes	No	No	Yes	Yes	Yes
Chromium, Total	35	34	97%	1.40E+00	2.00E+01	8.81E+00	8.81E+00	5.00E-01	5.00E-01	4.00E-01	4.48E+02	7.00E+01	Yes	No	No	No	No	No
Cobalt	14	14	100%	6.00E-01	1.05E+01	7.36E+00	7.36E+00	NA	NA	2.00E+01	1.92E+03	1.13E+01	Yes	No	No	No	No	No
Copper	35	35	100%	3.00E+00	6.98E+02	5.46E+01	5.46E+01	NA	NA	5.00E+01	4.09E+04	6.70E+01	Yes	No	No	Yes	Yes	Yes
Iron	35	35	100%	2.65E+03	9.73E+04	2.84E+04	2.84E+04	NA	NA	1.00E+01	1.00E+05	3.53E+04	Yes	No	No	Yes	Yes	Yes
Lead	35	35	100%	8.50E-01	2.43E+03	7.19E+02	7.19E+02	NA	NA	1.60E+01	8.00E+02	8.40E+00	Yes	No	No	Yes	Yes	Yes
Manganese	35	35	100%	2.53E+01	1.26E+03	5.92E+02	5.92E+02	NA	NA	1.00E+02	1.95E+04	1.06E+03	Yes	No	No	Yes	Yes	Yes
Mercury	35	30	86%	4.80E-02	7.84E+02	6.78E+01	6.78E+01	2.00E-02	2.50E-02	1.00E-01	3.07E+02	1.40E-01	Yes	No	No	Yes	Yes	Yes
Nickel	35	34	97%	4.00E-01	9.60E+00	5.03E+00	5.03E+00	5.00E-01	5.00E-01	3.00E+01	2.04E+04	7.00E+01	Yes	No	No	No	No	No
Selenium	35	35	100%	1.70E-01	3.26E+00	7.28E-01	7.28E-01	NA	NA	1.00E+00	5.11E+03	7.60E-01	Yes	No	No	Yes	Yes	Yes
Silver	35	34	97%	8.00E-02	3.19E+02	6.33E+01	6.33E+01	1.05E-01	1.05E-01	2.00E+00	5.11E+03	6.30E-01	Yes	No	No	Yes	Yes	Yes
Thallium	14	11	79%	3.40E-01	3.30E+00	1.60E+00	1.60E+00	1.30E-01	2.30E-01	1.00E+00	6.75E+01	9.70E-01	Yes	No	No	Yes	Yes	Yes
Vanadium	14	14	100%	5.10E+00	9.61E+01	4.58E+01	4.58E+01	NA	NA	2.00E+00	1.02E+03	4.78E+01	Yes	No	No	Yes	Yes	Yes
Zinc	35	35	100%	4.00E+00	2.41E+03	3.61E+02	3.61E+02	NA	NA	5.00E+01	1.00E+05	1.45E+02	Yes	No	No	Yes	Yes	Yes

NOTES:
Abbreviations: mg/kg = milligrams per kilogram, NA = not applicable.
1 90th percentile upper confidence limit on the mean or maximum (whichever is lower).

Appendix A3. Data Summary and Initial Human Health Screening for Subsurface Soil
Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

Chemical of Interest	Number of Analyses	Number of Detections	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	90% Upper Confidence Limit	Exposure Point Concentration [1]	Half of Minimum Sample Reporting Limit	Half of Maximum Sample Reporting Limit	Minimum Soil Ecological Risk-Based Screening Concentration	Minimum Human Health Risk-Based Screening Concentration	Maximum Background Concentration [1]	Exceeds 5% Frequency of Detection?	Reporting Limit Too High For Ecological Receptors?	Reporting Limit Too High for Human Health?	Maximum Concentration Exceeds Background?	Human Health Chemical of Interest?
				mg/kg													
Metals																	
Aluminum	10	10	100%	4.68E+03	1.76E+04	1.30E+04	1.30E+04	NA	NA	5.00E+01	1.00E+05	3.12E+04	Yes	No	No	No	No
Antimony	10	10	100%	3.80E-01	6.00E+00	3.74E+00	3.74E+00	NA	NA	5.00E+00	4.09E+02	8.40E-01	Yes	No	No	Yes	Yes
Arsenic, total	10	10	100%	1.01E+01	5.44E+02	2.41E+02	2.41E+02	NA	NA	1.00E+01	1.59E+00	4.35E+01	Yes	No	No	Yes	Yes
Barium	10	10	100%	1.38E+02	2.25E+02	1.91E+02	1.91E+02	NA	NA	8.50E+01	6.66E+04	3.19E+02	Yes	No	No	No	No
Beryllium	10	10	100%	2.10E-01	5.00E-01	FALSE	5.00E-01	NA	NA	1.00E+01	1.94E+03	1.20E+00	Yes	No	No	No	No
Cadmium	10	8	80%	5.20E-01	1.41E+01	5.35E+00	5.35E+00	1.25E-02	1.35E-02	4.00E+00	4.51E+02	2.03E+00	Yes	No	No	Yes	Yes
Chromium, Total	10	10	100%	3.30E+00	1.33E+01	8.42E+00	8.42E+00	NA	NA	4.00E-01	4.48E+02	7.00E+01	Yes	No	No	No	No
Cobalt	10	10	100%	6.40E+00	9.90E+00	8.62E+00	8.62E+00	NA	NA	2.00E+01	1.92E+03	1.13E+01	Yes	No	No	No	No
Copper	10	10	100%	5.50E+00	4.35E+01	FALSE	4.35E+01	NA	NA	5.00E+01	4.09E+04	6.70E+01	Yes	No	No	No	No
Iron	10	10	100%	1.88E+04	2.82E+04	2.34E+04	2.34E+04	NA	NA	1.00E+01	1.00E+05	3.53E+04	Yes	No	No	No	No
Lead	10	10	100%	3.60E+00	1.20E+02	5.37E+01	5.37E+01	NA	NA	1.60E+01	8.00E+02	8.40E+00	Yes	No	No	Yes	Yes
Manganese	10	10	100%	2.70E+02	8.33E+02	6.82E+02	6.82E+02	NA	NA	1.00E+02	1.95E+04	1.06E+03	Yes	No	No	No	No
Mercury	10	10	100%	2.60E-02	6.10E-01	2.96E-01	2.96E-01	NA	NA	1.00E-01	3.07E+02	1.40E-01	Yes	No	No	Yes	Yes
Nickel	10	10	100%	3.90E+00	9.70E+00	6.54E+00	6.54E+00	NA	NA	3.00E+01	2.04E+04	7.00E+01	Yes	No	No	No	No

NOTES:
Abbreviations: mg/kg = milligrams per kilogram, NA = not applicable.
1 90th percentile upper confidence limit on the mean or maximum (whichever is lower).

Appendix A4. Data Summary and Initial Ecological Screening for Vegetation
Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

Chemical of Interest	Number of Analyses	Number of Detections	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	90% Upper Confidence Limit	Exposure Point Concentration [1]	Half of Minimum Sample Reporting Limit	Half of Maximum Sample Reporting Limit	Minimum Terrestrial Ecological Risk-Based Screening Concentration	Maximum Background Concentration [1]	Exceeds 5% Frequency of Detection?	Reporting Limit Too High For Ecological Receptors?	Maximum Concentration Exceeds Background?	Ecological Chemical of Interest?
				mg/kg											
Metals															
Aluminum	6	6	100%	1.53E+02	2.84E+02	NA	2.84E+02	NA	NA	No Data	3.12E+02	Yes	No	No	No
Antimony	6	0	0%	ND	ND	NA	0.00E+00	4.70E-01	6.50E-01	No Data	0.00E+00	No	No	No	No
Arsenic, total	6	3	50%	1.00E+00	1.06E+01	NA	1.06E+01	6.00E-01	7.00E-01	No Data	0.00E+00	Yes	No	Yes	Yes
Barium	6	6	100%	5.19E+01	2.90E+02	NA	2.90E+02	NA	NA	No Data	5.05E+02	Yes	No	No	No
Beryllium	6	6	100%	8.70E-02	1.60E-01	NA	1.60E-01	NA	NA	No Data	1.20E-01	Yes	No	Yes	Yes
Cadmium	6	5	83%	5.00E-01	2.60E+00	NA	2.60E+00	7.50E-02	7.50E-02	No Data	3.70E-01	Yes	No	Yes	Yes
Chromium, Total	6	2	33%	4.80E-01	1.70E+00	NA	1.70E+00	1.80E-01	1.90E-01	No Data	0.00E+00	Yes	No	Yes	Yes
Cobalt	6	0	0%	ND	ND	NA	0.00E+00	2.00E-01	2.85E-01	No Data	0.00E+00	No	No	No	No
Copper	6	6	100%	4.60E+00	6.10E+00	NA	6.10E+00	NA	NA	No Data	5.70E+00	Yes	No	Yes	Yes
Iron	6	6	100%	1.97E+02	6.42E+02	NA	6.42E+02	NA	NA	No Data	3.15E+02	Yes	No	Yes	Yes
Lead	6	6	100%	5.00E-01	2.70E+00	NA	2.70E+00	NA	NA	No Data	1.10E+00	Yes	No	Yes	Yes
Manganese	6	6	100%	1.18E+02	2.91E+02	NA	2.91E+02	NA	NA	No Data	3.24E+02	Yes	No	No	No
Mercury	6	4	67%	5.00E-02	9.20E-02	NA	9.20E-02	2.30E-02	2.60E-02	No Data	0.00E+00	Yes	No	Yes	Yes
Nickel	6	0	0%	ND	ND	NA	0.00E+00	2.10E-01	3.00E-01	No Data	0.00E+00	No	No	No	No
Selenium	6	2	33%	7.00E-01	9.10E-01	NA	9.10E-01	4.35E-01	4.85E-01	No Data	1.40E+00	Yes	No	No	No
Silver	6	0	0%	ND	ND	NA	0.00E+00	2.20E-01	3.15E-01	No Data	0.00E+00	No	No	No	No
Thallium	6	0	0%	ND	ND	NA	0.00E+00	5.50E-01	8.00E-01	No Data	0.00E+00	No	No	No	No
Vanadium	6	6	100%	7.60E-01	1.20E+00	NA	1.20E+00	NA	NA	No Data	9.40E-01	Yes	No	Yes	Yes
Zinc	6	6	100%	1.67E+01	7.02E+01	NA	7.02E+01	NA	NA	No Data	2.14E+01	Yes	No	Yes	Yes

NOTES:
Abbreviations: mg/kg = milligrams per kilogram, NA = not applicable, ND = not detected.
1 90th percentile upper confidence limit on the mean or maximum (whichever is lower).

Appendix A5. Data Summary and Initial Screening for Surface Water
Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

Chemical of Interest	Number of Analyses	Number of Detections	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	90% Upper Confidence Limit	Exposure Point Concentration [1]	Half of Minimum Sample Reporting Limit	Half of Maximum Sample Reporting Limit	Minimum Surface Water Ecological Risk-Based Screening Concentration	Minimum Human Health Risk-Based Screening Concentration	Maximum Background Concentration [1]	Exceeds 5% Frequency of Detection?	Reporting Limit Too High For Ecological Receptors?	Reporting Limit Too High for Human Health?	Maximum Concentration Exceeds Background?	Ecological Chemical of Interest?	Human Health Chemical of Interest?
				mg/L														
Metals																		
Aluminum	13	3	23%	2.64E-02	1.26E-01	4.87E-02	4.87E-02	1.18E-02	3.16E-02	8.70E-02	3.65E+01	0.00E+00	Yes	No	No	Yes	Yes	Yes
Antimony	17	2	12%	7.00E-04	9.00E-04	2.27E-03	9.00E-04	2.00E-04	2.50E-03	1.00E+00	1.46E-02	0.00E+00	Yes	No	No	Yes	Yes	Yes
Arsenic, Total	17	7	41%	1.30E-03	8.18E-02	1.78E-02	1.78E-02	2.50E-04	3.00E-03	1.50E-01	4.48E-05	6.00E-04	Yes	No	Yes	Yes	Yes	Yes
Barium	13	13	100%	3.49E-02	9.95E-02	6.22E-02	6.22E-02	NA	NA	4.00E-03	2.55E+00	0.00E+00	Yes	No	No	Yes	Yes	Yes
Beryllium	17	0	0%	ND	ND	1.53E-04	0.00E+00	5.00E-05	2.00E-04	5.30E-03	7.30E-02	0.00E+00	No	No	No	No	No	No
Cadmium	17	2	12%	1.00E-04	7.00E-04	4.47E-04	4.47E-04	5.00E-05	6.00E-04	2.20E-03	1.82E-02	0.00E+00	Yes	No	No	Yes	Yes	Yes
Chromium, Total	17	1	6%	7.40E-04	7.40E-04	2.37E-03	7.40E-04	7.00E-04	5.00E-03	1.10E-02	No Data	0.00E+00	Yes	No	No	Yes	Yes	Yes
Cobalt	13	0	0%	ND	ND	1.62E-03	0.00E+00	9.00E-04	1.85E-03	2.30E-02	7.30E-01	0.00E+00	No	No	No	No	No	No
Copper	17	2	12%	7.00E-04	3.80E-03	1.56E-03	1.56E-03	2.50E-04	1.65E-03	9.00E-03	1.46E+00	0.00E+00	Yes	No	No	Yes	Yes	Yes
Iron	17	6	35%	3.23E-02	2.03E+00	6.43E-01	6.43E-01	8.40E-03	3.34E-02	1.00E+00	1.09E+01	1.00E-01	Yes	No	No	Yes	Yes	Yes
Lead	17	6	35%	1.00E-04	9.00E-03	2.13E-03	2.13E-03	5.00E-05	7.50E-04	2.50E-03	No Data	1.00E-04	Yes	No	No	Yes	Yes	Yes
Manganese	17	13	76%	7.20E-04	3.74E-01	1.01E-01	1.01E-01	3.50E-04	9.50E-04	1.20E-01	8.76E-01	0.00E+00	Yes	No	No	Yes	Yes	Yes
Mercury	17	6	35%	9.50E-07	2.00E-04	7.57E-05	7.57E-05	5.00E-05	5.00E-05	7.70E-04	1.09E-02	4.80E-07	Yes	No	No	Yes	Yes	Yes
Nickel	17	0	0%	ND	ND	2.88E-03	0.00E+00	1.00E-03	5.00E-03	5.20E-02	7.30E-01	0.00E+00	No	No	No	No	No	No
Selenium	17	2	12%	5.00E-04	2.60E-03	1.26E-03	1.26E-03	5.00E-05	1.70E-03	5.00E-03	1.82E-01	0.00E+00	Yes	No	No	Yes	Yes	Yes
Silver	17	1	6%	9.00E-05	9.00E-05	1.20E-03	9.00E-05	2.50E-05	1.45E-03	1.20E-04	1.82E-01	0.00E+00	Yes	Yes	No	Yes	Yes	Yes
Thallium	13	0	0%	ND	ND	2.22E-03	0.00E+00	1.40E-03	2.85E-03	4.00E-02	2.41E-03	0.00E+00	No	No	Yes	No	No	Yes
Vanadium	13	0	0%	ND	ND	1.52E-03	0.00E+00	1.00E-03	1.80E-03	2.00E-02	3.65E-02	0.00E+00	No	No	No	No	No	No
Zinc	17	14	82%	2.00E-03	1.31E+00	2.31E-01	2.31E-01	2.85E-03	5.00E-03	1.20E-01	1.09E+01	1.00E-02	Yes	No	No	Yes	Yes	Yes

NOTES:
Abbreviations: mg/L = milligrams per liter, NA = not applicable, ND = not detected.
1 90th percentile upper confidence limit on the mean or maximum (whichever is lower).

Appendix A6. Data Summary and Initial Screening for Pore Water
Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

Chemical of Interest	Number of Analyses	Number of Detections	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	90% Upper Confidence Limit	Exposure Point Concentration [1]	Half of Minimum Sample Reporting Limit	Half of Maximum Sample Reporting Limit	Minimum Surface Water Ecological Risk-Based Screening Concentration	Maximum Background Concentration [1]	Exceeds 5% Frequency of Detection?	Reporting Limit Too High For Ecological Receptors?	Maximum Concentration Exceeds Background?	Ecological Chemical of Interest?
				mg/L											
Metals															
Aluminum	11	2	18%	4.57E-02	6.05E-02	3.17E-02	3.17E-02	1.18E-02	3.16E-02	8.70E-02	0.00E+00	Yes	No	Yes	Yes
Antimony	14	0	0%	ND	ND	2.24E-03	0.00E+00	2.00E-04	2.50E-03	1.00E+00	0.00E+00	No	No	No	No
Arsenic, Total	14	7	50%	8.00E-04	1.67E-02	6.49E-03	6.49E-03	2.40E-03	3.00E-03	1.50E-01	3.40E-03	Yes	No	Yes	Yes
Barium	11	11	100%	3.10E-02	6.08E-02	4.85E-02	4.85E-02	NA	NA	4.00E-03	0.00E+00	Yes	No	Yes	Yes
Beryllium	14	0	0%	ND	ND	4.42E-04	0.00E+00	1.00E-04	1.00E-03	5.30E-03	0.00E+00	No	No	No	No
Cadmium	14	0	0%	ND	ND	3.75E-04	0.00E+00	5.00E-05	6.00E-04	2.20E-03	0.00E+00	No	No	No	No
Chromium, Total	14	3	21%	1.00E-02	1.00E-02	4.41E-03	4.41E-03	7.00E-04	9.50E-04	1.10E-02	1.00E-02	Yes	No	No	No
Cobalt	11	0	0%	ND	ND	1.39E-03	0.00E+00	1.00E-03	1.85E-03	2.30E-02	0.00E+00	No	No	No	No
Copper	14	0	0%	ND	ND	2.79E-03	0.00E+00	1.20E-03	5.00E-03	9.00E-03	0.00E+00	No	No	No	No
Iron	14	2	14%	2.33E-02	5.56E+00	1.21E+00	1.21E+00	8.40E-03	3.34E-02	1.00E+00	5.56E+00	Yes	No	No	No
Lead	14	6	43%	2.00E-04	2.40E-03	1.16E-03	1.16E-03	6.50E-04	6.50E-04	2.50E-03	3.00E-04	Yes	No	Yes	Yes
Manganese	14	11	79%	7.00E-04	2.59E-01	5.61E-02	5.61E-02	9.50E-04	2.50E-03	1.20E-01	2.59E-01	Yes	No	No	No
Mercury	14	3	21%	2.40E-07	1.20E-04	5.74E-05	5.74E-05	5.00E-08	5.00E-05	7.70E-04	6.60E-07	Yes	No	Yes	Yes
Nickel	14	0	0%	ND	ND	2.70E-03	0.00E+00	1.05E-03	5.00E-03	5.20E-02	0.00E+00	No	No	No	No
Selenium	14	1	7%	3.50E-03	3.50E-03	1.47E-03	1.47E-03	5.00E-05	1.70E-03	5.00E-03	0.00E+00	Yes	No	Yes	Yes
Silver	14	0	0%	ND	ND	1.12E-03	0.00E+00	2.50E-05	1.45E-03	1.20E-04	0.00E+00	No	Yes	No	Yes
Thallium	11	1	9%	4.10E-03	4.10E-03	2.76E-03	2.76E-03	1.40E-03	2.85E-03	4.00E-02	0.00E+00	Yes	No	Yes	Yes
Vanadium	11	0	0%	ND	ND	1.36E-03	0.00E+00	1.00E-03	1.80E-03	2.00E-02	0.00E+00	No	No	No	No
Zinc	14	11	79%	1.70E-03	5.90E-03	4.52E-03	4.52E-03	5.00E-03	5.00E-03	1.20E-01	0.00E+00	Yes	No	Yes	Yes

NOTES:
Abbreviations: mg/L = milligrams per liter, NA = not applicable, ND = not detected.
1 90th percentile upper confidence limit on the mean or maximum (whichever is lower).

Appendix A7. Data Summary and Initial Screening for Sediment
Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

Chemical of Interest	Number of Analyses	Number of Detections	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	90% Upper Confidence Limit	Exposure Point Concentration [1]	Half of Minimum Sample Reporting Limit	Half of Maximum Sample Reporting Limit	Minimum Sediment Ecological Risk-Based Screening Concentration	Minimum Human Health Risk-Based Screening Concentration	Maximum Background Concentration [1]	Exceeds 5% Frequency of Detection?	Reporting Limit Too High For Ecological Receptors?	Reporting Limit Too High for Human Health?	Maximum Concentration Exceeds Background?	Ecological Chemical of Interest?	Human Health Chemical of Interest?
				mg/kg														
Metals																		
Aluminum	20	20	100%	3.82E+03	1.17E+04	7.89E+03	7.89E+03	NA	NA	No Data	1.00E+05	0.00E+00	Yes	No	No	Yes	Yes	Yes
Antimony	27	16	59%	3.00E-01	5.10E+00	1.43E+00	1.43E+00	1.00E-01	2.75E-01	3.00E+00	4.09E+02	3.00E-01	Yes	No	No	Yes	Yes	Yes
Arsenic, total	27	27	100%	6.30E+00	3.03E+02	7.71E+01	7.71E+01	NA	NA	4.00E+00	1.59E+00	3.65E+01	Yes	No	No	Yes	Yes	Yes
Barium	20	20	100%	5.23E+01	2.17E+02	1.35E+02	1.35E+02	NA	NA	No Data	6.66E+04	0.00E+00	Yes	No	No	Yes	Yes	Yes
Beryllium	27	25	93%	1.10E-01	8.00E-01	3.50E-01	3.50E-01	1.00E-01	1.00E-01	1.22E+02	1.94E+03	8.00E-01	Yes	No	No	No	No	No
Cadmium	27	15	56%	6.90E-02	2.80E+00	6.47E-01	6.47E-01	2.65E-02	4.30E-02	3.00E-03	4.51E+02	2.20E-01	Yes	No	No	Yes	Yes	Yes
Chromium, Total	27	27	100%	2.30E+00	4.56E+01	1.71E+01	1.71E+01	NA	NA	3.70E+01	4.48E+02	1.00E+01	Yes	No	No	Yes	Yes	Yes
Cobalt	20	20	100%	1.90E+00	9.60E+00	6.72E+00	6.72E+00	NA	NA	No Data	1.92E+03	0.00E+00	Yes	No	No	Yes	Yes	Yes
Copper	27	27	100%	1.30E+00	3.00E+01	9.92E+00	9.92E+00	NA	NA	1.00E+01	4.09E+04	0.00E+00	Yes	No	No	Yes	Yes	Yes
Iron	27	27	100%	5.65E+03	5.46E+04	2.46E+04	2.46E+04	NA	NA	No Data	1.00E+05	1.66E+04	Yes	No	No	Yes	Yes	Yes
Lead	27	27	100%	1.89E+00	1.48E+02	3.39E+01	3.39E+01	NA	NA	3.50E+01	8.00E+02	2.63E+00	Yes	No	No	Yes	Yes	Yes
Manganese	27	27	100%	1.00E+02	6.11E+02	3.03E+02	3.03E+02	NA	NA	1.10E+03	1.95E+04	2.98E+02	Yes	No	No	Yes	Yes	Yes
Mercury	27	18	67%	2.70E-02	3.20E-01	1.14E-01	1.14E-01	9.50E-03	2.50E-02	2.00E-01	3.07E+02	1.00E-01	Yes	No	No	Yes	Yes	Yes
Nickel	27	25	93%	1.00E+00	7.60E+00	4.43E+00	4.43E+00	5.00E-01	5.00E-01	1.80E+01	2.04E+04	1.00E+00	Yes	No	No	Yes	Yes	Yes
Selenium	27	27	100%	9.00E-02	8.80E-01	5.06E-01	5.06E-01	NA	NA	1.00E-01	5.11E+03	3.10E-01	Yes	No	No	Yes	Yes	Yes
Silver	27	24	89%	5.00E-02	7.90E+00	2.02E+00	2.02E+00	4.70E-02	5.00E-02	4.50E+00	5.11E+03	1.30E-01	Yes	No	No	Yes	Yes	Yes
Thallium	20	12	60%	3.00E-01	1.80E+00	7.89E-01	7.89E-01	1.25E-01	3.35E-01	7.00E-01	6.75E+01	0.00E+00	Yes	No	No	Yes	Yes	Yes
Vanadium	20	20	100%	1.30E+01	1.54E+02	7.10E+01	7.10E+01	NA	NA	No Data	1.02E+03	0.00E+00	Yes	No	No	Yes	Yes	Yes
Zinc	27	27	100%	2.07E+01	1.86E+02	8.28E+01	8.28E+01	NA	NA	3.00E+00	1.00E+05	3.60E+01	Yes	No	No	Yes	Yes	Yes

NOTES:
Abbreviations: mg/kg = milligrams per kilogram, NA = not applicable.
1 90th percentile upper confidence limit on the mean or maximum (whichever is lower).

Appendix B. Human Health Risk-Based Screening Tables

Appendix B1. Selection of Human Health Chemicals of Potential Concern
Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

Chemical of Interest	Media: Surface Soil					Media: Subsurface soil				
	Preliminary Remediation Goal (mg/kg)	Exposure Point Concentration (mg/kg)	Risk Ratio (Rij)	Chemical of Potential Concern?	Inordinate Contribution to Medium-Specific Risks?	Preliminary Remediation Goal (mg/kg)	Exposure Point Concentration (mg/kg)	Risk Ratio (Rij)	Chemical of Potential Concern?	Inordinate Contribution to Medium-Specific Risks?
Aluminum										
Antimony	4.09E+02	4.44E+01	1.08E-01	No	No	4.09E+02	3.74E+00	9.14E-03	No	No
Arsenic	1.59E+00	2.25E+03	1.42E+03	**YES**	**YES**	1.59E+00	2.41E+02	1.51E+02	**YES**	**YES**
Barium	6.66E+04	1.86E+02	2.80E-03	No	No					
Beryllium										
Cadmium	4.50E+02	4.51E+00	1.00E-02	No	No	4.50E+02	5.35E+00	1.19E-02	No	No
Chromium										
Cobalt										
Copper	4.09E+04	5.46E+01	1.34E-03	No	No					
Iron	1.00E+05	2.84E+04	2.84E-01	No	No					
Lead	8.00E+02	7.19E+02	8.99E-01	No	No	8.00E+02	5.37E+01	6.71E-02	No	No
Manganese	1.95E+04	5.92E+02	3.04E-02	No	No					
Mercury	3.07E+02	6.78E+01	2.21E-01	No	No	3.07E+02	2.96E-01	9.67E-04	No	No
Nickel										
Selenium	5.11E+03	7.28E-01	1.42E-04	No	No	5.11E+03	8.37E-01	1.64E-04	No	No
Silver	5.11E+03	6.33E+01	1.24E-02	No	No	5.11E+03	1.18E+01	2.31E-03	No	No
Thallium	6.75E+01	1.60E+00	2.37E-02	No	No	6.75E+01	1.65E+00	2.45E-02	No	No
Vanadium	1.02E+03	4.58E+01	4.48E-02	No	No	1.02E+03	5.31E+01	5.20E-02	No	No
Zinc	1.00E+05	3.61E+02	3.61E-03	No	No	1.00E+05	2.43E+02	2.43E-03	No	No

Chemical of Interest	Media: Sediment					Media: Surface Water				All Exposure Media	
	Preliminary Remediation Goal (mg/kg)	Exposure Point Concentration (mg/kg)	Risk Ratio (Rij)	Chemical of Potential Concern?	Inordinate Contribution to Medium-Specific Risks?	Preliminary Remediation Goal (µg/L)	Exposure Point Concentration (µg/L)	Risk Ratio (Rij)	Chemical of Potential Concern?	Sum of Medium-Specific Risk Ratios	Chemical of Potential Concern?
Aluminum	1.00E+05	7.89E+03	7.89E-02	No	No	3.65E+04	4.87E-02	1.33E-06	No	7.89E-02	No
Antimony	4.09E+02	1.43E+00	3.49E-03	No	No	1.46E+01	9.00E-04	6.16E-05	No	1.21E-01	No
Arsenic	1.59E+00	7.71E+01	4.85E+01	**YES**	**YES**	4.48E-02	1.78E-02	3.97E-01	No	1.62E+03	**YES**
Barium	6.66E+04	1.35E+02	2.02E-03	No	No	2.55E+03	6.22E-02	2.43E-05	No	4.84E-03	No
Beryllium	1.94E+03	3.50E-01	1.80E-04	No	No					1.80E-04	No
Cadmium	4.50E+02	6.47E-01	1.44E-03	No	No	1.82E+01	4.47E-04	2.45E-05	No	2.34E-02	No
Chromium	2.10E+02	1.71E+01	8.12E-02	No	No	5.47E+04	7.40E-04	1.35E-08	No	8.12E-02	No
Cobalt	1.92E+03	6.72E+00	3.50E-03	No	No					3.50E-03	No
Copper	4.09E+04	9.92E+00	2.43E-04	No	No	1.46E+03	1.56E-03	1.07E-06	No	1.58E-03	No
Iron	1.00E+05	2.46E+04	2.46E-01	No	No	1.09E+04	6.43E-01	5.87E-05	No	5.30E-01	No
Lead	8.00E+02	3.39E+01	4.24E-02	No	No	1.50E+01	2.13E-03	1.42E-04	No	1.01E+00	**YES**
Manganese	1.95E+04	3.03E+02	1.55E-02	No	No	8.76E+02	1.01E-01	1.16E-04	No	4.61E-02	No
Mercury	3.07E+02	1.14E-01	3.73E-04	No	No	1.09E+01	7.57E-05	6.91E-06	No	2.22E-01	No
Nickel	1.60E+03	4.43E+00	2.77E-03	No	No					2.77E-03	No
Selenium						1.82E+02	1.26E-03	6.90E-06	No	3.13E-04	No
Silver	5.11E+03	2.02E+00	3.96E-04	No	No	1.82E+02	9.00E-05	4.93E-07	No	1.51E-02	No
Thallium	6.75E+01	7.89E-01	1.17E-02	No	No	2.41E+00	2.85E-03	1.18E-03	No	6.11E-02	No
Vanadium	1.02E+03	7.10E+01	6.94E-02	No	No					1.66E-01	No
Zinc	1.00E+05	8.28E+01	8.28E-04	No	No	1.09E+04	2.31E-01	2.11E-05	No	6.89E-03	No

	Surface Soil	Subsurface soil	Sediment	Surface Water
Sum of Rij:	1.4E+03	1.5E+02	4.9E+01	4.0E-01
No. of Samples:	1.4E+01	1.0E+01	1.8E+01	1.5E+01
1/No. of Samples:	7.1E-02	1.0E-01	5.6E-02	6.7E-02

NOTE:
Abbreviation: mg/kg = milligrams per kilogram.

Appendix B2. Chemical Exposure and Intake Factors
Upper Granite Creek Mines Human Health and Ecological Risk Assessment
Wallowa-Whitman National Forest, Oregon

Exposure Factors	Recreational Receptor				Source
	Child		Adult		
	Central Tendency Exposure	Reasonable Maximum Exposure	Central Tendency Exposure	Reasonable Maximum Exposure	
Body Weight (kg)	15	15	70	70	EPA, 1997
Exposure Frequency (d/yr) soil	6	12	6	24	Site Specific
Exposure Frequency (d/yr) sediment	6	12	6	24	Site Specific
Exposure Frequency (d/yr) surface water	6	12	6	24	Site Specific
Event time (hrs/event) soil	1	2	2	2	Site Specific
Event Frequency (events per day)	1	1	1	1	Site Specific
Exposure Duration (yr)	6	6	9	24	EPA, 1997
Averaging Time (d) [1]					
carcinogens	25,550	25,550	25,550	25,550	EPA, 1989
noncarcinogens	2,190	2,190	3,285	8,760	EPA, 1989
Intake Factors					
Ingestion of soil (mg/d)	100	200	50	100	EPA, 1997
Incidental ingestion of sediment (mg/d)	50	100	25	50	EPA, 1997
Incidental surface water ingestion (L/hr)	0.05	0.05	0.05	0.05	EPA, 1997
Exposed skin surface area (cm^2)	6,600	7,300	18,000	22,000	EPA, 2004a
Inhalation rate (m^3/d)	8.3	8.3	15.2	15.2	EPA, 1997
Dermal absorption factor					
volatile vp> 12000 Pa	0.0005	0.0005	0.0005	0.0005	EPA, 2004a
volatile vp< 12000 Pa	0.03	0.03	0.03	0.03	EPA, 2004a
inorganics	0.1	0.01	0.01	0.01	EPA, 2004a
Soil Adherence Factor (mg/cm^2-event)	0.01	0.07	0.01	0.07	EPA, 2004a
PEF (mg^3/kg)	1.32E+09	1.32E+09	1.32E+09	1.32E+09	EPA, 2004a

NOTES:
Abbreviations: cm^2 = square centimeters, d = day, d/yr = days per year, kg = kilograms, L/hr = liters per hour, m^3/d = cubic meters per day, mg/cm^2 = milligrams per square centimeter, mg^3/kg = cubic milligrams per kilogram, mg/d = milligrams per day, Pa = Pascal, PEF = Particulate Emission Factor, vp = vapor pressure, yr = year.
1 Averaging Time = Exposure Duration (yrs) X 365 days per year.

SOURCES:

EPA, 1989. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A). EPA/540/1-89/002.
EPA, 1997. "Exposure Factors Handbook". Volumes I - III. EPA Office of Research and Development. August
EPA, 2004a. "Risk Assessment Guide for Superfund, Part E, Supplemental Guidance for Dermal Risk Assessment." July
EPA, 2004b. "Region IV Preliminary Remediation Goals". 2004 Update. EPA. December

Appendix B3. Exposure Point Concentrations
Upper Granite Creek Mines Human Health and Ecological Risk Assessment
Wallowa-Whitman National Forest, Oregon

Chemical of Potential Concern	n	Maximum Concentrations	Central Tendency Exposure [1]	Reasonable Maximum Exposure [2]
Surface Soil (mg/kg)				
Arsenic	35	1.14E+04	8.53E+02	2.25E+03
Sediment (mg/kg)				
Arsenic	27	3.03E+02	5.44E+01	7.71E+01
Surface Water (mg/L)				
Arsenic	17	8.18E-02	9.88E-03	1.78E-02

NOTES:
Abbreviations: mg/kg = milligrams per kilogram, mg/L = milligrams per liter, n = number of samples.
1 Average Concentration
2 90% Upper Confidence Limit on the mean if greater then 10 datapoints or
maximum concentration if less than 10 datapoints.

Appendix B4. Human Chemical Intake Rates
Upper Granite Creek Mines Human Health and Ecological Risk Assessment
Wallowa-Whitman National Forest, Oregon

Scenario (Recreational)	Carcinogen		Noncarcinogen	
	Central Tendency Exposure	Reasonable Maximum Exposure	Central Tendency Exposure	Reasonable Maximum Exposure
	mg/kg-day			
Surface Soil				
Ingestion	9.1E-10	5.8E-09	1.0E-08	4.4E-08
Inhalation of particulates	1.29E-12	9.78E-12	1.23E-11	4.92E-11
Dermal	5.43E-01	7.09E+00	4.23E+00	2.07E+01
Sediments				
Ingestion	1.1E-09	2.9E-09	5.1E-09	2.2E-08
Dermal	5.43E-01	7.09E+00	4.23E+00	2.07E+01
Surface Water				
Ingestion	2.2E-07	1.0E-06	6.3E-08	6.7E-07
Dermal	8.01E-01	2.01E+00	7.23E+00	1.60E+01

NOTE:
Abbreviation: mg/kg-day = milligrams per kilogram per day.

Appendix B5. Human Health Dermal Absorption Factors for Soil
Non-Carcinogenic Dermal Exposure
Upper Granite Creek Mines Human Health and Ecological Risk Assessment
Wallowa-Whitman National Forest, Oregon

Chemical of Potential Concern	Dermal Absorption Factor	Conversion Factor	Recreational Adherence Factors		Recreational Dermal Absorption	
			Central Tendency Exposure	Reasonable Maximum Exposure	Central Tendency Exposure	Reasonable Maximum Exposure
Arsenic	0.01	0.000001	1.00E-02	7.00E-02	1.00E-10	7.00E-10

Appendix B6. Human Health Dermal Absorption Factors for Carinogens
Upper Granite Creek Mines Human Health and Ecological Risk Assessment
Wallowa-Whitman National Forest, Oregon

Chemical of Potential Concern	Dermal Absorption Factor	Conversion Factor	Recreational Adherence Factors		Recreational Dermal Absorption	
			Central Tendency Exposure	Reasonable Maximum Exposure	Central Tendency Exposure	Reasonable Maximum Exposure
Arsenic	0.01	0.000001	1.00E-02	7.00E-02	1.00E-10	7.00E-10

Appendix B7. Critical Toxicity Factors for Non-Carcinogenic Chemicals of Potential Concern
Upper Granite Creek Mines Human Health and Ecological Risk Assessment
Wallowa-Whitman National Forest, Oregon

Contaminant	CAS Number	Chronic Oral RfD [1]		Confidence in RfD	Endpoint
		Oral	Inhalation		
		mg/kg-day			
Arsenic	7440-38-2	0.0003	NA	Medium	hyperpigmentation, vascular

NOTES:

Abbreviations: CAS = chemical abstracts scientific (registration), mg/kg-day = milligrams per kilograms per day, RfD = non-cancer reference dose.

1 RfD value from Region IX Preliminarty Remediation goal tables.

Appendix B8. Critical Toxicity Factors for Carcinogenic Chemicals of Potential Concern
Upper Granite Creek Mines Human Health and Ecological Risk Assessment
Wallowa-Whitman National Forest, Oregon

Contaminant	CAS Number	Slope Factor (mg/kg-day)-1		Weight of Evidence Classification	Type of Cancer	Basis of Slope Factor
		Oral	Inhalation	Oral/Inhalation	Oral/ Inhalation	Oral/ Inhalation
Arsenic	7440-38-2	1.5E+00	1.5E+01	A	skin	EPI studies

NOTES:
Abbreviations: A = known human carcinogen, CAS = chemical abstracts scientific (registration),
mg/kg-day = milligrams per kilograms per day.

Appendix B9. Hazard Quotients for Non-Carcinogenic Chemicals of Potential Concern - Recreation Scenario
Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

Route of Exposure	Chemicals of Potential Concern	Exposure Point Concentration		Average Daily Dose [1]		Oral Reference Dose	Hazard Quotient [2]	
		Central Tendency Exposure	Reasonable Maximum Exposure	Central Tendency Exposure	Reasonable Maximum Exposure		Central Tendency Exposure	Reasonable Maximum Exposure
Soil		**mg/kg**		**mg/kg-day**				
Ingestion	Arsenic	6.82E+02	1.80E+03	1.01E-08	4.44E-08	3.00E-04	2.E-02	3.E-01
Dermal	Arsenic	6.82E+02	1.80E+03	4.23E-10	1.45E-08	3.00E-04	1.E-03	9.E-02
Sediments		**mg/kg**		**mg/kg-day**				
Ingestion	Arsenic	4.35E+01	6.17E+01	5.06E-09	2.22E-08	3.00E-04	7.E-04	5.E-03
Dermal	Arsenic	4.35E+01	6.17E+01	4.23E-10	1.45E-08	3.00E-04	6.E-05	3.E-03
Surface Water		**mg/L**		**mg/L-day**				
Ingestion	Arsenic	7.90E-03	1.42E-02	6.29E-08	6.71E-07	3.00E-04	2.E-06	3.E-05
Dermal	Arsenic	7.90E-03	1.42E-02	7.23E-06	1.60E-05	3.00E-04	2.E-04	8.E-04
						Total HI [3]	**2.E-02**	**4.E-01**

NOTES:

Abbreviations: HI = Hazard Index, mg/kg = milligrams per kilogram, mg/kg-day = milligrams per kilogram per day, mg/L = milligrams per liter, mg/L-day = milligrams per liter per day.

1 Average Daily Dose = Exposure Point Concentration x Intake (Appendix B4).

2 Hazard quotient = Average Daily Dose / Oral Reference Dose (RfDo).

3 Hazard Index = sum of all Hazard Quotients.

Appendix B10. Excess Cancer Ricks for Carcinogenic Chemicals of Potential Concern - Recreational Scenario
Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

Route of Exposure	Chemicals of Potential Concern	Exposure Point Concentration		Average Daily Dose		Oral Slope Factor	Inhalation Slope Factor	Excess Cancer Risk [1]	
		Central Tendency Exposure	Reasonable Maximum Exposure	Central Tendency Exposure	Reasonable Maximum Exposure			Central Tendency Exposure	Reasonable Maximum Exposure
Soil		**mg/kg**		**mg/kg-day**					
Ingestion	Arsenic	6.82E+02	1.80E+03	9.09E-10	5.81E-09	1.5E+00		9.E-07	**2.E-05**
dermal	Arsenic	6.82E+02	1.80E+03	5.43E-11	4.96E-09	1.5E+00		6.E-08	**1.E-05**
Inhalation of particulates	Arsenic	6.82E+02	1.80E+03	1.29E-12	9.78E-12		1.5E+01	1.E-08	3.E-07
Sediments		**mg/kg**		**mg/kg-day**					
Ingestion	Arsenic	4.35E+01	6.17E+01	1.15E-09	2.91E-09	1.5E+00		7.E-08	3.E-07
dermal	Arsenic	4.35E+01	6.17E+01	5.43E-11	4.96E-09	1.5E+00		4.E-09	5.E-07
Surface Water		**mg/L**		**mg/L-day**					
Ingestion	Arsenic	7.90E-03	1.42E-02	2.17E-07	1.03E-06	1.5E+00		3.E-09	2.E-08
dermal	Arsenic	7.90E-03	1.42E-02	8.01E-07	2.01E-06	1.5E+00		9.E-09	4.E-08
						Total Excess Cancer Risk		**1.E-06**	**3.E-05**

NOTES:

Abbreviations: mg/kg = milligrams per kilogram, mg/kg-day = milligrams per kilogram per day, mg/L = milligrams per liter.

Bold = Unacceptable Excess Cancer Risk

1 Excess Cancer Risk = Exposure Point Concentration x Average Daily Dose x Slope Factor (Sfo or Sfi).

Appendix B11. Human Health Hotspot Evaluation
Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

Sample Number	Sampling Depth	Arsenic, Total	Hotspot Concentration	Hotspot?
	feet	mg/kg		
GF-WR-01		2.9E+01	1.43E+04	No
GF-WR-2		1.3E+03	1.43E+04	No
GF-WR-3		8.9E+01	1.43E+04	No
TILL-WR-01		1.4E+02	1.43E+04	No
TM-TA-SSS-30	0.4	7.3E+01	1.43E+04	No
CMM-WR1-1-0.5'	0.5	7.5E+03	1.43E+04	No
CMM-WR2-1-0.5'	0.5	4.5E+03	1.43E+04	No
CMM-WR2-2-0.5'	0.5	8.6E+02	1.43E+04	No
CMM-WR3-1-0.5'	0.5	6.2E+02	1.43E+04	No
CMM-WR4-1-0.5'	0.5	5.7E+02	1.43E+04	No
CM-WP-SSS-31	0.5	1.1E+04	1.43E+04	No
GC3-WR-01	0.5	2.0E+01	1.43E+04	No
GC5-WR-01	0.5	9.7E+00	1.43E+04	No
GC5-WR-02	0.5	2.7E+01	1.43E+04	No
GC6-WR-01	0.5	1.3E+02	1.43E+04	No
GC6-WR-02	0.5	2.6E+02	1.43E+04	No
GC6-WR-03	0.5	6.3E+00	1.43E+04	No
GC7-WR-01	0.5	1.7E+01	1.43E+04	No
GC7-WR-02	0.5	2.6E+01	1.43E+04	No
GC7-WR-03	0.5	3.7E+02	1.43E+04	No
GC7-WR-04	0.5	5.9E+01	1.43E+04	No
GF-WR2-1-0.5'	0.5	8.8E+01	1.43E+04	No
MM-ML-SSS-16	0.5	1.8E+02	1.43E+04	No
MM-ML-SSS-38	0.5	2.7E+01	1.43E+04	No
MM-WP-SSS-15	0.5	3.0E+02	1.43E+04	No
SM-WR2-1-0.5'	0.5	3.4E+02	1.43E+04	No
MM-ML-SSS-12	0.7	1.6E+02	1.43E+04	No
MM-WP-SSS-14	0.7	1.7E+02	1.43E+04	No
TM-WP-SSS-27	0.8	9.3E+00	1.43E+04	No
TM-WP-SSS-28	0.8	6.6E+00	1.43E+04	No
MM-WP-SSS-13	1	1.7E+00	1.43E+04	No
MM-WP-SSS-17	1	1.9E+02	1.43E+04	No
CMM-TA-SUS-22	1.5	1.4E+02	1.43E+04	No
CM-TA-SUS-33	1.5	2.2E+02	1.43E+04	No
SM-TA-SUS-25	1.5	2.3E+01	1.43E+04	No

NOTE:
Abbreviation: mg/kg = milligrams per kilogram.

Appendix C. Ecological Scoping Checklist

Ecological Scoping Checklist

Site Name	Granite Creek Mines
Date of Site Inspection	Summer 2005
Site Location	Wallowa Whitman National Forest; Granite, Oregon
Site Visit Conducted by	EA Engineering, Science, and Technology

Part ❶

CONTAMINANTS OF INTEREST Types, Classes, Or Specific Hazardous Substances‡ Known Or Suspected	Onsite	Adjacent to or in locality of the facility†
Metals	Yes	Yes

‡ As defined by OAR 340-122-115(34) † As defined by OAR 340-122-115(38)

Part ❷

OBSERVED IMPACTS ASSOCIATED WITH THE SITE	Finding
Onsite vegetation (None, Limited, Extensive)	E
Vegetation in the locality of the site (None, Limited, Extensive)	L
Onsite wildlife such as macroinvertebrates, reptiles, amphibians, birds, mammals, other (None, Limited, Extensive)	N
Wildlife such as macroinvertebrates, reptiles, amphibians, birds, mammals, other in the locality of the site (None, Limited, Extensive)	L
Other readily observable impacts (None, Discuss below)	D
Discussion: Drainage from several adits.	
Vegetation is sparse on waste material piles and in the vicinity of the disturbed mine areas.	
Past forest cutting surrounding mines	

Ecological Scoping Checklist (cont'd)
Part ❸

SPECIFIC EVALUATION OF ECOLOGICAL RECEPTORS / HABITAT	Finding
Terrestrial – Wooded	
Percentage of site that is wooded	82
Dominant vegetation type (Evergreen, Deciduous, Mixed)	E
Prominent tree size at breast height, i.e., four feet (<6", 6" to 12", >12")	6"- 12"
Evidence / observation of wildlife (Macroinvertebrates, Reptiles, Amphibians, Birds, Mammals, Other)	Ma, B, M
Terrestrial – Natural Scrub/Shrub/Grasses	
Percentage of site that is scrub/shrub/Grass	3
Dominant vegetation type (Scrub, Shrub, Grasses, Other)	G
Prominent height of vegetation (<2', 2' to 5', >5')	2' – 5'
Density of vegetation (Dense, Patchy, Sparse)	P
Evidence / observation of wildlife (Macroinvertebrates, Reptiles, Amphibians, Birds, Mammals, Other)	Ma, B
Terrestrial – Ruderal	
Percentage of site that is ruderal	10
Dominant vegetation type (Landscaped, Agriculture, Bare ground)	B, Successional
Prominent height of vegetation (0', >0' to <2', 2' to 5', >5')	<2 and >5'
Density of vegetation (Dense, Patchy, Sparse)	S
Evidence / observation of wildlife (Macroinvertebrates, Reptiles, Amphibians, Birds, Mammals, Other)	Ma, B
Aquatic – Non-flowing (lentic)	
Percentage of site that is covered by lakes or ponds	0
Type of water bodies (Lakes, Ponds, Vernal pools, Impoundments, Lagoon, Reservoir, Canal)	
Size (acres), average depth (feet), trophic status of water bodies	
Source water (River, Stream, Groundwater, Industrial discharge, Surface water runoff)	
Water discharge point (None, River, Stream, Groundwater, Wetlands impoundment)	
Nature of bottom (Muddy, Rocky, Sand, Concrete, Other)	
Vegetation present (Submerged, Emergent, Floating)	
Obvious wetlands present (Yes / No)	
Evidence / observation of wildlife (Macroinvertebrates, Reptiles, Amphibians, Birds, Mammals, Other)	

Aquatic - Flowing (lotic)	
Percentage of site that is covered by rivers, streams (brooks, creeks), intermittent streams, dry wash, arroyo, ditches, or channel waterway	2
Type of water bodies (Rivers, Streams, Intermittent Streams, Dry Wash, Arroyo, Ditches, Channel waterway)	Adit Drainage into stream
Size (acres), average depth (feet), approximate flow rate (cfs) of water bodies	~1-5 ft wide, 0.1-0.5 ft deep, 1-5 cfs
Bank environment (cover: Vegetated, Bare / slope: Steep, Gradual / height (in feet))	B / G to S 0 – 2 ft.
Source water (River, Stream, Groundwater, Industrial discharge, Surface water runoff)	Adit, groundwater, and surface runoff,
Tidal influence (Yes / No)	N
Water discharge point (None, River, Stream, Groundwater, Wetlands impoundment)	River
Nature of bottom (Muddy, Rocky, Sand, Concrete, Other)	Rocky, Sand
Vegetation present (Submerged, Emergent, Floating)	None
Obvious wetlands present (Yes / No)	Y
Evidence / observation of wildlife (Macroinvertebrates, Reptiles, Amphibians, Fish, Birds, Mammals, Other)	Ma, Fish
Aquatic – Wetlands	
Obvious or designated wetlands present (Yes / No)	3
Wetlands suspected at site is/has (Adjacent to water body, in Floodplain, Standing water, Dark wet soils, Mud cracks, Debris line, Water marks)	Adj.; Fl.; St. Wat.; Veg.
Vegetation present (Submerged, Emergent, Scrub/shrub, Wooded)	Emergent
Size (acres) and depth (feet) of suspected wetlands	<1 acre/0.5 ft
Source water (River, Stream, Groundwater, Industrial discharge, Surface water runoff)	Str.; Grdwat.; Surf Wat.
Water discharge point (None, River, Stream, Groundwater, Impoundment)	Stream
Tidal influence (Yes / No)	No
Evidence / observation of wildlife (Macroinvertebrates, Reptiles, Amphibians, Birds, Mammals, Other)	Ma; B

* P: Photographic documentation of these features is highly recommended.

Part ❹

ECOLOGICALLY IMPORTANT SPECIES / HABITATS OBSERVED

Evaluation of Receptor-Pathway Interactions

EVALUATION OF RECEPTOR-PATHWAY INTERACTIONS	Y	N	U
Are hazardous substances present or potentially present in surface waters? AND Are ecologically important species or habitats present? AND Could hazardous substances reach receptors via surface water?	X X X		
When answering the above questions, consider the following: Known or suspected presence of hazardous substances in surface waters. Ability of hazardous substances to migrate to surface waters. Terrestrial organisms may be dermally exposed to water-borne contaminants as a result of wading or swimming in contaminated waters. Aquatic receptors may be exposed through osmotic exchange, respiration or ventilation of surface waters. Contaminants may be taken-up by terrestrial plants whose roots are in contact with surface waters. Terrestrial receptors may ingest water-borne contaminants if contaminated surface waters are used as a drinking water source.			
Are hazardous substances present or potentially present in groundwater? AND Are ecologically important species or habitats present? AND Could hazardous substances reach these receptors via groundwater?		 X X	X
When answering the above questions, consider the following: Known or suspected presence of hazardous substances in groundwater. Ability of hazardous substances to migrate to groundwater. Potential for hazardous substances to migrate via groundwater and discharge into habitats and/or surface waters. Contaminants may be taken-up by terrestrial and rooted aquatic plants whose roots are in contact with groundwater present within the root zone (~1m depth). Terrestrial wildlife receptors generally will not contact groundwater unless it is discharged to the surface.			

“Y” = yes; “N” = No, “U” = Unknown (counts as a “Y”)

ATTACHMENT 2
Evaluation of Receptor-Pathway Interactions (cont'd)

EVALUATION OF RECEPTOR-PATHWAY INTERACTIONS	Y	N	U
Are hazardous substances present or potentially present in sediments? AND Are ecologically important species or habitats present? AND Could hazardous substances reach these receptors via contact with sediments?	X X X		
When answering the above questions, consider the following: Known or suspected presence of hazardous substances in sediment. Ability of hazardous substances to leach or erode from surface soils and be carried into sediment via surface runoff. Potential for contaminated groundwater to upwell through, and deposit contaminants in, sediments. If sediments are present in an area that is only periodically inundated with water, terrestrial species may be dermally exposed during dry periods. Aquatic receptors may be directly exposed to sediments or may be exposed through osmotic exchange, respiration or ventilation of sediment pore waters. Terrestrial plants may be exposed to sediment in an area that is only periodically inundated with water. If sediments are present in an area that is only periodically inundated with water, terrestrial species may have direct access to sediments for the purposes of incidental ingestion. Aquatic receptors may regularly or incidentally ingest sediment while foraging.			
Are hazardous substances present or potentially present in prey or food items of ecologically important receptors? AND Are ecologically important species or habitats present? AND Could hazardous substances reach these receptors via consumption of food items?	 X X		X
When answering the above questions, consider the following: Higher trophic level terrestrial and aquatic consumers and predators may be exposed through consumption of contaminated food sources. In general, organic contaminants with log K_{ow} > 3.5 may accumulate in terrestrial mammals and those with a log K_{ow} > 5 may accumulate in aquatic vertebrates.			

"Y" = yes; "N" = No, "U" = Unknown (counts as a "Y")

ATTACHMENT 2
Evaluation of Receptor-Pathway Interactions (cont'd)

EVALUATION OF RECEPTOR-PATHWAY INTERACTIONS	Y	N	U
Are hazardous substances present or potentially present in surficial soils? AND Are ecologically important species or habitats present? AND Could hazardous substances reach these receptors via incidental ingestion of or dermal contact with surficial soils?	X X X		
When answering the above questions, consider the following: Known or suspected presence of hazardous substances in surficial (~1m depth) soils. Ability of hazardous substances to migrate to surficial soils. Significant exposure via dermal contact would generally be limited to organic contaminants which are lipophilic and can cross epidermal barriers. Exposure of terrestrial plants to contaminants present in particulates deposited on leaf and stem surfaces by rain striking contaminated soils (i.e., rain splash). Contaminants in bulk soil may partition into soil solution, making them available to roots. Incidental ingestion of contaminated soil could occur while animals grub for food resident in the soil, feed on plant matter covered with contaminated soil or while grooming themselves clean of soil.			
Are hazardous substances present or potentially present in subsurface soils? AND Are ecologically important species or habitats present? AND Could hazardous substances reach these receptors via vapors or fugitive dust carried in surface air or confined in burrows?	X	 X X	
When answering the above questions, consider the following: Volatility of the hazardous substance (volatile chemicals generally have Henry's Law constant > 10^{-5} atm-m^3/mol and molecular weight < 200 g/mol). Exposure via inhalation is most important to organisms that burrow in contaminated soils, given the limited amounts of air present to dilute vapors and an absence of air movement to disperse gases. Exposure via inhalation of fugitive dust is particularly applicable to ground-dwelling species that could be exposed to dust disturbed by their foraging or burrowing activities or by wind movement. Foliar uptake of organic vapors would be limited to those contaminants with relatively high vapor pressures. Exposure of terrestrial plants to contaminants present in particulates deposited on leaf and stem surfaces.			

"Y" = yes; "N" = No, "U" = Unknown (counts as a "Y")

Appendix D. Ecological Risk-Based Screening Tables

Appendix D1. Ecological Risk-Based Screening Concentrations
Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

Chemical of Interest	Oregon Soil Screening Level Values				Oregon Freshwater Screening Level Values			Oregon Sediment Screening Level Values	
	Plants	Invertebrates	Birds	Mammals	Aquatic Life	Birds	Mammals	Freshwater	Bioaccumulation
	mg/kg				mg/L			mg/kg	
Aluminum	5.0E+01 pH<5.5	6.0E+02 pH<5.5	4.5E+02 pH<5.5	1.07E+02 pH<5.5	8.70E-02	7.97E+02	8.00E+00	No Data	No Data
Antimony	5.0E+00	7.80E+01 USEPA, 2005a	No Data	1.50E+01	1.60E+00	No Data	1.00E+00	3.00E+00	1.00E+01
Arsenic, Total	1.8E+01 USEPA, 2005b	6.0E+01 Arsenic III	4.3E+01 USEPA, 2005b	4.6E+01 USEPA, 2005b	1.50E-01 Arsenic III	1.80E+01 Arsenic III	6.00E+00 Arsenic III	6.00E+00 Arsenic III	4.00E+00 Arsenic III
Barium	5.0E+02	3.0E+03	8.5E+01	6.4E+02	4.00E-03	1.50E+02	3.90E+01	No Data	No Data
Beryllium	1.0E+01	4.0E+01 USEPA, 2005c	1.0E+01 Efroymsen et. al., 1997	8.3E+01	5.30E-03	No Data	No Data	No Data	1.22E+02
Cadmium	4.0E+00	2.0E+01	6.0E+00	1.3E+02	2.20E-03	1.00E+01	8.00E+00	6.00E-01	3.00E-03
Chromium, Total	1.0E+00 Chromium III	4.0E-01 Chromium III	4.0E+00 Chromium III	4.1E+02 Chromium VI	1.10E-02 Chromium VI	7.20E+00 Chromium III	2.50E+01 Chromium VI	3.70E+01 Chromium, Total	4.20E+03 Chromium, Total
Cobalt	2.0E+01	1.0E+03	1.2E+02 USEPA, 2005d	1.5E+02	2.30E-02	No Data	9.00E+00	No Data	No Data
Copper	1.0E+02	5.0E+01	1.9E+02	3.9E+02	9.00E-03	3.41E+02	5.30E+01	3.60E+01	1.00E+01
Iron	1.0E+01	2.0E+02	No Data 5>pH>8	No Data 5>pH>8	1.00E+00	No Data	No Data	No Data	No Data
Lead	5.0E+01	5.0E+02	1.6E+01	4.0E+03	2.50E-03	2.80E+01	3.23E+02	3.50E+01	1.28E+02
Manganese	5.0E+02	1.0E+02	4.1E+03	1.1E+04	1.20E-01	7.24E+03	6.76E+02	1.10E+03	No Data
Mercury	3.0E-01	1.0E-01	1.5E+00	7.3E+01	7.70E-04	3.30E+00	1.00E+01	2.00E-01	No Data
Nickel	3.0E+01	2.0E+02	3.2E+02	6.3E+02	5.20E-02	5.62E+02	3.80E+01	1.80E+01	3.16E+02
Selenium	1.0E+00	7.0E+01	2.0E+00	2.5E+01	5.00E-03	3.60E+00	1.50E+00	No Data	1.00E-01
Silver	2.0E+00	5.0E+01	No Data	No Data	1.20E-04	No Data	No Data	4.50E+00	No Data
Thallium	1.0E+00	1.0E+00 CCME, 1999	No Data	1.0E+00	4.00E-02	No Data	6.00E-02	No Data	7.00E-01
Vanadium	2.0E+00	No Data	4.7E+01	2.5E+01	2.00E-02	8.20E+01	1.60E+00	No Data	No Data
Zinc	5.0E+01	2.0E+02	6.0E+01	2.0E+04	1.20E-01	1.05E+02	1.23E+03	1.23E+02	3.00E+00

NOTES:
Use of surrogate chemical toxicity data indicated by chemical name adjacent to concentration.
Abbreviations: mg/kg = milligrams per kilogram, mg/L = milligrams per liter.

SOURCES:

CCME, 1999. Canadian Soil Quality Guidelines. Canadian Council of Resource and Environmental Ministers. Canadian Council of Ministers of the Environment, Winnipeg.

Efroymson, R.A., G.W. Suter II, B.E. Sample, and D.S. Jones, 1997. Preliminary Remediation goals for Ecological Endpoints. ES/ER/TM-162/R2. Prepared for the U.S. Department of Energy, Office of Environmental Management.

USEPA, 2005a. Ecological Soil Screening Levels for Antimony – Interim Final. Office of Solid Waste and Emergency Response. OSWER Directive 9285.7-61. February.

USEPA, 2005b. Ecological Soil Screening Levels for Arsenic – Interim Final. Office of Solid Waste and Emergency Response. OSWER Directive 9285.7-62. March.

USEPA, 2005c. Ecological Soil Screening Levels for Beryllium – Interim Final. Office of Solid Waste and Emergency Response. OSWER Directive 9285.7-64. February.

USEPA, 2005d. Ecological Soil Screening Levels for Cobalt – Interim Final. Office of Solid Waste and Emergency Response. OSWER Directive 9285.7-67. March.

Appendix D2. Ecological Risk-Based Screening for Surface Soil/Waste Rock
Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

Chemical of Interest [1]	Maximum Detected Concentration	Exposure Point Concentration [2]	Half of Maximum Sample Reporting Limit	Risk-Based Screening Value				Risk Ratio for				Potential Bioaccumulator? [4]
				Plants	Invertebrates	Birds	Mammals	Plants (Rij) [3]	Invertebrates (Rij) [3]	Birds (Rij) [3]	Mammals (Rij) [3]	
	mg/kg											
Metals												
Antimony	3.68E+02	4.11E+01	5.00E-01	5.00E+00	7.80E+01	No Data	1.50E+01	**8E+00**	5E-01	0E+00	3E+00	No
Arsenic, Total	1.14E+04	1.79E+03	NA	1.80E+01	6.00E+01	4.30E+01	4.60E+01	**9.9E+01**	**3.0E+01**	**4.2E+01**	**3.9E+01**	**Yes**
Barium	3.22E+02	1.82E+02	NA	5.00E+02	3.00E+03	8.50E+01	6.38E+02	4E-01	6E-02	2E+00	3E-01	No
Cadmium	2.34E+01	4.77E+00	3.20E-02	4.00E+00	2.00E+01	6.00E+00	1.25E+02	1E+00	2E-01	8E-01	4E-02	**Yes**
Copper	6.98E+02	5.21E+01	NA	1.00E+02	5.00E+01	1.90E+02	3.90E+02	5E-01	1E+00	3E-01	1E-01	No
Iron	9.73E+04	2.78E+04	NA	1.00E+01	2.00E+02	No Data	No Data	**2.782E+03**	**1.39E+02**	0E+00	0E+00	No
Lead	2.43E+03	5.95E+02	NA	5.00E+01	5.00E+02	1.60E+01	4.00E+03	**1.2E+01**	1E+00	**3.7E+01**	1E-01	**Yes**
Manganese	1.26E+03	5.85E+02	NA	5.00E+02	1.00E+02	4.13E+03	1.10E+04	1E+00	**6E+00**	1E-01	5E-02	No
Mercury	7.84E+02	6.25E+01	2.50E-02	3.00E-01	1.00E-01	1.50E+00	7.30E+01	**2.08E+02**	**6.25E+02**	**4.2E+01**	9E-01	Yes
Selenium	3.26E+00	7.21E-01	NA	1.00E+00	7.00E+01	2.00E+00	2.50E+01	7E-01	1E-02	4E-01	3E-02	**Yes**
Silver	3.19E+02	4.70E+01	1.05E-01	2.00E+00	5.00E+01	No Data	No Data	**2.3E+01**	9E-01	0E+00	0E+00	No
Thallium	3.30E+00	1.52E+00	2.30E-01	1.00E+00	1.00E+00	No Data	1.00E+00	2E+00	2E+00	0E+00	2E+00	No
Vanadium	9.61E+01	4.49E+01	NA	2.00E+00	No Data	4.70E+01	2.50E+01	**2.2E+01**	0E+00	1E+00	2E+00	No
Zinc	2.41E+03	3.67E+02	NA	5.00E+01	2.00E+02	6.00E+01	2.00E+04	**7E+00**	2E+00	**6E+00**	2E-02	No

	Plants	Invertebrates	Birds	Mammals	
	3.168E+03	**8.07E+02**	**1.31E+02**	**4.6E+01**	:Sum of Rij (Rj)
	1.4E+01	1.4E+01	1.4E+01	1.4E+01	:Number of COIs (Nij)
	7E-02	7E-02	7E-02	7E-02	:1/Nij

NOTES:
Abbreviations: **Bold** = indicates chemcials of potential concern that may require further assessment at the site, mg/kg = milligrams per kilogram, NA = not applicable, NC = not calculated, Unknown = chemical was detected but no screening criterial are available.
1 Chemicals remaining following the frequency of detection, essential nutrient, and background concentrations screening procedures.
2 Upper confidence limit on the mean or maximum (whichever is lower).
3 The risk ratio is the exposure point concentration divided by the Screening Level Values (SLV).
4 As listed in the Draft Sediment Evaluation Framework (USACE et al., 2005).
5 The chemical of interest is considered a chemical of potential ecological concern if:
a) The risk ratio (Rij) is greater than 5 (non-protected) or 1 (protected).
b) The chemical of interest is a bioaccumulator.
c) No SLV or bioaccumulation vaule is available.
d) Not Calculated = Risk was not calculated for analytes with no screening criteria or bioaccumulation data.

Appendix D2. Ecological Risk-Based Screening for Surface Soil/Waste Rock (continued)
Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

Chemical of Interest [1]	Risked Posed to Non-Protected				Risks Posed to Protected				Risks Posed to Non-Protected				Risks Posed to Protected			
	Plants (Rij>5) [5]	Invertebrates (Rij>5) [5]	Birds (Rij>5) [5]	Mammals (Rij>5) [5]	Plants (Rij>1) [5]	Invertebrates (Rij>1) [5]	Birds (Rij>1) [5]	Mammals (Rij>1) [5]	Plants	Invertebrates	Birds	Mammals	Plants	Invertebrates	Birds	Mammals
									Due to Elevated Reporting Limit				Due to Elevated Reporting Limit			
Metals																
Antimony	**Yes**	No	NC	No	**Yes**	No	NC	**Yes**	No	No	No	No	No	No	No	No
Arsenic, Total	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	No	No	No	No	No	No	No
Barium	No	No	No	No	No	No	**Yes**	No	No	No	No	No	No	No	No	No
Cadmium	No	No	**Yes**	**Yes**	No	No	**Yes**	**Yes**	No	No	No	No	No	No	No	No
Copper	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Iron	**Yes**	**Yes**	NC	NC	**Yes**	**Yes**	NC	NC	No	No	No	No	No	No	No	No
Lead	**Yes**	No	**Yes**	**Yes**	**Yes**	No	**Yes**	**Yes**	No	No	No	No	No	No	No	No
Manganese	No	**Yes**	No	No	No	**Yes**	No	No	No	No	No	No	No	No	No	No
Mercury	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	No	No	No	No	No	No	No
Selenium	No	No	**Yes**	**Yes**	No	No	**Yes**	**Yes**	No	No	No	No	No	No	No	No
Silver	**Yes**	No	NC	NC	**Yes**	No	NC	NC	No	No	No	No	No	No	No	No
Thallium	No	No	NC	No	**Yes**	**Yes**	NC	**Yes**	No	No	No	No	No	No	No	No
Vanadium	**Yes**	NC	No	No	**Yes**	NC	No	**Yes**	No	No	No	No	No	No	No	No
Zinc	Yes	**No**	**Yes**	No	**Yes**	**Yes**	**Yes**	No	No	No	No	No	No	No	No	No

NOTES:

Abbreviations: **Bold** = indicates chemcials of potential concern that may require further assessment at the site, mg/kg = milligrams per kilogram, NA = not applicable, NC = not calculated, Unknown = chemical was detected but no screening criterial are available.

1 Chemicals remaining following the frequency of detection, essential nutrient, and background concentrations screening procedures.

2 Upper confidence limit on the mean or maximum (whichever is lower).

3 The risk ratio is the exposure point concentration divided by the Screening Level Values (SLV).

4 As listed in the Draft Sediment Evaluation Framework (USACE et al., 2005).

5 The chemical of interest is considered a chemical of potential ecological concern if:

a) The risk ratio (Rij) is greater than 5 (non-protected) or 1 (protected).

b) The chemical of interest is a bioaccumulator.

c) No SLV or bioaccumulation vaule is available.

d) Not Calculated = Risk was not calculated for analytes with no screening criteria or bioaccumulation data.

Appendix D2. Ecological Risk-Based Screening for Surface Soil/Waste Rock (continued)
Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

Chemical of Interest [1]	Inordinate Contribution to Overall Risk for Protected Species ($R_{ij}/R_j > 1/N_{ij}$)				Inordinate Contribution to Overall Risks ($R_{ij}/R_j > 5/N_{ij}$)				Risks Posed to Protected Species				Risks Posed to Non-Protected Species			
	Plants	Invertebrates	Birds	Mammals	Plants	Invertebrates	Birds	Mammals	Plants	Invertebrates	Birds	Mammals	Plants	Invertebrates	Birds	Mammals
Metals																
Antimony	No	No	Unkown	No	No	No	Unkown	No	**Yes**	No	No	**Yes**	**Yes**	No	No	No
Arsenic, Total	No	No	**Yes**	**Yes**	No	No	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Barium	No	No	No	No	No	No	No	No	No	No	**Yes**	No	No	No	No	No
Cadmium	No	No	No	No	No	No	No	No	No	No	**Yes**	**Yes**	No	No	**Yes**	**Yes**
Copper	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Iron	**Yes**	**Yes**	Unkown	Unkown	**Yes**	No	Unkown	Unkown	**Yes**	**Yes**	No	No	**Yes**	**Yes**	No	Yes
Lead	No	No	Yes	No	No	No	No	No	**Yes**	No	**Yes**	**Yes**	**Yes**	No	**Yes**	**Yes**
Manganese	No	No	No	No	No	No	No	No	No	**Yes**	No	No	No	**Yes**	No	No
Mercury	No	**Yes**	**Yes**	No	No	**Yes**	No	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Selenium	No	No	No	No	No	No	No	No	No	No	**Yes**	**Yes**	No	No	**Yes**	**Yes**
Silver	No	No	Unkown	Unkown	No	No	Unkown	Unkown	**Yes**	No	No	No	**Yes**	No	No	No
Thallium	No	No	Unkown	No	No	No	Unkown	No	**Yes**	**Yes**	No	**Yes**	No	No	No	No
Vanadium	No	Unkown	No	No	No	Unkown	No	No	**Yes**	**Unknown**	No	**Yes**	**Yes**	**Unknown**	No	No
Zinc	No	No	No	No	No	No	No	No	**Yes**	**Yes**	**Yes**	No	**Yes**	No	**Yes**	No

NOTES:
Abbreviations: **Bold** = indicates chemcials of potential concern that may require further assessment at the site, mg/kg = milligrams per kilogram, NA = not applicable, NC = not calculated, Unknown = chemical was detected but no screening criterial are available.
1 Chemicals remaining following the frequency of detection, essential nutrient, and background concentrations screening procedures.
2 Upper confidence limit on the mean or maximum (whichever is lower).
3 The risk ratio is the exposure point concentration divided by the Screening Level Values (SLV).
4 As listed in the Draft Sediment Evaluation Framework (USACE et al., 2005).
5 The chemical of interest is considered a chemical of potential ecological concern if:
a) The risk ratio (Rij) is greater than 5 (non-protected) or 1 (protected).
b) The chemical of interest is a bioaccumulator.
c) No SLV or bioaccumulation vaule is available.
d) Not Calculated = Risk was not calculated for analytes with no screening criteria or bioaccumulation data.

Appendix D3. **Ecological Risk-Based Screening for Surface Wate**
Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

Chemical of Interest (COI) [1]	Exposure Point Concentration [2]	Half of Maximum Sample Reporting Limit	Freshwater Risk-Based Screening Value			Risk Ratio			Bioaccumulator? [3]	Risks Posed				
			Aquatic Life	Birds	Mammals	Aquatic Life (Rij) [2]	Birds (Rij) [2]	Mammals (Rij) [2]		Aquatic Life (Rij>1) [4]	Protected Birds (Rij>1) [4]	Non-Protected Birds (Rij>5) [4]	Protected Mammals (Rij>1) [4]	Non-Protected Mammals (Rij>5) [4]
	mg/L													
Metals														
Aluminum	4.87E-02	3.16E-02	8.70E-02	7.97E+02	8.00E+00	6E-01	6E-05	6E-03	No	No	No	No	No	No
Antimony	9.00E-04	2.50E-03	1.60E+00	No Data	1.00E+00	6E-04	0E+00	9E-04	No	No	NC	NC	No	No
Arsenic, Total	1.78E-02	3.00E-03	1.50E-01	1.80E+01	6.00E+00	1E-01	1E-03	3E-03	**Yes**	No	**Yes**	**Yes**	**Yes**	**Yes**
Barium	6.22E-02	NA	4.00E-03	1.50E+02	3.90E+01	**1.6E+01**	4E-04	2E-03	No	**Yes**	No	No	No	No
Cadmium	4.47E-04	6.00E-04	2.20E-03	1.00E+01	8.00E+00	2E-01	4E-05	6E-05	**Yes**	No	**Yes**	**Yes**	**Yes**	**Yes**
Chromium, Total	7.40E-04	5.00E-03	1.10E-02	7.20E+00	2.50E+01	7E-02	1E-04	3E-05	No	No	No	No	No	No
Copper	1.56E-03	1.65E-03	9.00E-03	3.41E+02	5.30E+01	2E-01	5E-06	3E-05	No	**No**	No	No	No	No
Iron	6.43E-01	3.34E-02	1.00E+00	No Data	No Data	6E-01	0E+00	0E+00	No	No	NC	NC	NC	NC
Lead	2.13E-03	7.50E-04	2.50E-03	2.80E+01	3.23E+02	9E-01	8E-05	7E-06	**Yes**	No	**Yes**	**Yes**	**Yes**	**Yes**
Manganese	1.01E-01	9.50E-04	1.20E-01	7.24E+03	6.76E+02	8E-01	1E-05	1E-04	No	No	No	No	No	No
Mercury	7.57E-05	5.00E-05	7.70E-04	3.30E+00	1.00E+01	1E-01	2E-05	8E-06	**Yes**	No	**Yes**	**Yes**	**Yes**	**Yes**
Selenium	1.26E-03	1.70E-03	5.00E-03	3.60E+00	1.50E+00	3E-01	3E-04	8E-04	**Yes**	No	**Yes**	**Yes**	**Yes**	**Yes**
Silver	9.00E-05	1.45E-03	1.20E-04	No Data	No Data	8E-01	0E+00	0E+00	No	No	NC	NC	NC	NC
Zinc	2.31E-01	5.00E-03	1.20E-01	1.05E+02	1.23E+03	**2E+00**	2E-03	2E-04	No	**Yes**	No	No	No	No

NOTES:

Abbreviations: **Bold** = indicates chemicals of potential ecological concern that may require further assessment at the site was detected but no screening criteria are available,
mg/L = milligrams per liter, NA = not applicable, Unknown = Chemical was detected but no screening criteria are available.

1 Chemicals remaining following the frequency of detection, essential nutrient, and background concentrations screening procedures.

2 Upper confidence limit on the mean or maximum (whichever is lower).

2 The risk ratio is the exposure point concentration divided by the Screening Level Values (SLV).

3 As listed in the Draft Sediment Evaluation Framework (USACE et al., 2005).

4 The chemical of interest is considered a chemical of potential ecological concern if:

a) The risk ratio (Rij) is greater than 1 for protected species and aquatic life.
b) The risk ratio (Rij) is greater than 5 for other species.
c) The chemical of interest is a bioaccumulator.
d) The chemical of interest has an elevated detection limit.
e) No risk-based screening or bioaccumulation vaule is available.
f) Inordinate contribution to overall risk (Rj).

Aquatic Life	Birds	Mammals	
2.2E+01	4E-03	1E-02	:Sum of Rij (Rj)
14	14	14	:Number of COIs (Nij)
7E-02	7E-02	7.1E-02	:1/Nij

Appendix D3. Ecological Risk-Based Screening for Surface Water (continuec
Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

Chemical of Interest (COI) [1]	Risks Posed to					Inordinate Contribution to Overall Risk for Protected Species ($R_{ij}/R_j > 1/N_{ij}$)			Inordinate Contribution to Overall Risks for Non-Protected Species ($R_{ij}/R_j > 5/N_{ij}$)			Risks Posed to Protected Species			Risks Posed to Non-Protected Species		
	Aquatic Life	Protected Birds	Non-Protected Birds	Protected Mammals	Non-Protected Mammals												
	Due to Elevated Reporting Limit					Aquatic Life	Birds	Mammals	Aquatic Life	Birds	Mammals	Aquatic Life	Birds	Mammals	Aquatic Life	Birds	Mammals
Metals																	
Aluminum	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Antimony	No	No	No	No	No	No	No	No	No	No	No	No	**Unknown**	No	No	**Unknown**	No
Arsenic, Total	No	No	No	No	No	No	No	No	No	No	No	No	**Yes**	**Yes**	No	**Yes**	**Yes**
Barium	No	No	No	No	No	**Yes**	No	No	**Yes**	No	No	**Yes**	No	No	**Yes**	No	No
Cadmium	No	No	No	No	No	No	No	No	No	No	No	No	**Yes**	**Yes**	No	**Yes**	**Yes**
Chromium, Total	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Copper	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Iron	No	No	No	No	No	No	No	No	No	No	No	No	**Unknown**	**Unknown**	No	**Unknown**	**Unknown**
Lead	No	No	No	No	No	No	No	No	No	No	No	No	**Yes**	**Yes**	No	**Yes**	**Yes**
Manganese	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Mercury	No	No	No	No	No	No	No	No	No	No	No	No	**Yes**	**Yes**	No	**Yes**	**Yes**
Selenium	No	No	No	No	No	No	No	No	No	No	No	No	**Yes**	**Yes**	No	**Yes**	**Yes**
Silver	**Yes**	No	No	No	No	No	No	No	No	No	No	**Yes**	**Unknown**	**Unknown**	**Yes**	**Unknown**	**Unknown**
Zinc	No	No	No	No	No	No	No	No	No	No	No	**Yes**	No	No	**Yes**	No	No

NOTES:
Abbreviations: **Bold** = indicates chemicals of potential ecological concern that may require further assessment at the site was detected but no screening criteria are available,
mg/L = milligrams per liter, NA = not applicable, Unknown = Chemical was detected but no screening criteria are available.
1 Chemicals remaining following the frequency of detection, essential nutrient, and background concentrations screening procedures.
2 Upper confidence limit on the mean or maximum (whichever is lower).
2 The risk ratio is the exposure point concentration divided by the Screening Level Values (SLV).
3 As listed in the Draft Sediment Evaluation Framework (USACE et al., 2005).
4 The chemical of interest is considered a chemical of potential ecological concern if:
a) The risk ratio (Rij) is greater than 1 for protected species and aquatic life.
b) The risk ratio (Rij) is greater than 5 for other species.
c) The chemical of interest is a bioaccumulator.
d) The chemical of interest has an elevated detection limit.
e) No risk-based screening or bioaccumulation vaule is available.
f) Inordinate contribution to overall risk (Rj).

Appendix D4. Ecological Risk-Based Screening for Pore Wate
Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

Chemical of Interest (COI) [1]	Exposure Point Concentration [2]	Half of Maximum Sample Reporting Limit	Freshwater Risk-Based Screening Value			Risk Ratio			Bioaccumulator? [3]	Risks Posed				
			Aquatic Life	Birds	Mammals	Aquatic Life (Rij) [2]	Birds (Rij) [2]	Mammals (Rij) [2]		Aquatic Life (Rij>1) [4]	Protected Birds (Rij>1) [4]	Non-Protected Birds (Rij>5) [4]	Protected Mammals (Rij>1) [4]	Non-Protected Mammals (Rij>5) [4]
	mg/L													
Metals														
Aluminum	3.17E-02	3.16E-02	8.70E-02	7.97E+02	8.00E+00	4E-01	4E-05	4E-03	No	No	No	No	No	No
Arsenic, Total	6.49E-03	3.00E-03	1.50E-01	1.80E+01	6.00E+00	4E-02	4E-04	1E-03	**Yes**	No	**Yes**	**Yes**	**Yes**	**Yes**
Barium	4.85E-02	NA	4.00E-03	1.50E+02	3.90E+01	**1.2E+01**	3E-04	1E-03	No	**Yes**	No	No	No	No
Lead	1.16E-03	6.50E-04	2.50E-03	2.80E+01	3.23E+02	5E-01	4E-05	4E-06	**Yes**	No	**Yes**	**Yes**	**Yes**	**Yes**
Mercury	5.74E-05	5.00E-05	7.70E-04	3.30E+00	1.00E+01	7E-02	2E-05	6E-06	**Yes**	No	**Yes**	**Yes**	**Yes**	**Yes**
Selenium	1.47E-03	1.70E-03	5.00E-03	3.60E+00	1.50E+00	3E-01	4E-04	1E-03	**Yes**	No	**Yes**	**Yes**	**Yes**	**Yes**
Silver	0.00E+00	1.45E-03	1.20E-04	No Data	No Data	0E+00	0E+00	0E+00	No	No	No	NC	NC	NC
Thallium	2.76E-03	2.85E-03	4.00E-02	No Data	6.00E-02	7E-02	0E+00	5E-02	No	No	No	NC	NC	No
Zinc	4.52E-03	5.00E-03	1.20E-01	1.05E+02	1.23E+03	4E-02	4E-05	4E-06	No	No	No	No	No	No

Aquatic Life	Birds	Mammals	
1.3E+01	1E-03	5E-02	:Sum of Rij (Rj)
9.0.E+00	9.0.E+00	9.0.E+00	:Number of COIs (Nij)
1.1.E-01	1.1.E-01	1.1.E-01	:1/Nij

NOTES:

Abbreviations: **Bold** = indicates chemicals of potential ecological concern that may require further assessment at the site was detected but no screening criteria are available,
mg/L = milligrams per liter, NA = not applicable, NC = not calculated, Unknown = Chemical was detected but no screening criteria are available.

1 Chemicals remaining following the frequency of detection, essential nutrient, and background concentrations screening procedures.

2 Upper confidence limit on the mean or maximum (whichever is lower).

2 The risk ratio is the exposure point concentration divided by the Screening Level Values (SLV).

3 As listed in the Draft Sediment Evaluation Framework (USACE et al., 2005).

4 The chemical of interest is considered a chemical of potential ecological concern if:
a) The risk ratio (Rij) is greater than 1 for protected species and aquatic life.
b) The risk ratio (Rij) is greater than 5 for other species.
c) The chemical of interest is a bioaccumulator.
d) The chemical of interest has an elevated detection limit.
e) No risk-based screening or bioaccumulation vaule is available.
f) Inordinate contribution to overall risk (Rj).

Appendix D4. **Ecological Risk-Based Screening for Pore Water (continued**
Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

Chemical of Interest (COI)[1]	Risks Posed to					Inordinate Contribution to Overall Risk for Protected Species ($R_{ij}/R_j > 1/N_{ij}$)			Inordinate Contribution to Overall Risks for Non-Protected Species ($R_{ij}/R_j > 5/N_{ij}$)			Risks Posed to Protected Species			Risks Posed to Non-Protected Species		
	Aquatic Life	Protected Birds	Non-Protected Birds	Protected Mammals	Non-Protected Mammals												
	Due to Elevated Reporting Limit					Aquatic Life	Birds	Mammals	Aquatic Life	Birds	Mammals	Aquatic Life	Birds	Mammals	Aquatic Life	Birds	Mammals
Metals																	
Aluminum	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Arsenic, Total	No	No	No	No	No	No	No	No	No	No	No	No	**Yes**	**Yes**	No	**Yes**	**Yes**
Barium	No	No	No	No	No	**Yes**	No	No	**Yes**	No	No	**Yes**	No	No	**Yes**	No	No
Lead	No	No	No	No	No	No	No	No	No	No	No	No	**Yes**	**Yes**	No	**Yes**	**Yes**
Mercury	No	No	No	No	No	No	No	No	No	No	No	No	**Yes**	**Yes**	No	**Yes**	**Yes**
Selenium	No	No	No	No	No	No	No	No	No	No	No	No	**Yes**	**Yes**	No	**Yes**	**Yes**
Silver	**Yes**	No	No	No	No	Unknown	No	No	Unknown	No	No	**Yes**	No	**Unknown**	**Yes**	**Unknown**	**Unknown**
Thallium	No	No	No	No	No	No	No	No	No	No	No	No	No	**Unknown**	No	**Unknown**	No
Zinc	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

NOTES:
Abbreviations: **Bold** = indicates chemicals of potential ecological concern that may require further assessment at the site was detected but no screening criteria are available,
mg/L = milligrams per liter, NA = not applicable, NC = not calculated, Unknown = Chemical was detected but no screening criteria are available.
1 Chemicals remaining following the frequency of detection, essential nutrient, and background concentrations screening procedures.
2 Upper confidence limit on the mean or maximum (whichever is lower).
2 The risk ratio is the exposure point concentration divided by the Screening Level Values (SLV).
3 As listed in the Draft Sediment Evaluation Framework (USACE et al., 2005).
4 The chemical of interest is considered a chemical of potential ecological concern if:
a) The risk ratio (Rij) is greater than 1 for protected species and aquatic life.
b) The risk ratio (Rij) is greater than 5 for other species.
c) The chemical of interest is a bioaccumulator.
d) The chemical of interest has an elevated detection limit.
e) No risk-based screening or bioaccumulation vaule is available.
f) Inordinate contribution to overall risk (Rj).

Appendix D5. Ecological Risk-Based Screening for Sediment
Upper Granite Creek Mines Human Health and Ecological Risk Assessment, Wallowa-Whitman National Forest, Oregon

Chemical of Interest (COI) [1]	Maximum Detected Concentration	Sediment Exposure Point Concentration [2]	Maximum Sample Reporting Limit	Freshwater Sediment Risk-Based Screening Value: Benthic Invertebrates	Freshwater Sediment Risk-Based Screening Value: Bioaccumulation	Risk Ratio: Benthic Invertebrates (Rij) [3]	Risk Ratio: Birds and Mammals (Rij) [3]	Bioaccumulator? [4]	Risks Posed to: Invertebrates (Rij>1) [5]	Risks Posed to: Non-Protected Birds and Mammals (Rij>5) [5]	Risks Posed Due to Elevated Reporting Limit: Invertebrates	Risks Posed Due to Elevated Reporting Limit: Non-Protected Birds and Mammals	Inordinate Contribution to Overall Risks ($R_{ij}/R_j > 5/N_{ij}$): Benthic Invertebrates	Inordinate Contribution to Overall Risks ($R_{ij}/R_j > 5/N_{ij}$): Birds, and Mammals	Risks Posed?: Benthic Invertebrates	Risks Posed?: Birds and Mammals
	mg/kg															
Metals																
Aluminum	1.17E+04	7.89E+03	NA	No Data	No Data	0.E+00	0.E+00	No	NC	No	No	No	Unknown	Unknown	**Unknown**	No
Antimony	5.10E+00	1.43E+00	2.75E-01	3.00E+00	1.00E+01	5E-01	1E-01	Not Required	No	No	No	No	No	No	No	No
Arsenic, Total	3.03E+02	7.71E+01	NA	6.00E+00	4.00E+00	**1.3E+01**	**1.9E+01**	Not Required	**Yes**	**Yes**	No	No	No	No	**Yes**	**Yes**
Barium	2.17E+02	1.35E+02	NA	No Data	No Data	0E+00	0E+00	No	NC	No	No	No	No	No	**Unknown**	No
Cadmium	2.80E+00	6.47E-01	4.30E-02	6.00E-01	3.00E-03	1E+00	**2.16E+02**	Not Required	No	**Yes**	No	**Yes**	No	No	No	**Yes**
Chromium, Total	4.56E+01	1.71E+01	NA	3.70E+01	4.20E+03	5E-01	4.1E-03	Not Required	No	No	No	No	No	No	No	No
Cobalt	9.60E+00	6.72E+00	NA	No Data	No Data	0E+00	0E+00	No	NC	No	No	No	No	No	**Unknown**	No
Copper	3.00E+01	9.92E+00	NA	3.60E+01	1.00E+01	3E-01	9.9E-01	Not Required	No	No	No	No	No	No	No	No
Iron	5.46E+04	2.46E+04	NA	No Data	No Data	0E+00	0.00E+00	No	NC	No	No	No	No	No	**Unknown**	No
Lead	1.48E+02	3.39E+01	NA	3.50E+01	1.28E+02	1E+00	3E-01	Not Required	No	No	No	No	No	No	No	No
Manganese	6.11E+02	3.03E+02	NA	1.10E+03	No Data	3E-01	0E+00	No	No	No	No	No	No	No	No	No
Mercury	3.20E-01	1.14E-01	2.50E-02	2.00E-01	No Data	6E-01	0E+00	**Yes**	No	**Yes**	No	No	No	No	No	**Yes**
Nickel	7.60E+00	4.43E+00	5.00E-01	1.80E+01	3.16E+02	2E-01	1E-02	Not Required	No	No	No	No	No	No	No	No
Selenium	8.80E-01	5.06E-01	NA	No Data	1.00E-01	0E+00	5E+00	Not Required	NC	No	No	No	No	No	**Unknown**	No
Silver	7.90E+00	2.02E+00	5.00E-02	4.50E+00	No Data	4E-01	0E+00	No	No	No	No	No	No	No	No	No
Thallium	1.80E+00	7.89E-01	3.35E-01	No Data	7.00E-01	0E+00	1E+00	Not Required	NC	No	No	No	No	No	**Unknown**	No
Vanadium	1.54E+02	7.10E+01	NA	No Data	No Data	0E+00	0E+00	No	NC	No	No	No	No	No	**Unknown**	No
Zinc	1.86E+02	8.28E+01	NA	1.23E+02	3.00E+00	7E-01	**2.8E+01**	No	No	**Yes**	No	No	No	No	No	**Yes**

NOTES:

Abbreviations: **Bold** = indicates chemcials of potential concern that may require further assessment at the site, mg/kg = milligrams per kilogram, NA = not applicable, NC = not calculated, Unknown = chemical was detected but no screening criterial are available.

1 Chemicals remaining following the frequency of detection, essential nutrient, and background concentrations screening procedures.

2 Upper confidence limit on the mean or maximum (whichever is lower)

3 The risk ratio is the exposure point concentration divided by the Screening Level Values (SLV).

4 As listed in the Draft Sediment Evaluation Framework (USACE et al., 2005).

Bioaccumulation screening not required when a bioaccumulation screening value is available.

	Benthic Invertebrates	Birds and Mammals	
	1.8E+01	**2.65E+02**	:Sum of Rij (Rj)
	18	18	:Number of COIs (Nij)
	0.1	0.1	:1/Nij

5 The chemical of interest is considered a chemical of potential ecological concern if:

a) The risk ratio (Rij) is greater than 1 for protected species and benthic invertebrates.

b) The risk ratio (Rij) is greater than 5 for other species.

c) The chemical of interest is a bioaccumulator.

d) The chemical of interest has an elevated detection limit.

e) No risk-based screening or bioaccumulation vaule is available.

f) Inordinate contribution to overall risk (Rj).