SUBMITTED TO:
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FINAL R2

CAPPING AND ABANDONMENT PLAN

Grant Mine Primary Mine Tailings Impoundment

ESTER DOME, ALASKA

SHANNON & WILSON

June 2021

Shannon & Wilson No: 31-1-20094-008

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Submitted To: Mr. Roger Burggraf
3180 Peger Road, Suite 270
Fairbanks, Alaska 99709
Attn: Contact Name

Subject: FINAL R2 CAPPING AND ABANDONMENT PLAN, GRANT MINE PRIMARY MINE TAILINGS IMPOUNDMENT, ESTER DOME, ALASKA

Shannon & Wilson prepared this report and participated in this project as a consultant to Mr. Roger Burggraf. Our scope of services was specified in our proposal dated March 8, 2018. This report presents recommendations for the primary tailings impoundment capping and abandonment and was prepared by the undersigned.

We appreciate the opportunity to be of service to you on this project. If you have questions concerning this report, or we may be of further service, please contact us.

Sincerely,

SHANNON & WILSON

Mark Lockwood, CPG
Senior Associate

MSL:CBD/msl

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Figures

Appendices

ACRONYMS

18 AAC 75	18 Alaska Administrative Code 75
18 AAC 60	18 Alaska Administrative Code 60
ADEC	Alaska Department of Environmental Conservation
ADNR	Alaska Department of Natural Resources
BLM	Bureau of Land Management
bgs	below ground surface
°C	degrees Celsius
COC	chain of custody
COPCs	contaminants of potential concern
CSM	conceptual site model
DO	dissolved oxygen
EPA	Environmental Protection Agency
IDW	investigation-derived waste
MCL	maximum contaminant level
RPD	relative percent difference
QA	quality assurance
QAO	quality assurance objective
QC	quality control
SGS	SGS North America, Inc.
Silverado	Silverado Gold Mines, Inc.
SPLP	synthetic precipitation leaching procedure
TCLP	toxicity characteristic leaching procedure
TCM	TriCon Mining, Inc.
ug/L	micrograms per liter
WAD	weak-acid-dissociable

1 INTRODUCTION

This report presents a capping/abandonment plan for the primary mine-tailings impoundment at the Grant Mine located on Ester Dome, northwest of Fairbanks, Alaska (Figure 1). The claim holder, Mr. Roger Burggraf, secured our services for the purpose of pursuing closure of the mine-tailings impoundment (impoundment) through the Alaska Department of Environmental Conservation (ADEC) contaminated sites program. The contaminated sites database file number for the Grant Mine site is 100.38.182, Hazard ID 731. The contaminated site comprises the primary tailings impoundment, the former secondary tailings area, and a cyanide release to groundwater.

Silverado Gold Mines (Silverado)/Tri-con Mining Alaska (TCM), former operators of the mine, submitted an Application to Construct or Modify a Dam to the Alaska Department of Natural Resources (ADNR) on January 11, 1985. They received approval to construct the Grant Mine Tailings Impoundment on July 11, 1985. TCM prepared a Solid Waste Disposal Permit Application in 1985; there is no record that the permit was obtained. In 1998, Silverado/TCM prepared a *Mine Tailings Impoundment Closure Plan.* The plan proposed constructing a compacted silt cap over the mine tailings to isolate the tailings from potential receptors and limit infiltration. This plan was not carried out. We understand Mr. Burggraf is prepared to undertake this plan for abandonment of the impoundment without the assistance of the former operators and is continuing groundwater monitoring to close the groundwater portion of the contaminated site

1.1 Land Status

The impoundment is located on the following active State of Alaska Mining Claims:

- *Grant 29* (ADL 536567),
- *Grant 28* (ADL 536566), and
- *Grant 16* (ADL 511378).

We understand Mr. Burggraf is in the process of obtaining an easement for the impoundment. He will submit the property description once the easement paperwork is complete.

1.2 Regulatory Framework

We are presenting this background information and the proposed plan to ADEC, the regulatory agency overseeing the tailing impoundment closure, and ADNR, the landowner.

1.2.1 ADEC Contaminated Sites

We have prepared this closure plan in general accordance with ADEC's 18 Alaska Administrative Code (AAC) 75 *Oil and Other Hazardous Substances Pollution Control* (18 AAC 75). 18 AAC 75 regulates site characterizations and the cleanup of hazardous substances. The contaminated site includes the tailings within the primary impoundment, the former secondary impoundment, and the cyanide release to groundwater. Closure of the site will require addressing these three areas at the mine. The cleanup of the secondary tailings area has been accepted by ADEC (see Appendix A for sampling results following removal of tailings and ADEC acceptance letter).

1.2.2 ADEC Solid Waste

Since 18 AAC 75 does not contain guidance for capping, we have prepared this capping plan in general accordance with ADEC's 18 AAC 60 *Solid Waste Management* (18 AAC 60). Although 18 AAC 60.455 defines mining waste, the only section that provides guidance for cover/capping of monofills is 18 AAC 60.485 which presents capping/cover criteria for industrial waste. The cover requirements include:

- The surface may not be sloped more steeply than a 3:1 grade;
- The cover should include an infiltration layer of at least 18 inches of earthen material with a permeability no greater than 1×10^{-5} centimeters per second (cm/sec); and
- the cover should contain an erosion layer of at least six inches of earthen material capable of sustaining native plant growth.

According to 18 AAC 60.200, a waste disposal permit is not required since the capping will be considered an "approved contaminated site cleanup plan under 18 AAC 75".

1.2.3 ADNR

1.2.3.1 Division on Mining, Land, and Water

As the owner of the property, ADNR oversees and manages the activities that occur during discovery, mining and reclamation. Please note that the use of the word "site" in this section refers to the mine not a contaminated site. The following sections describe the ADNR requirements:

The Alaska Statues Section 27.19.020. states "A mining operation shall be conducted in a manner that prevents unnecessary and undue degradation of land and water resources, and the mining operation shall be reclaimed as contemporaneously as practicable with the mining operation to leave the mined area in a stable condition."

"Stable condition" means the rehabilitation, where feasible, of the physical environment of the mine to a condition that allows for the reestablishment of renewable resources in the area within a reasonable period of time by natural processes.

Article 2 of 11 AAC 97.200 - Land reclamation performance standards provides the following:

A miner shall reclaim areas disturbed by a mining operation so that any surface that will not have a stream flowing over it is left in a stable condition.

(1) For the purposes of AS 27.19.100(7) and this section, a stable condition that "allows for the reestablishment of renewable resources on the site within a reasonable period of time by natural processes" means a condition that can reasonably be expected to return waterborne soil erosion to pre-mining levels within one year after the reclamation is completed, and that can reasonably be expected to achieve revegetation, where feasible, within five years after the reclamation is completed, without the need for fertilization or reseeding. If rehabilitation of a mined site to this standard is not feasible because the surface materials on the mined site have low natural fertility or the site lacks a natural seed source, the department recommends that the miner fertilize and reseed or replant the site with native vegetation to protect against soil erosion; however, AS 27.19 does not require the miner to do so. Rehabilitation to allow for the reestablishment of renewable resources is not required if that reestablishment would be inconsistent with an alternate post-mining land use approved under AS 27.19.030(b) on state, federal, or municipal land, or with the post-mining land use intended by the landowner on private land.

(2) If topsoil from an area disturbed by a mining operation is not promptly redistributed to an area being reclaimed, a miner shall segregate it, protect it from erosion and from contamination by acidic or toxic materials, and preserve it in a condition suitable for later use.

(3) If the natural composition, texture, or porosity of the surface materials is not conducive to natural revegetation, a miner shall take measures to promote natural revegetation, including redistribution of topsoil, where available. If no topsoil is available, a miner shall apply fines or other suitable growing medium, if available. However, a miner may not redistribute topsoil and fines over surfaces likely to be exposed to annual flooding, unless the action is authorized in an approved reclamation plan and will not result in an unlawful point or non-point-source discharge of pollutants.

A miner shall reclaim an area disturbed by a mining operation so that the surface contours after reclamation is complete are conducive to natural revegetation or are consistent with an alternate post-mining land use approved under AS 27.19.030(b) on state, federal, or

municipal land, or with the post-mining land use intended by the landowner on private land. Measures taken to accomplish this result may include backfilling, contouring, and grading, but a miner need not restore the site's approximate original contours. A miner shall stabilize the reclaimed site to a condition that will retain sufficient moisture for natural revegetation or for an alternate post-mining land use approved under AS 27.19.030(b) on state, federal, or municipal land, or for the post-mining land use intended by the landowner on private land.

A pit wall, subsidence feature, or quarry wall is exempt from the requirements of (a) and (b) of this section if the steepness of the wall makes them impracticable or impossible to accomplish. However, a miner shall leave the wall in a condition such that it will not collapse nor allow loose rock that presents a safety hazard to fall from it.

If a mining operation diverts a stream channel or modifies a flood plain to the extent that the stream channel is no longer stable, a miner shall reestablish the stream channel in a stable location. A miner may not place a settling basin in the way of the reestablished channel location unless the fines will be properly removed or protected from erosion.

1.2.3.2 Dam Safety Program

The Alaska Dam Safety Program (ADSP) oversees the construction, modification, and removal of dams in Alaska under 11 AAC 93. Mr. Burggraf has submitted an Application for Certificate of Approval to Construct, Modify, Repair, Remove or Abandon a Dam. ADSP is in the process of reviewing the application. As part of the application Shannon & Wilson conducted a stability assessment of tailings impoundment titled *Grant Mine Tailings Impoundment Closure AK00409, Ester Dome, Alaska* dated March 2021.

2 SITE DESCRIPTION

The Grant Mine is located along St. Patrick Road approximately 1.2 miles from the intersection with Ester Dome Road, near Fairbanks, Alaska (Figure 1); latitude 64.8802 north, longitude 147.9602 west. The former mine facility and tailings impoundment are located on the eastern flank of Ester Dome, approximately 780 feet above mean sea level. The area around the mine slopes gently to the east and is vegetated with spruce, hardwoods, and shrubs.

The property is underlain by as much as 60 feet of loess (aeolian silt) that mantles schist bedrock. The schist is cut by gold-bearing quartz veins. According to Youcha (2003), the groundwater on Ester Dome is present in unconfined bedrock aquifers, localized by regional faults, fractures, and joints. The Environmental Protection Agency (EPA) found

elevated concentrations of arsenic, barium, copper, manganese, selenium, and zinc in background groundwater samples; background arsenic concentrations exceeded 1,000 µg/L (ADEC cleanup level = 0.52 µg/L). According to Verplanck et al., (2007) oxidation of arsenopyrite in sheared gold-bearing quartz veins is the primary source of elevated arsenic concentrations in groundwater at Ester Dome.

The primary tailings impoundment occupies approximately 4 acres (Figure 2). A secondary (initial) tailings impoundment was located about 400 feet to the east and was about one acre. The primary impoundment was last active in 1989 and is fenced to restrict access; the secondary impoundment was used during pilot mill testing of the mill; tailings from the secondary impoundment were moved into the primary tailings impoundment in October 2019 and will be covered by the proposed cap. Details of the secondary tailing area cleanup, results of soil sampling at the limits of the excavation, and ADEC's acceptance of closure letter are included in Appendix A.

The land use around the mine is a mix of undeveloped land and low-density residential housing (Figure 2). Residents in the area are not connected to a municipal water system but instead obtain water from deliveries to holding tanks and/or from wells. It is unknown how many wells are used for drinking water; naturally high arsenic and mineral levels render the groundwater non-potable.

3 BACKGROUND

Roger Burggraf has held the mining claims since 1972. The land was previously owned by the Bureau of Land Management (BLM) and is now owned by the ADNR. Silverado and TCM leased the claims from 1978 to 2019. Between 1980 and 1983, Silverado operated a pilot mill for metallurgical testing. The pilot mill recovered gold through gravity separation; no cyanide was used during the operation of the pilot mill. Tailings from the pilot mill were placed in the initial tailings area also known the secondary tailings impoundment.

In 1985, Shannon & Wilson prepared a geotechnical investigation in the area of the proposed tailings impoundment for TCM. Shannon & Wilson's report provided geotechnical design recommendations for surface preparation, embankment configurations, and fill placement.

The primary tailings impoundment, lined with compacted silt and bordered by a 45-foot high berm, was designed and built by TCM in 1985. The impoundment had a capacity of approximately 130,000 cubic yards. TCM/Silverado operated the mill at the Grant Mine from 1985 to 1989 using a cyanide process for gold extraction. The cyanide process involved mixing crushed ore with sodium cyanide and lime solution and then extracting the gold,

generating a slurry containing waste rock, lime, sodium cyanide, and water. The slurry was piped into primary tailings impoundment; the discharge point of the piping was manually moved to distribute the tailing throughout the impoundment.

The mine came to the attention of ADEC in 1988 when TCM applied for a rezone, and water samples from two wells adjacent to the impoundment contained cyanide concentrations above the federally established maximum contaminant level (MCL) of 0.2 mg/L. According to TCM employees, the cyanide-rich tailings slurry was accidentally discharged upslope of the impoundment, allowing the tailings to reach groundwater through the former water supply well. TCM removed the well casing and sealed the boring by pressure grouting in 1989. Please note that this release did not result in a breach of the western embankment. Monitoring wells, M-1 and M-2, were installed in 1989 and 1990, respectively, to continue monitoring cyanide in groundwater. The wells were routinely sampled for total cyanide and/or weak-acid-dissociable (WAD) cyanide concentrations. Mr. Burggraf is planning to continue sampling monitoring wells, M-1 and M-2 until the total cyanide concentration does not exceed the ADEC cleanup for three consecutive sampling events. Once the sampling results indicate cyanide is less than ADEC cleanup level and the cap has been constructed, Mr. Burggraf he will request the ADEC consider the site for closure (see Section 6.2.1 for institutional controls required for closure).

In July of 1994, EPA sampled tailings from the primary and secondary tailings impoundments, groundwater from on-site monitoring wells, and groundwater from off-site domestic wells. Two soil and two groundwater samples were collected from upgradient, off-site sources to represent background analyte concentrations.

The EPA site investigation identified metals above background concentrations in both the primary and secondary tailings impoundments. The tailings in the primary tailings impoundment contained arsenic and antimony exceeding the ADEC cleanup levels. The tailings in the secondary tailings area contained arsenic exceeding the ADEC cleanup level.

Arsenic, cyanide, lead, manganese, mercury, and silver were detected above ADEC cleanup levels in groundwater from on-site monitoring wells. Contaminants were detected above background in upgradient domestic wells, suggesting elevated metals concentrations were naturally occurring.

Silverado and TCM prepared a *Mine Tailings Impoundment Closure Plan* in 1998. The plan proposed constructing a compacted silt cap to isolate the mine tailings from potential receptors and limit infiltration.

In 2019, Shannon & Wilson prepared a *Site Characterization Report* summarizing the site history, results of the previous sampling, and results of recent monitoring well sampling.

In October 2019, Mr. Burggraf moved the tailings from secondary tailings area into the primary tailings area; these tailings will be covered by the proposed cap. Details of the secondary tailing area cleanup, results of soil sampling at the limits of the excavation, and ADEC's acceptance of closure sampling letter are included in Appendix A.

4 CONTAMINANTS OF POTENTIAL CONCERN

EPA and TCM collected samples of the tailings within the impoundment in 1994 and 1996, respectively.. We do not anticipate the concentrations have changed since this sampling occurred. We did not collect soil samples from within the primary tailings impoundment, but assume concentrations remain above regulatory limits.

Contaminants of potential concern (COPCs) at the primary tailings are arsenic, antimony, manganese, and cyanide. COPCs at the secondary tailings are arsenic, antimony, silver, and mercury. Analytical results for the following COPCs in soil exceeded ADEC's most stringent cleanup levels in previous investigations: weak-acid digestion (WAD) and/or total cyanide, antimony, arsenic, manganese, and mercury. Only antimony and arsenic exceeded the human health risk cleanup levels in the tailings.

5 CONCEPTUAL SITE MODEL

Shannon & Wilson presented an updated conceptual site model (CSM) in our *Revised Site Characterization Report, Grant Mine Tailings Impoundment, 1.2 Mile St. Patrick Road, Fairbanks, Alaska* dated August 2019. The exposure medium of concern at the site described in the CSM is the uncapped mine tailings. The following sections summarize the CSM, and potential receptors and exposure pathways and describes the affect the capping would have on the risk of exposure.

5.1 Description of Potential Receptors

We consider mine workers, site visitors, trespassers, construction workers, and nearby residents to be current or future potential receptors. We do not consider farmers or subsistence harvesters and consumers to be potential receptors at present. Animals are also potential receptors as moose tracks have been seen inside the fence in the primary tailings impoundment, and birds may be attracted to standing water in the impoundment; to date; no bird fatalities have been observed within the impoundment. Plants may uptake contaminants in tailings if they colonize the bare tailings surface.

5.2 Potential Exposure Pathways

Potential human and wildlife exposure pathways include direct contact with tailings leading to potential incidental ingestion and dermal absorption of contaminants.

5.2.1 Direct Contact with Soil

Dermal absorption and direct ingestion of surface soil will no longer be exposure pathways once the cap is in place. Direct contact with subsurface soil at the site is unlikely since future land use restrictions will prohibit excavation.

5.2.2 Direct Contact with Groundwater

Nearby residential wells may contain naturally high concentration of metals (EPA 1995). Groundwater has been measured at approximately 155 feet bgs during field activities. Recent drilling as part of our stability analysis did not encounter groundwater or perched water within the tailings. The tailings consist of silty sand and clay that appears to be limiting infiltration of precipitation and snow melt. Industrial workers/contractors sampling monitoring wells on-site and residents with wells downgradient from the site may be exposed to groundwater through ingestion or dermal exposure. Elevated metal concentrations in groundwater are naturally occurring. Previous investigation of on-site monitoring wells detected elevated levels of cyanide; however, recent sampling indicates free cyanide is near or below the DEC cleanup levels; sampling for cyanide is ongoing.

5.2.3 Direct Contact with Surface Water

Snowmelt and rainwater will not come in contact with the tailings and will no longer accumulate in the primary impoundment once the cap is in place.

6 CAPPING PLAN

This capping plan has been developed to reduce the potential for redistribution, limit long-term risk to human health and the environment, and limit surface-water infiltration with a minimum amount of future maintenance. The capping plan presented here is based on the following:

- The horizontal and vertical extent of the tailings has been adequately characterized; the secondary tailings have been moved to the primary tailings impoundment and will covered by the cap. Tailings that are encountered outside the primary tailings impoundment during the stripping of the vegetation will be moved into the primary tailings impoundment and capped.

- Free product and surface soil staining are not present in the area of the primary tailings impoundment.
- The primary tailings-impoundment COPCs are below ADEC human health-based soil cleanup levels except for arsenic and antimony. A cap would eliminate the potential for contact with the tailings.
- The tailings in the primary impoundment are not contributing to the metals in groundwater at the site as evidenced by higher concentrations of metals in upgradient, background wells.
- Sensitive subpopulations and permanently occupied buildings are not present at the site.
- There are no unacceptable human health or ecological risks once the cap is in place.
- No streams flow through or near the impoundment; ditches and culverts are effective at channeling surface water away from the impoundment. St. Patrick's Road is maintained by the Alaska Department of Transportation and Public Facilities (DOT&PF). In the event the road is threatened by clogged ditches, DOT&PF would clean the sediment from the ditch.
- The proposed cap thickness of 30 inches exceeds the 24-inch cover thickness recommended in the DEC Solid Waste Regulations.
- The final 6-inch course of capping material (erosion layer) will not be compacted to allow the soil to support the establishment of native plant species. Any organic material removed from the ground surface will be stockpiled and spread over the surface of the cap to encourage the growth of native vegetation.
- Consolidation occurs naturally over time. The angular nature of individual tailings grains allow for tighter packing limiting the material's compressibility. Since the tailings have been in place for over thirty years, we anticipate the subsidence of the tailings will be minimal.
- The capping does not preclude future mining on other areas of the property; the property owner knows the cap is not to be disturbed in the future.

6.1 Cap Design and Construction

Stutzman Engineering (Stutzman) has prepared a grading plan for the impoundment; the final plans were stamped by a professional engineer licensed to practice in Alaska. A schematic of the cap is presented in Figure 3. The complete plan set is included in the *Design Report*. Stutzman's plans show the extent of the cap and the location of the area to be excavated to provide the capping material. They specify a lift thickness of 8 inches. Compacting the individual lifts will require multiple passes with loaded rubber-tired equipment to achieve a permeability of no less than 1×10^{-5} cm/sec.

The cap will be a minimum of 2.5 feet thick, constructed from silt obtained from the berms and the area west of the impoundment. The silt will meet the definition of DOT&PF's Type C - Select Material which contains no muck, peat, frozen material, roots, sod, or other deleterious material. The surface of the cap will be graded to a 3-percent grade sloped to the east and domed to minimize accumulation of standing water and encourage radial flow of water from the tailings. A new diversion ditch will be established on the uphill side of the capped area to carry runoff to the north then east away from the impoundment.

The fence will be removed from around the tailings. The areas of the berm and to the west of the impoundment will be cleared and grubbed before silt for the cap is spread. Stutzmann estimated about 20-percent of the material will be waste. This surficial organic-rich material will be stockpiled and later spread over the completed cap on top of the erosion layer to encourage revegetation with native plants. The capping material in the erosion layer is the same soil that supports the surrounding forest and is capable of sustaining native plant growth. The newly exposed top of the berm and the unlined ditches will be seeded. The recommended seed mix is presented in Stutzman's plan. Root wads and logs will be placed on the surface of the cap to make the area unattractive to recreational vehicle users.

6.2 Future Land Use

6.2.1 Institutional Controls

Because the tailings within the impoundment exceed ADEC's human health risk cleanup levels and will not be removed from the site, ADEC will require institutional controls (ICs) in the form of a deed notification/environmental covenants to ensure future land use will not adversely affect or disturb the cap. ADNR, as the landowner, will need to agree with and comply with the ICs and modify the deed as required by 18 AAC 60 and 18 AAC 75.

18 AAC 60.490 (a) outlines the deed notifications required once the closure is complete. The owner/operator will record the modified deed which includes the following:

- the land has been used as a monofill;
- the type of waste that was placed in the monofill;
- the geographical boundaries of the waste management areas; and
- details of any final cover, cap, or other structures or devices installed as part of the dam abandonment/capping.

According to Section 46.04.300 of the Alaska Statues:
(a) An environmental covenant is required if the department makes a remedial decision as part of an environmental response project and that environmental response project results

in

(1) residual contamination remaining in the environment in concentrations that are safe for some, but not all, uses; or

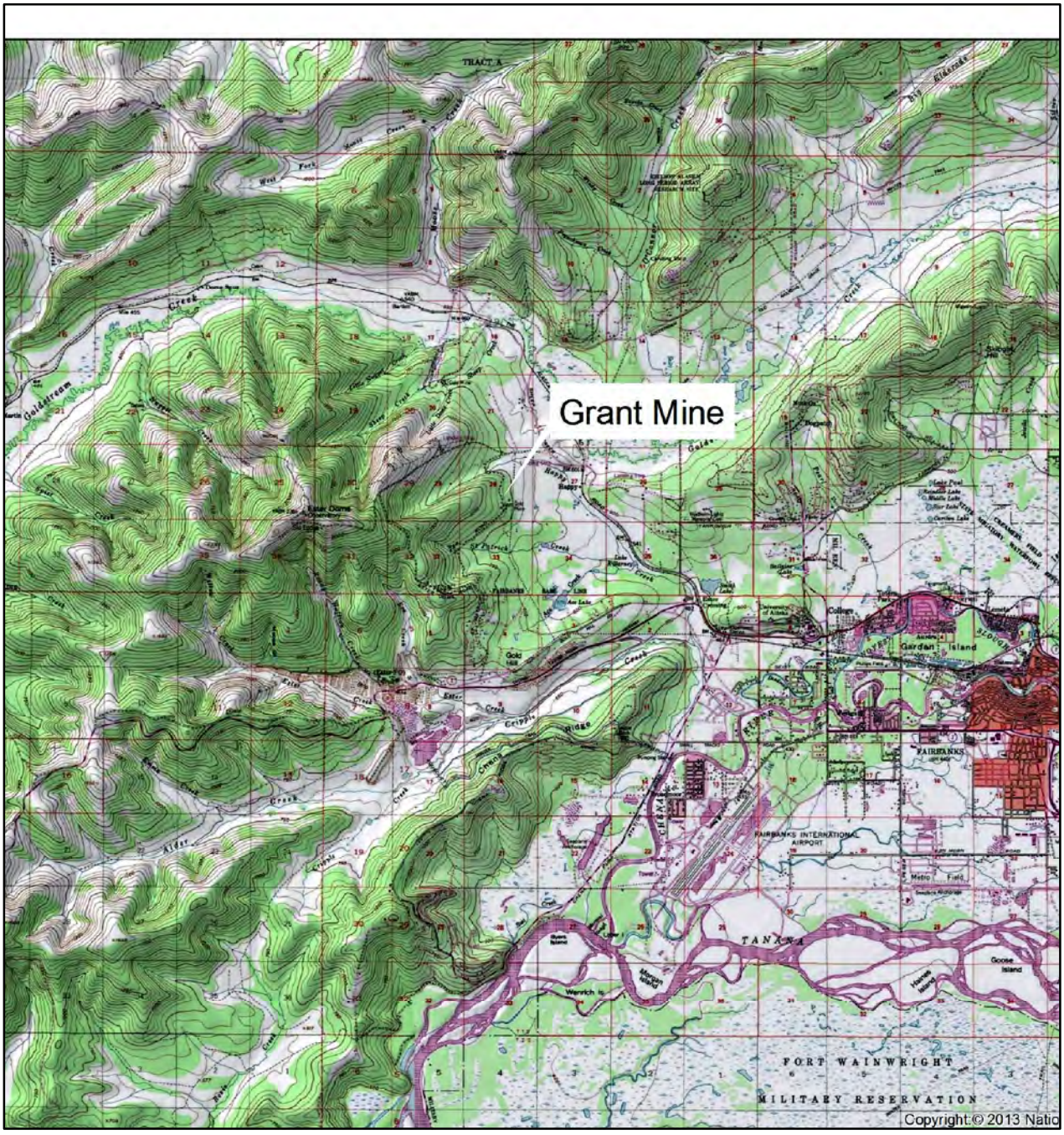
(2) an engineered feature or structure that requires monitoring, maintenance, or operation, or that will not function as intended if disturbed.

(b) An environmental covenant may be held by one or more holders. A holder may own an interest in the real property subject to an environmental covenant. The interest of a holder is an interest in real property.

Mr. Burggraf will work with ADEC and ADNR to develop the appropriate deed notice/environmental covenant for the portion of the property surrounding the impoundment.

6.2.2 Post-Capping Monitoring

18 AAC 60.490 (c) outlines the post-capping monitoring requirements for monofills. The owner/operator shall conduct visual monitoring, for settlement and erosion, for at least 60 consecutive months following the completion of the cap. Additional monitoring may be required as described in 18 AAC 60.815, if a change is observed. At the end of the post-capping period, the owner or operator shall submit a report to the department that describes site conditions and summarizes the information collected during post-capping period



N

1 Mile

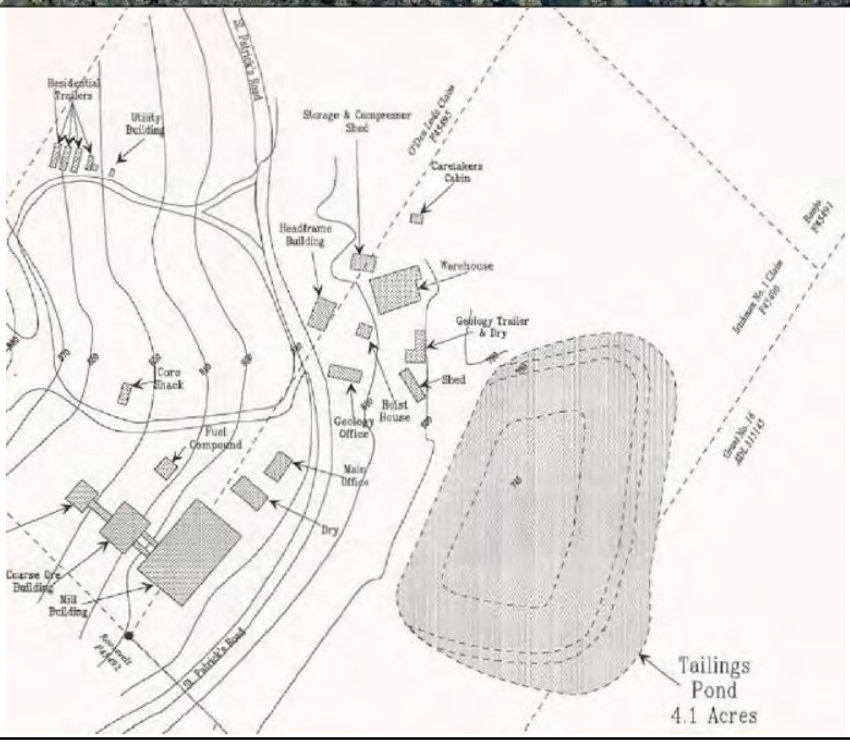
Grant Mine Tailing Impoundment Closure
Ester Dome, Alaska

SITE VICINITY

June 2021 31-1-20094-007

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Figure 1



N

200 Feet

Grant Mine Tailing Impoundment Closure
Ester Dome, Alaska

SITE MAP

June 2021 31-1-20094-007

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Figure 2

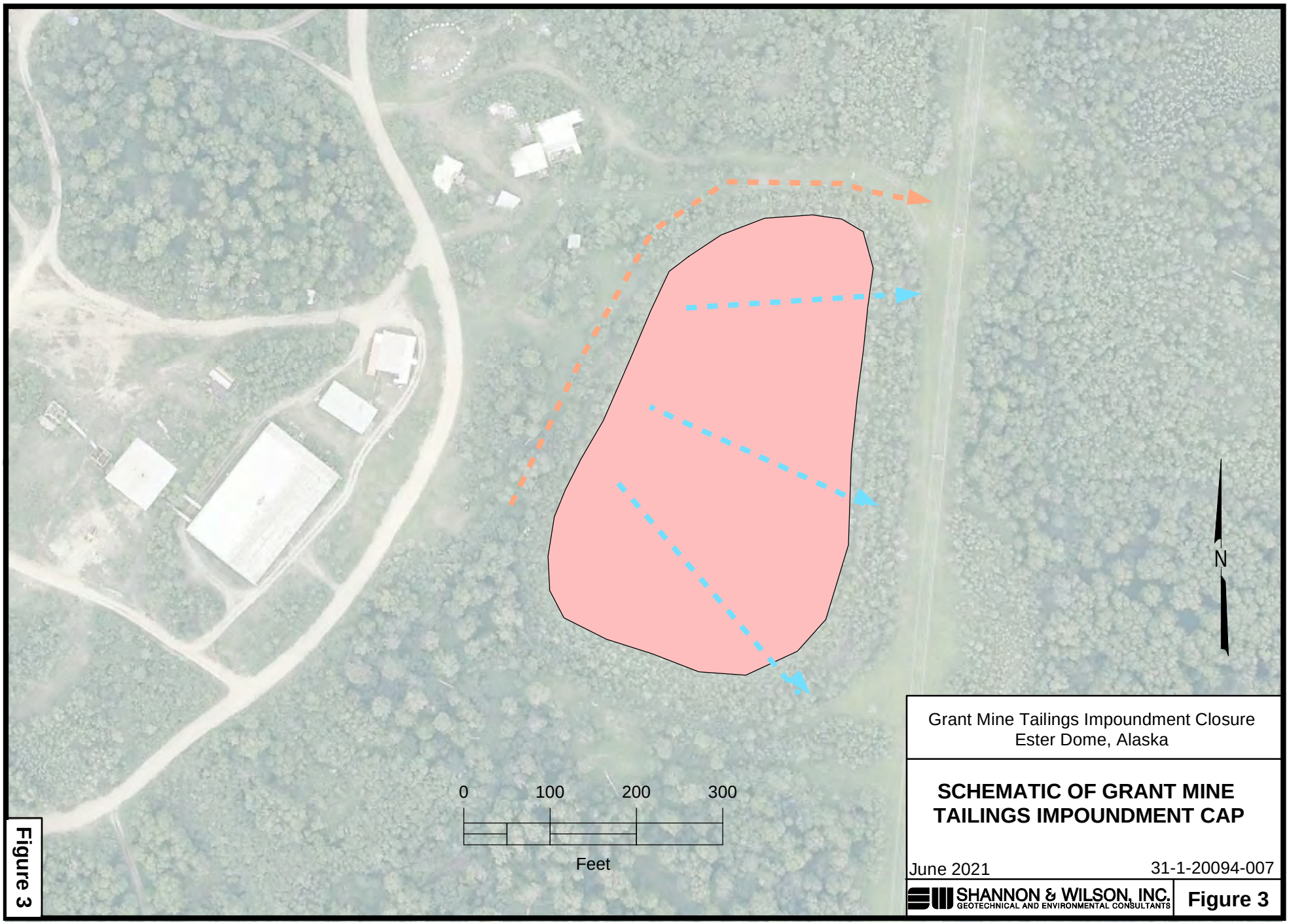

Figure 3

Grant Mine Tailings Impoundment Closure
Ester Dome, Alaska

SCHEMATIC OF GRANT MINE TAILINGS IMPOUNDMENT CAP

June 2021

31-1-20094-007

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Figure 3

APPENDIX A: SECONDARY TAILINGS AREA CLEANUP

Appendix A

Secondary Tailings Area Cleanup

CONTENTS

SHANNON & WILSON
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

March 5, 2020

Mr. Roger Burggraf
830 Sheep Creek Road
Fairbanks, Alaska 99709-6130

RE: POST-EXCAVATION SAMPLING, SECONDARY TAILINGS IMPOUNDMENT, GRANT MINE, ESTER DOME, ALASKA, ADEC FILE #100.38.182, HAZARD ID 731

Dear Mr. Burggraf,

We are pleased to present the results of our confirmation sampling following the removal of arsenic-rich tailings from the Secondary Tailings Impoundment (STI) at the Grant Mine. The tailings removal was part of the overall closure of the primary tailings impoundment at the Grant Mine on Ester Dome near Fairbanks, Alaska (Figure 1). Our post-excavation sampling methodology was outlined in our letter *Post-Excavation Sampling Plan, Secondary Tailing Impoundment, Grant Mine, Ester Dome, Alaska, ADEC File #100.38.182, Hazard ID 731* dated October 18, 2019. The Alaska Department of Environmental Conservation (ADEC) approved our sampling approach in an e-mail dated October 22, 2019.

BACKGROUND

Roger Burggraf has held the mining claims since 1972. Between 1980 and 1983, Silverado operated a pilot mill for metallurgical testing. The pilot mill recovered free gold through gravity separation; no cyanide was used during the operation of the pilot mill. Tailings from the pilot mill were placed in the initial tailings area also known as the Secondary Tailings Impoundment (Figure 2). Records show 4,723 dry tons of ore were processed through the pilot mill from 1980 through 1983. The volume of the tailings generated would be about 2,100 cubic yards assuming a conservative specific gravity 2.65 grams/cubic centimeter (specific gravity of quartz). According to Mr. Burggraf, cyanide was not used during the pilot study and therefore was not discharged to the STI.

Based on our field observations and a 1986 aerial photograph, the STI was an unlined bermed area prior to the placement of the tailings. The tailings occupied about 2,200 square feet with a thickness of up to 4 feet. Since the tailings were deposited as a slurry, the coarser sandy tailings accumulated near the discharge point to the north and finer grained material flowed further south.

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Shannon & Wilson prepared a *Revised Site Characterization Report, Grant Mine Tailings Impoundment, 1.2 Mile St. Patrick Road, Fairbanks, Alaska*, dated August 2019, and concluded the tailings in the secondary impoundment exceeded ADEC human health cleanup levels for arsenic and were not contained. Samples of the tailings and fine-grained runoff contained arsenic, antimony, and silver exceeding the ADEC cleanup level. In addition, the soil samples had Synthetic Precipitation Leaching Procedure (SPLP) exceedances for arsenic, antimony, and lead.

To mitigate the exposure risk, Shannon & Wilson recommended excavating the tailings in the secondary impoundment and moving them to the primary tailings impoundment before capping the primary tailings impoundment. In their letter dated September 19, 2019, the ADEC agreed with Shannon & Wilson's recommendation.

Mr. Burggraf revised his Annual Placer Mining Application (APMA #F16-7130) to include this tailing removal.

FIELD ACTIVITIES

Mr. Burggraf used an excavator, front-end loader, and dump truck to remove of the tailings from the secondary impoundment between October 8, 2019 and October 21, 2019. The removal was based on visual segregation of the tailings from the underlying silt. Exhibit 1 illustrates the difference between the dark brown native silt on the left and the tan runoff material on the right. The excavation area was approximately 20,000 square feet. Based on this area and an average depth of removal of 3.5 feet, the volume of tailings removed was about 2,500 cubic yards. Mr. Burggraf placed the tailings into the center of the primary tailings impoundment. Following the removal, we observed the limits of the excavation and determined the tailings had been removed to the extent practicable.

Exhibit 1: Comparison of native soil (left) with tailings (right) within the secondary tailings impoundment.

Confirmation Sampling

To assess the concentrations of RCRA (Resource Conservation and Recovery Act) metals at the limits of the excavation, and to confirm the complete removal of the tailings, we used a combination of Incremental Sampling Methodology (ISM) and discrete sampling. ISM

samples were collected to characterize the surface area of the tailings excavation while discrete samples were collected from locations around the perimeter of the tailings excavation. We collected the soil samples on October 22 and 23, 2019.

Incremental Sampling

We divided the tailings excavation into three decision units (DUs), as shown in Figure 2. Each DU was then divided into 30 equivalently sized sample units (SU), aligned in a grid configuration. A random number generator was used to select X and Y coordinates within these SUs from which a subsample was collected. We used a TerraCore Sampler™ to collect a 30- to 35-gram subsample from the random location selected within each SU. The subsamples were then composited into a single soil sample container representing the entire DU. Photos of the sampling grid and the sampling process are attached.

We submitted the composited samples to SGS North America for sample processing which included drying, sieving, and random subsampling. SGS analyzed the processed sample for RCRA Metals plus antimony by EPA Method 6000/7000 Series.

We collected replicate ISM samples from DU3 to verify the representativeness of the sampling methodology. To accomplish this, three sets of random coordinates were generated for DU3. Subsamples were collected from these three locations within each of the 30 increments of DU3. These subsamples were then composited into three unique soil masses and submitted to the laboratory as three distinct ISM samples. We assessed the representativeness of the data by calculating the relative standard deviation (RSD) and 95% upper confidence limit (95% UCL) for each of the detected analytes in the replicate ISM samples. Per ADEC guidance, we consider an RSD of less than or equal to 30% to meet our data quality objectives (DQOs).

The following guidance documents were used to develop our approach to multi-increment sampling:

- *Draft Guidance on Multi Increment Soil Sampling*, Alaska Department of Environmental Conservation, March 2009.
- *Incremental Sampling Methodology*, The Interstate Technology & Regulatory Council, February 2012.

Discrete Sampling

We collected three discrete samples from the area around the small body of water in the Secondary Impoundment and six discrete samples plus a field duplicate sample from

around the perimeter of the tailings excavation. We collected the samples from a depth of six inches below ground surface. We submitted the samples to SGS North America, Inc. (SGS) for the analysis of RCRA Metals plus antimony by EPA Method 6000/7000 Series.

ANALYTICAL RESULTS

The analytical results were compared with ADEC cleanup levels in 18 AAC 75 Table B1 Method Two – Human Health (Under 40-Inch Zone) and are summarized in Table 1. Arsenic was the only metal that exceeded the ADEC human health cleanup levels, and arsenic exceeded the cleanup level in all but one of the 12 samples we collected.

Barium, chromium, and lead were detected in all samples below the ADEC Human Health cleanup level. Cadmium was detected below the cleanup level in about half of the samples and silver was detected in two samples; the remainder of samples had estimated detections for cadmium and silver below the laboratory limit of quantitation (LOQ). Mercury and selenium were detected at estimated concentrations below the LOQ in all samples. Antimony was detected at an estimated concentration below the LOQ in two samples and was not detected in the remainder.

STATISTICAL ANALYSIS OF BACKGROUND METALS

We compared the arsenic results for the grab samples from the STI with the Ester Dome background soil data published by Hawkins et al. (1982; Figure 3) to test whether the mean arsenic concentration in the STI was greater than in the background.

The data were first segregated into two groups: Grant Mine limit-of-excavation samples (including ISM and discrete samples) and Ester Dome background samples. Statistical assessments were conducted in accordance with DEC Technical Memorandum *Guidance for Evaluating Metals at Contaminated Sites* (August 2018) and EPA's *Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites* (EPA 540-R-01-003; September 2002) document. Data reduction was conducted in accordance with the DEC Technical Memorandum *Treatment of Non-Detect Values, Data Reduction for Multiple-Detections and Comparison of Quantitation Limits to Cleanup Values* (April 2017).

Field-duplicate and triplicate samples were reduced as follows:

- For field-duplicate samples, the highest detected result is used for statistical evaluations.
- For ISM field-triplicate samples, the 95-percent UCL is used for statistical evaluations.

Statistical evaluations were conducted using the EPA statistics software package ProUCL® Version 5.1. The data were then imported to ProUCL and a Dixon's Outlier Test was performed. Analytical results that were identified as outliers at a 5 percent significance level were removed from the data set prior to further evaluation. The following data points were removed:

- 148 mg/kg was removed from the Background data set.
- 110 mg/kg was removed from the Grant Mine data set.

The data were then evaluated to assess if they followed a normal or lognormal distribution. The background data set was normal and lognormal but the Grant Mine data set was neither. As such, a non-parametric comparison of the mean values was conducted using the Wilcoxon-Mann-Whitney Rank and Sum Hypothesis Test. Below is a summary of the null hypothesis, alternative hypothesis, and the results of the Hypothesis Testing.

- The null hypothesis is that the Grant Mine data set is greater than the background data set (H_0: $\mu_{GM} > \mu_{BK}$).
- The alternative hypothesis is that the Grant Mine data is less than or equal to the background data set (H_A: $\mu_{GM} \leq \mu_{BK}$).
- The null hypothesis was rejected at a 95-percent confidence (approximate p-value 0.003). The alternative hypothesis is supported.

This conclusion is supported by a depiction of the data as box plots for the Ester Dome and the Grant Mine data sets. Arsenic concentrations in the samples from the STI ranged from 8.22 to 110 mg/kg, and the mean arsenic concentration (following data reduction) was 20.99 mg/kg. The mean background arsenic concentration was 37.46. There is sufficient evidence to suggest that the mean of Grant Mine data is less than the mean of the background data set.

QUALITITY ASSURANCE/QUALITITY CONTROL

Quality assurance (QA)/quality control (QC) procedures assist in producing data of acceptable quality and reliability. Analytical results for laboratory QC samples were reviewed and a QA assessment of the data was conducted as the data were generated. The QA review procedure provided documentation of the accuracy and precision of the analytical data and confirmed that the analyses were sufficiently sensitive to detect analytes at levels below suggested action levels or regulatory standards, where such standards exist. Shannon & Wilson conducted a QA assessment of SGS laboratory report 1199895, following the ADEC's laboratory data review checklist (LDRC).

Sample Handling

Soil samples collected by Shannon & Wilson personnel were hand delivered to the SGS receiving office in Fairbanks, Alaska. SGS then shipped the samples to their laboratory in Anchorage, Alaska to perform the requested analyses, using the methods specified in the Chain-of-Custody (COC) records.

Sample-receipt forms provided by SGS were reviewed and checked to verify samples were received in good condition and within the acceptable temperature range. The ADEC considers samples received free of ice and at temperatures between 0 °C and 6 °C as acceptable.

Samples were generally received in good condition, properly preserved, and within the acceptable temperature range upon arrival at the laboratory. COC records were also reviewed to confirm information was complete, custody was not breached, and samples were analyzed within the acceptable holding times required by the requested analytical methods.

Analytical Sensitivity and Blanks

Reported limits of detection (LODs) for regulated analytes were below applicable ADEC cleanup levels for the samples included with this work order.

Laboratory method blanks were analyzed in conjunction with samples collected for this project to check for contributions to the analytical results possibly attributable to laboratory-based contamination. There were no method blank detections for the reported results included with this data set.

Laboratory QC Samples

In order to evaluate the accuracy and precision of the analytical method, the laboratory analyzed QC samples for each preparatory batch. These QC samples consist of laboratory control samples (LCS), matrix spike (MS) and MS duplicate (MSD) samples, and bench spike samples. We reviewed the results of the laboratory QC samples to verify that the reported accuracy and precision were within acceptable limits. We identified several QC irregularities relating to MS/MSD recovery. However, the none of the identified irregularities had an adverse effect on data quality/usability. All instances of analyte recovery failure in the MS/MSD samples were accompanied by LCS and/or bench spike samples which demonstrated method accuracy for all reported analytes.

ISM Sample Representativeness

The amount of agreement between the detected results of the replicate ISM samples was evaluated by calculating the RSD. The RSD is defined as:

$$RSD(\%) = \frac{Standard\ Deviation}{Arithmetic\ Mean\ of\ Target\ Analyte} \times 100$$

The RSD for each detected target analyte was compared to the project specific DQO of 30% maximum deviation. Our review revealed that all target analytes reported for the replicate ISM samples met this DQO.

DATA QUALITY SUMMARY

Based on the methods outlined in our Grant Mine Tailings Impoundment Closure approved work plan, the samples detailed in the SGS laboratory report 1199895 are considered to be representative of site conditions at the locations and times they were obtained. The quality of the analytical data for these samples does not appear to have been compromised by analytical irregularities.

DISCUSSION

Many investigators have documented anomalous arsenic and other metals concentrations in surface and subsurface soil, rock, and groundwater on and around Ester Dome.

An investigation in 1988 conducted by the United States Geological Survey (USGS) examined metal concentrations in soil samples collected in various locations throughout Alaska. The geometric mean concentration of arsenic is 6.7 mg/kg, with concentrations of arsenic ranging up to 750 mg/kg. Of the 48 soil samples analyzed in the study, 64.8 percent contained arsenic in concentrations of up to 10 mg/kg, 19.7 percent contained arsenic up to 20 mg/kg, and 15.5 percent contained arsenic up to 100 mg/kg.

Hawkins, et al. (1982) collected soil from various soil horizons along the ridge to the northwest of the Grant Mine. In the fourteen samples they collected, arsenic ranged from 19 to 148 mg/kg (mean of 45.36 mg/kg) in the B soil horizon. Arsenic in sediment samples they collected from streams draining the eastern side of Ester Dome ranged from 350 mg/kg to 1,389 mg/kg. Stevens et al. (1969) collected hundreds of rock samples along Ester Dome Road after it was constructed in 1968; arsenic was detected as high as 4,500 mg/kg. According to Verplanck et al. (2003), Ester Dome is known to contain groundwater with high dissolved arsenic concentrations in excess of 1 milligram per liter (mg/L).

The mean concentration of arsenic detected in our discrete and ISM soil samples from the area surrounding and beneath the secondary tailings impoundment was 28.05 mg/kg, less than the mean soil arsenic concentration of 45.36 reported by Hawkins et al. Based on the results of the regional and local studies, we believe that the arsenic exceedances measured in soil samples collected from the STI following the removal of the tailings are consistent with naturally occurring background levels. In addition, there are naturally occurring high concentrations of arsenic and other metals in groundwater that make it non-potable.

CONCLUSIONS AND RECOMMENDATIONS

The samples we collected from the base of the excavation and the areas adjacent to the excavation shows Mr. Burggraf was successful in moving the tailings from the STI to the primary tailings impoundment. The combined tailings will be capped to during the closure of the impoundment. The concentration of arsenic detected in the samples from the limits of the excavation were less than the background concentrations. We recommend DEC considers cleanup complete status for the STI.

Sincerely,

SHANNON & WILSON

Dana Fjare
Environmental Scientist

MSL:CBD/msl

Enc. References
Table 1. Grant Mine Tailings Impoundment Analytical Soil Results October 2019
Figure 1. Site Location
Figure 2. Decision Units and Discrete Sample Locations
Figure 3. Hawkins et al. 1982 Background Soil Sample Locations
SGS Laboratory Report 1199895
ADEC Laboratory Data Review Checklist
ProUCL Statistical Output Summaries
Field Forms

REFERENCES

Alaska Department of Environmental Conservation. Technical Memorandum *Guidance for Evaluating Metals at Contaminated Sites*, August 2018.

Alaska Department of Environmental Conservation. Technical Memorandum *Treatment of Non-Detect Values, Data Reduction for Multiple-Detections and Comparison of Quantitation Limits to Cleanup Values*, April 2017.

Interstate Technology Research Council. *Incremental Sampling Methodology,* February 2012.

Hawkins, D.B., R.B. Forbes, C.I. Hok, and D. Dinkel. *Arsenic in the Water, Soil, Bedrock and Plants of the Ester Dome Area of Alaska.* University of Alaska Fairbanks Institute of Water Resources, 1982.

Stevens, D.L., R.B. Forbes, and D.B. Hawkins. *Gold Anomalies and Magnetometer Profile Data Ester Dome Area, Fairbanks District, Alaska.* University of Alaska Fairbanks, 1969.

U.S. Geological Survey. *Element Concentrations in Soils and Other Surficial Materials of Alaska, 1988.*

U.S. Environmental Protection Agency. *Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites*. EPA 540-R-01-003, September 2002.

Verplanck, P.L., S.H. Mueller, E.K. Youcha, R.J. Goldfarb, R.F. Sanzolone, R.B. McCleskey, P.H. Briggs, M. Roller, M. Adams, and D.K. Nordstrom. *Chemical Analyses of Ground and Surface Waters, Ester Dome, Central Alaska, 2000-2001*. U.S. Geological Survey, 2003.

TABLE 1
GRANT MINE SECONDARY TAILINGS IMPOUNDMENT ANALYTICAL SOIL RESULTS
OCTOBER 2019

		Antimony	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
ADEC Cleanup Level →		41 mg/kg	8.8 mg/kg	20,000 mg/kg	92 mg/kg	100,000 mg/kg	400 mg/kg	32 mg/kg	510 mg/kg	510 mg/kg
19GM-DU1		<0.560	**13.8**	184	0.268	26.8	9.85	0.0496 J	0.733 J	0.115 J
19GM-DU2		0.601 J	**55.1**	174	0.251	26.8	14.1	0.0436 J	0.705 J	0.28
19GM-DU3	Replicate A	<0.565	**15.2**	178	0.26	26.2	11.6	0.0400 J	0.741 J	0.117 J
	Replicate B	<0.565	**18.9**	205	0.284	26.5	11	0.0401 J	0.694 J	0.130 J
	Replicate C	<0.565	**19.8**	176	0.235	25.9	9.95	0.0454 J	0.631 J	0.137 J
	95% UCL	<0.565	**24.1**	227	0.321	27.0	12.95	0.0496 J	0.828 J	0.154 J
GM19-1		<0.570	**11.5**	194	0.161 J	28.6	9.46	0.0407 J	0.607 J	0.118 J
GM19-10		<0.545	**15.0**	184	0.247	25.7	10.3	0.0409 J	0.464 J	0.136 J
GM19-2		<0.580	**9.09**	183	0.252	31.4	9.75	0.0468 J	0.518 J	0.101 J
GM19-3		0.763 J	**110**	171	0.177 J	28.9	15.1	0.0629 J	0.740 J	0.324
GM19-4		<0.595	**50.0**	152	0.157 J	31.5	8.82	0.0721 J	0.836 J	0.150 J
GM19-5		<0.565	8.22	168	0.188 J	28.3	9.38	0.0423 J	0.544 J	0.127 J
GM19-6		<0.575	**13.9**	209	0.205 J	28.8	9.53	0.0332 J	0.696 J	0.117 J
GM19-7		<0.620	**12.3**	216	0.217 J	30.4	9.41	0.0349 J	0.527 J	0.0899 J
GM19-8		<0.575	**14.6**	211	0.163 J	28.7	9.94	0.0323 J	0.644 J	0.113 J
GM19-9		<0.565	**14.8**	186	0.254	26.8	10.4	0.0450 J	0.517 J	0.144 J

Notes:

Analytical results reported from SGS North America, Inc. work order 1199895.

ADEC Soil Cleanup Levels from 18 AAC 75.341 Table B1 Method Two - Human Health (Under 40-Inch Zone)

Sample *GM19-10* is a field duplicate of sample *GM19-1* .

ADEC — Alaska Department of Environmental Conservation

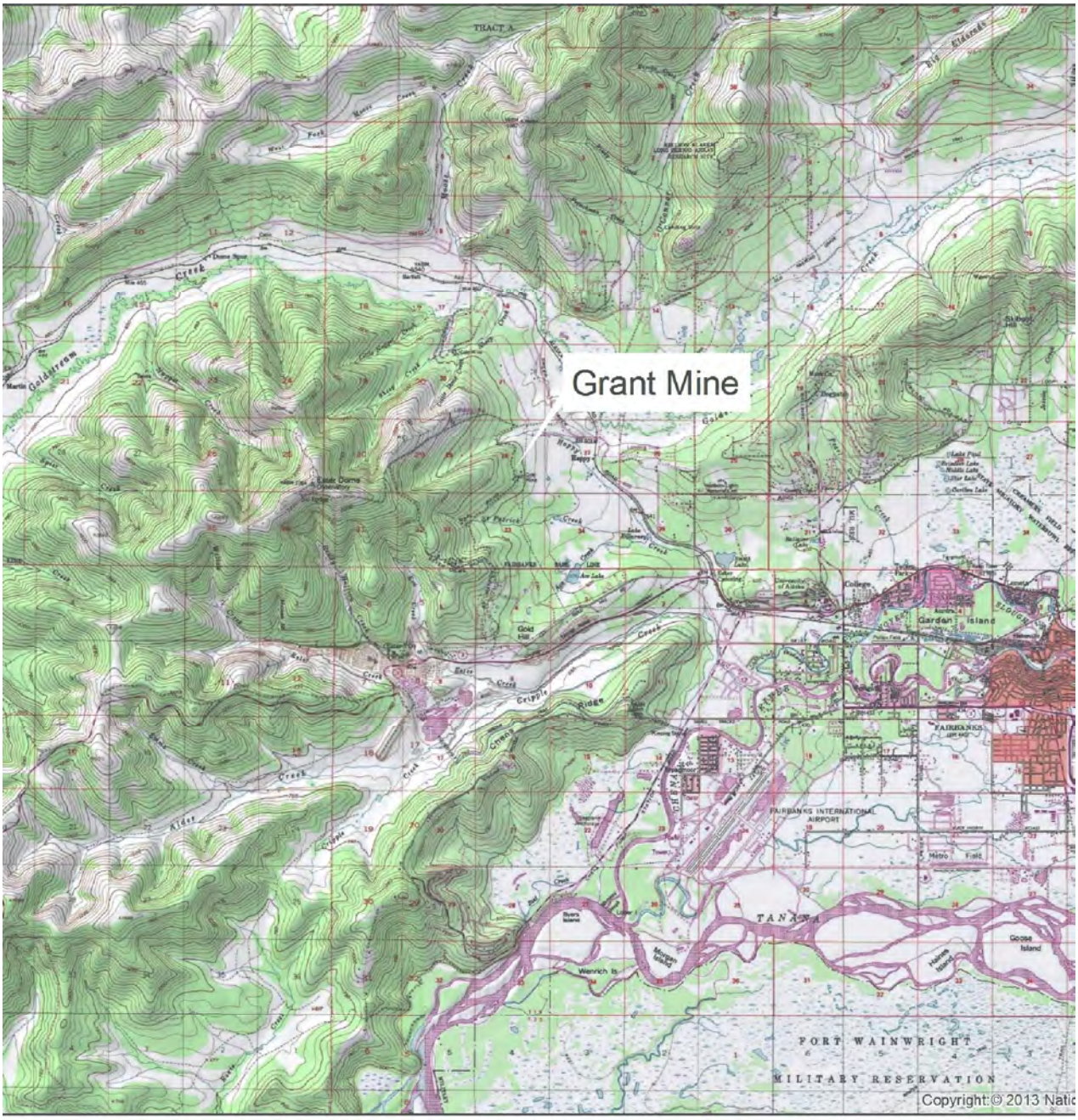
mg/kg — milligrams per kilogram

UCL — upper confidence limit

J — Estimated concentration, detected greater than the limit of detection (LOD) and less than the limit of quantitation (LOQ). Flag applied by the laboratory.

< — Analyte was not detected; reported as <LOD.

Bold — Detected concentration exceeds the ADEC Human Health (Under 40-Inch Zone) soil cleanup level.



N

1 Mile

Grant Mine Secondary Tailings Impoundment
Post-Excavation Sampling
Ester Dome, Alaska

SITE LOCATION

March 2020 31-1-20094

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Figure 1

Quantum Spatial - June 14, 1986

0 50 100

Feet

LEGEND

Discrete Sample Locations

- Excavation Perimeter
- Surface Water Body Perimeter
- Decision Units
- Excavation Limits

N

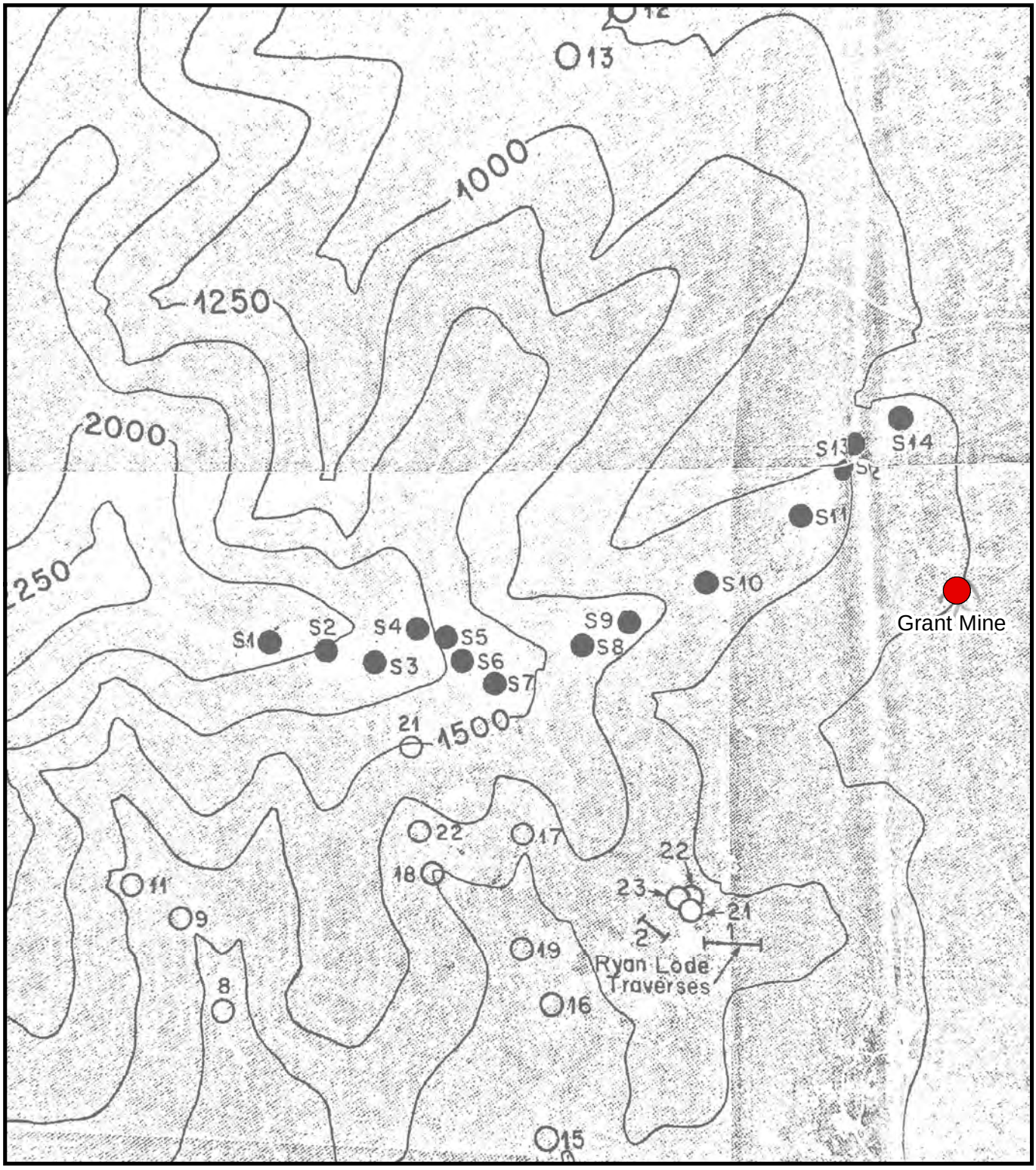
Grant Mine Secondary Tailings Impoundment
Post-Excavation Sampling
Ester Dome, Alaska

DECISION UNIT AND DISCRETE SAMPLE LOCATIONS

March 2020 31-1-20094

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Figure 2



Source: Adapted from Hawkins et al. June 1982

NOTE: Background samples collected for arsenic (S1 through S14) are symbolized as black circles.

N

Grant Mine Secondary Tailings Impoundment
Post-Excavation Sampling
Ester Dome, Alaska

HAWKINS ET AL. 1982 BACKGROUND SOIL SAMPLE LOCATIONS

March 2020 31-1-20094

SHANNON & WILSON, INC. GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Figure 3

Laboratory Report of Analysis

To: Shannon & Wilson-Fairbanks
2355 Hill Road
Fairbanks, AK 99709
(907)749-0600

Report Number: **1199895**

Client Project: **20094 Grant Mine**

Dear Andrew Frick,

Enclosed are the results of the analytical services performed under the referenced project for the received samples and associated QC as applicable. The samples are certified to meet the requirements of the National Environmental Laboratory Accreditation Conference Standards. Copies of this report and supporting data will be retained in our files for a period of ten years in the event they are required for future reference. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. Any samples submitted to our laboratory will be retained for a maximum of fourteen (14) days from the date of this report unless other archiving requirements were included in the quote.

If there are any questions about the report or services performed during this project, please call Jennifer at (907) 562-2343. We will be happy to answer any questions or concerns which you may have.

Thank you for using SGS North America Inc. for your analytical services. We look forward to working with you again on any additional analytical needs.

Sincerely,
SGS North America Inc.

Stephen C. Ede
Stephen Ede
2019.11.12
10:25:11 -09'00'

Jennifer Dawkins Date
Project Manager
Jennifer.Dawkins@sgs.com

SGS North America Inc. 200 West Potter Drive, Anchorage, AK 99518
t 907.562.2343 f 907.561.5301 www.us.sgs.com

Case Narrative

SGS Client: Shannon & Wilson-Fairbanks

SGS Project: 1199895

Project Name/Site: 20094 Grant Mine

Refer to sample receipt form for information on sample condition.

1541153MS **1541154 MS**

6020A - Metals MS recovery for barium and antimony does not meet QC criteria. The post digestion spike was successful.

1541153MSD **1541155 MSD**

6020A - Metals MSD recovery for barium and antimony does not meet QC criteria. The post digestion spike was successful.

* QC comments may be associated with the field samples found in this report. When applicable, comments will be applied to the associated field samples.

Laboratory Qualifiers

Enclosed are the analytical results associated with the above work order. The results apply to the samples as received. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. This document is issued by the Company under its General Conditions of Service accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx>. Attention is drawn to the limitation of liability, indenmification and jurisdiction issues defined therein.

Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the context or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

SGS maintains a formal Quality Assurance/Quality Control (QA/QC) program. A copy of our Quality Assurance Plan (QAP), which outlines this program, is available at your request. The laboratory certification numbers are AK00971 (DW Chemistry & Microbiology) & 17-021 (CS) for ADEC and 2944.01 for DOD ELAP/ISO17025 (RCRA methods: 1020B, 1311, 3010A, 3050B, 3520C, 3550C, 5030B, 5035A, 6020A, 7470A, 7471B, 8015C, 8021B, 8082A, 8260C, 8270D, 8270D-SIM, 9040C, 9045D, 9056A, 9060A, AK101 and AK102/103). SGS is only certified for the analytes listed on our Drinking Water Certification (DW methods: 200.8, 2130B, 2320B, 2510B, 300.0, 4500-CN-C,E, 4500-H-B, 4500-NO3-F, 4500-P-E and 524.2) and only those analytes will be reported to the State of Alaska for compliance. Except as specifically noted, all statements and data in this report are in conformance to the provisions set forth by the SGS QAP and, when applicable, other regulatory authorities.

The following descriptors or qualifiers may be found in your report:

*	The analyte has exceeded allowable regulatory or control limits.
!	Surrogate out of control limits.
B	Indicates the analyte is found in a blank associated with the sample.
CCV/CVA/CVB	Continuing Calibration Verification
CCCV/CVC/CVCA/CVCB	Closing Continuing Calibration Verification
CL	Control Limit
DF	Analytical Dilution Factor
DL	Detection Limit (i.e., maximum method detection limit)
E	The analyte result is above the calibrated range.
GT	Greater Than
IB	Instrument Blank
ICV	Initial Calibration Verification
J	The quantitation is an estimation.
LCS(D)	Laboratory Control Spike (Duplicate)
LLQC/LLIQC	Low Level Quantitation Check
LOD	Limit of Detection (i.e., 1/2 of the LOQ)
LOQ	Limit of Quantitation (i.e., reporting or practical quantitation limit)
LT	Less Than
MB	Method Blank
MS(D)	Matrix Spike (Duplicate)
ND	Indicates the analyte is not detected.
RPD	Relative Percent Difference
U	Indicates the analyte was analyzed for but not detected.

Note: Sample summaries which include a result for "Total Solids" have already been adjusted for moisture content. All DRO/RRO analyses are integrated per SOP.

SGS North America Inc. 200 West Potter Drive, Anchorage, AK 99518
t 907.562.2343 f 907.561.5301 www.us.sgs.com

Sample Summary

Client Sample ID	Lab Sample ID	Collected	Received	Matrix
GM19-1	1199895001	10/22/2019	10/29/2019	Soil/Solid (dry weight)
GM19-2	1199895002	10/22/2019	10/29/2019	Soil/Solid (dry weight)
GM19-3	1199895003	10/22/2019	10/29/2019	Soil/Solid (dry weight)
GM19-4	1199895004	10/23/2019	10/29/2019	Soil/Solid (dry weight)
GM19-5	1199895005	10/23/2019	10/29/2019	Soil/Solid (dry weight)
GM19-6	1199895006	10/23/2019	10/29/2019	Soil/Solid (dry weight)
GM19-7	1199895007	10/23/2019	10/29/2019	Soil/Solid (dry weight)
GM19-8	1199895008	10/23/2019	10/29/2019	Soil/Solid (dry weight)
GM19-9	1199895009	10/23/2019	10/29/2019	Soil/Solid (dry weight)
GM19-10	1199895010	10/23/2019	10/29/2019	Soil/Solid (dry weight)
19GM-DU3 A	1199895011	10/22/2019	10/29/2019	Soil/Solid (dry weight)
19GM-DU3 B	1199895012	10/22/2019	10/29/2019	Soil/Solid (dry weight)
19GM-DU3 C	1199895013	10/22/2019	10/29/2019	Soil/Solid (dry weight)
19GM-DU2	1199895014	10/23/2019	10/29/2019	Soil/Solid (dry weight)
19GM-DU1	1199895015	10/23/2019	10/29/2019	Soil/Solid (dry weight)

Method	Method Description
SW6020A	Metals by ICP-MS (S)
MI-ITRC ISM (Feb 2012)	MI Sampling/Sieving
SM21 2540G	Percent Solids SM2540G

SGS North America Inc.
200 West Potter Drive, Anchorage, AK 99518
t 907.562.2343 f 907.561.5301 www.us.sgs.com

Detectable Results Summary

Client Sample ID: **GM19-1**
Lab Sample ID: 1199895001
Metals by ICP/MS

Parameter	Result	Units
Arsenic	11.5	mg/Kg
Barium	194	mg/Kg
Cadmium	0.161J	mg/Kg
Chromium	28.6	mg/Kg
Lead	9.46	mg/Kg
Mercury	0.0407J	mg/Kg
Selenium	0.607J	mg/Kg
Silver	0.118J	mg/Kg

Client Sample ID: **GM19-2**
Lab Sample ID: 1199895002
Metals by ICP/MS

Parameter	Result	Units
Arsenic	9.09	mg/Kg
Barium	183	mg/Kg
Cadmium	0.252	mg/Kg
Chromium	31.4	mg/Kg
Lead	9.75	mg/Kg
Mercury	0.0468J	mg/Kg
Selenium	0.518J	mg/Kg
Silver	0.101J	mg/Kg

Client Sample ID: **GM19-3**
Lab Sample ID: 1199895003
Metals by ICP/MS

Parameter	Result	Units
Antimony	0.763J	mg/Kg
Arsenic	110	mg/Kg
Barium	171	mg/Kg
Cadmium	0.177J	mg/Kg
Chromium	28.9	mg/Kg
Lead	15.1	mg/Kg
Mercury	0.0629J	mg/Kg
Selenium	0.740J	mg/Kg
Silver	0.324	mg/Kg

Client Sample ID: **GM19-4**
Lab Sample ID: 1199895004
Metals by ICP/MS

Parameter	Result	Units
Arsenic	50.0	mg/Kg
Barium	152	mg/Kg
Cadmium	0.157J	mg/Kg
Chromium	31.5	mg/Kg
Lead	8.82	mg/Kg
Mercury	0.0721J	mg/Kg
Selenium	0.836J	mg/Kg
Silver	0.150J	mg/Kg

SGS North America Inc.
200 West Potter Drive, Anchorage, AK 99518
t 907.562.2343 **f** 907.561.5301 www.us.sgs.com

Detectable Results Summary

Client Sample ID: **GM19-5**
Lab Sample ID: 1199895005
Metals by ICP/MS

Parameter	Result	Units
Arsenic	8.22	mg/Kg
Barium	168	mg/Kg
Cadmium	0.188J	mg/Kg
Chromium	28.3	mg/Kg
Lead	9.38	mg/Kg
Mercury	0.0423J	mg/Kg
Selenium	0.544J	mg/Kg
Silver	0.127J	mg/Kg

Client Sample ID: **GM19-6**
Lab Sample ID: 1199895006
Metals by ICP/MS

Parameter	Result	Units
Arsenic	13.9	mg/Kg
Barium	209	mg/Kg
Cadmium	0.205J	mg/Kg
Chromium	28.8	mg/Kg
Lead	9.53	mg/Kg
Mercury	0.0332J	mg/Kg
Selenium	0.696J	mg/Kg
Silver	0.117J	mg/Kg

Client Sample ID: **GM19-7**
Lab Sample ID: 1199895007
Metals by ICP/MS

Parameter	Result	Units
Arsenic	12.3	mg/Kg
Barium	216	mg/Kg
Cadmium	0.217J	mg/Kg
Chromium	30.4	mg/Kg
Lead	9.41	mg/Kg
Mercury	0.0349J	mg/Kg
Selenium	0.527J	mg/Kg
Silver	0.0899J	mg/Kg

Client Sample ID: **GM19-8**
Lab Sample ID: 1199895008
Metals by ICP/MS

Parameter	Result	Units
Arsenic	14.6	mg/Kg
Barium	211	mg/Kg
Cadmium	0.163J	mg/Kg
Chromium	28.7	mg/Kg
Lead	9.94	mg/Kg
Mercury	0.0323J	mg/Kg
Selenium	0.644J	mg/Kg
Silver	0.113J	mg/Kg

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Detectable Results Summary

Client Sample ID: **GM19-9**
Lab Sample ID: 1199895009
Metals by ICP/MS

Parameter	Result	Units
Arsenic	14.8	mg/Kg
Barium	186	mg/Kg
Cadmium	0.254	mg/Kg
Chromium	26.8	mg/Kg
Lead	10.4	mg/Kg
Mercury	0.0450J	mg/Kg
Selenium	0.517J	mg/Kg
Silver	0.144J	mg/Kg

Client Sample ID: **GM19-10**
Lab Sample ID: 1199895010
Metals by ICP/MS

Parameter	Result	Units
Arsenic	15.0	mg/Kg
Barium	184	mg/Kg
Cadmium	0.247	mg/Kg
Chromium	25.7	mg/Kg
Lead	10.3	mg/Kg
Mercury	0.0409J	mg/Kg
Selenium	0.464J	mg/Kg
Silver	0.136J	mg/Kg

Client Sample ID: **19GM-DU3 A**
Lab Sample ID: 1199895011
ITRC Incremental Samp Method (2012)
Metals by ICP/MS

Parameter	Result	Units
Multi-Incremental Sub Sampling	0.00	
Arsenic	15.2	mg/Kg
Barium	178	mg/Kg
Cadmium	0.260	mg/Kg
Chromium	26.2	mg/Kg
Lead	11.6	mg/Kg
Mercury	0.0400J	mg/Kg
Selenium	0.741J	mg/Kg
Silver	0.117J	mg/Kg

Client Sample ID: **19GM-DU3 B**
Lab Sample ID: 1199895012
ITRC Incremental Samp Method (2012)
Metals by ICP/MS

Parameter	Result	Units
Multi-Incremental Sub Sampling	0.00	
Arsenic	18.9	mg/Kg
Barium	205	mg/Kg
Cadmium	0.284	mg/Kg
Chromium	26.5	mg/Kg
Lead	11.0	mg/Kg
Mercury	0.0401J	mg/Kg
Selenium	0.694J	mg/Kg
Silver	0.130J	mg/Kg

Detectable Results Summary

Client Sample ID: **19GM-DU3 C**
Lab Sample ID: 1199895013
ITRC Incremental Samp Method (2012)
Metals by ICP/MS

Parameter	Result	Units
Multi-Incremental Sub Sampling	0.00	
Arsenic	19.8	mg/Kg
Barium	176	mg/Kg
Cadmium	0.235	mg/Kg
Chromium	25.9	mg/Kg
Lead	9.95	mg/Kg
Mercury	0.0454J	mg/Kg
Selenium	0.631J	mg/Kg
Silver	0.137J	mg/Kg

Client Sample ID: **19GM-DU2**
Lab Sample ID: 1199895014
ITRC Incremental Samp Method (2012)
Metals by ICP/MS

Parameter	Result	Units
Multi-Incremental Sub Sampling	0.00	
Antimony	0.601J	mg/Kg
Arsenic	55.1	mg/Kg
Barium	174	mg/Kg
Cadmium	0.251	mg/Kg
Chromium	26.8	mg/Kg
Lead	14.1	mg/Kg
Mercury	0.0436J	mg/Kg
Selenium	0.705J	mg/Kg
Silver	0.280	mg/Kg

Client Sample ID: **19GM-DU1**
Lab Sample ID: 1199895015
ITRC Incremental Samp Method (2012)
Metals by ICP/MS

Parameter	Result	Units
Multi-Incremental Sub Sampling	0.00	
Arsenic	13.8	mg/Kg
Barium	184	mg/Kg
Cadmium	0.268	mg/Kg
Chromium	26.8	mg/Kg
Lead	9.85	mg/Kg
Mercury	0.0496J	mg/Kg
Selenium	0.733J	mg/Kg
Silver	0.115J	mg/Kg

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Results of **GM19-1**

Client Sample ID: **GM19-1**
Client Project ID: **20094 Grant Mine**
Lab Sample ID: 1199895001
Lab Project ID: 1199895

Collection Date: 10/22/19 14:30
Received Date: 10/29/19 09:32
Matrix: Soil/Solid (dry weight)
Solids (%):83.8
Location:

Results by **Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Antimony	0.570	U	1.14	0.354	mg/Kg	10		11/04/19 19:16
Arsenic	11.5		1.14	0.354	mg/Kg	10		11/04/19 19:16
Barium	194		0.342	0.107	mg/Kg	10		11/04/19 19:16
Cadmium	0.161	J	0.228	0.0707	mg/Kg	10		11/04/19 19:16
Chromium	28.6		0.456	0.148	mg/Kg	10		11/04/19 19:16
Lead	9.46		0.228	0.0707	mg/Kg	10		11/04/19 19:16
Mercury	0.0407	J	0.0912	0.0228	mg/Kg	10		11/04/19 19:16
Selenium	0.607	J	1.14	0.354	mg/Kg	10		11/04/19 19:16
Silver	0.118	J	0.228	0.0707	mg/Kg	10		11/04/19 19:16

Batch Information

Analytical Batch: MMS10669
Analytical Method: SW6020A
Analyst: BMZ
Analytical Date/Time: 11/04/19 19:16
Container ID: 1199895001-A

Prep Batch: MXX32947
Prep Method: SW3050B
Prep Date/Time: 10/30/19 13:05
Prep Initial Wt./Vol.: 1.047 g
Prep Extract Vol: 50 mL

Print Date: 11/12/2019 9:35:54AM

J flagging is activated

Results of **GM19-2**

Client Sample ID: **GM19-2**
Client Project ID: **20094 Grant Mine**
Lab Sample ID: 1199895002
Lab Project ID: 1199895

Collection Date: 10/22/19 14:35
Received Date: 10/29/19 09:32
Matrix: Soil/Solid (dry weight)
Solids (%):82.1
Location:

Results by **Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Antimony	0.580	U	1.16	0.361	mg/Kg	10		11/04/19 19:53
Arsenic	9.09		1.16	0.361	mg/Kg	10		11/04/19 19:53
Barium	183		0.349	0.109	mg/Kg	10		11/04/19 19:53
Cadmium	0.252		0.233	0.0722	mg/Kg	10		11/04/19 19:53
Chromium	31.4		0.466	0.151	mg/Kg	10		11/08/19 18:22
Lead	9.75		0.233	0.0722	mg/Kg	10		11/04/19 19:53
Mercury	0.0468	J	0.0932	0.0233	mg/Kg	10		11/04/19 19:53
Selenium	0.518	J	1.16	0.361	mg/Kg	10		11/04/19 19:53
Silver	0.101	J	0.233	0.0722	mg/Kg	10		11/04/19 19:53

Batch Information

Analytical Batch: MMS10674
Analytical Method: SW6020A
Analyst: DMM
Analytical Date/Time: 11/08/19 18:22
Container ID: 1199895002-A

Prep Batch: MXX32947
Prep Method: SW3050B
Prep Date/Time: 10/30/19 13:05
Prep Initial Wt./Vol.: 1.046 g
Prep Extract Vol: 50 mL

Analytical Batch: MMS10669
Analytical Method: SW6020A
Analyst: BMZ
Analytical Date/Time: 11/04/19 19:53
Container ID: 1199895002-A

Prep Batch: MXX32947
Prep Method: SW3050B
Prep Date/Time: 10/30/19 13:05
Prep Initial Wt./Vol.: 1.046 g
Prep Extract Vol: 50 mL

Print Date: 11/12/2019 9:35:54AM

J flagging is activated

Results of **GM19-3**

Client Sample ID: **GM19-3**
Client Project ID: **20094 Grant Mine**
Lab Sample ID: 1199895003
Lab Project ID: 1199895

Collection Date: 10/22/19 14:40
Received Date: 10/29/19 09:32
Matrix: Soil/Solid (dry weight)
Solids (%):82.5
Location:

Results by **Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Antimony	0.763	J	1.16	0.361	mg/Kg	10		11/04/19 19:58
Arsenic	110		11.6	3.61	mg/Kg	100		11/08/19 18:31
Barium	171		0.349	0.109	mg/Kg	10		11/04/19 19:58
Cadmium	0.177	J	0.233	0.0722	mg/Kg	10		11/04/19 19:58
Chromium	28.9		0.466	0.151	mg/Kg	10		11/08/19 18:27
Lead	15.1		0.233	0.0722	mg/Kg	10		11/04/19 19:58
Mercury	0.0629	J	0.0932	0.0233	mg/Kg	10		11/04/19 19:58
Selenium	0.740	J	1.16	0.361	mg/Kg	10		11/04/19 19:58
Silver	0.324		0.233	0.0722	mg/Kg	10		11/04/19 19:58

Batch Information

Analytical Batch: MMS10674
Analytical Method: SW6020A
Analyst: DMM
Analytical Date/Time: 11/08/19 18:27
Container ID: 1199895003-A

Prep Batch: MXX32947
Prep Method: SW3050B
Prep Date/Time: 10/30/19 13:05
Prep Initial Wt./Vol.: 1.041 g
Prep Extract Vol: 50 mL

Analytical Batch: MMS10674
Analytical Method: SW6020A
Analyst: DMM
Analytical Date/Time: 11/08/19 18:31
Container ID: 1199895003-A

Prep Batch: MXX32947
Prep Method: SW3050B
Prep Date/Time: 10/30/19 13:05
Prep Initial Wt./Vol.: 1.041 g
Prep Extract Vol: 50 mL

Analytical Batch: MMS10669
Analytical Method: SW6020A
Analyst: BMZ
Analytical Date/Time: 11/04/19 19:58
Container ID: 1199895003-A

Prep Batch: MXX32947
Prep Method: SW3050B
Prep Date/Time: 10/30/19 13:05
Prep Initial Wt./Vol.: 1.041 g
Prep Extract Vol: 50 mL

Print Date: 11/12/2019 9:35:54AM

J flagging is activated

Results of **GM19-4**

Client Sample ID: **GM19-4**
Client Project ID: **20094 Grant Mine**
Lab Sample ID: 1199895004
Lab Project ID: 1199895

Collection Date: 10/23/19 10:10
Received Date: 10/29/19 09:32
Matrix: Soil/Solid (dry weight)
Solids (%):77.6
Location:

Results by **Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Antimony	0.595	U	1.19	0.370	mg/Kg	10		11/04/19 20:03
Arsenic	50.0		2.99	0.926	mg/Kg	25		11/08/19 18:41
Barium	152		0.358	0.112	mg/Kg	10		11/04/19 20:03
Cadmium	0.157	J	0.239	0.0741	mg/Kg	10		11/04/19 20:03
Chromium	31.5		0.478	0.155	mg/Kg	10		11/08/19 18:36
Lead	8.82		0.239	0.0741	mg/Kg	10		11/04/19 20:03
Mercury	0.0721	J	0.0955	0.0239	mg/Kg	10		11/04/19 20:03
Selenium	0.836	J	1.19	0.370	mg/Kg	10		11/04/19 20:03
Silver	0.150	J	0.239	0.0741	mg/Kg	10		11/04/19 20:03

Batch Information

Analytical Batch: MMS10674
Analytical Method: SW6020A
Analyst: DMM
Analytical Date/Time: 11/08/19 18:36
Container ID: 1199895004-A

Prep Batch: MXX32947
Prep Method: SW3050B
Prep Date/Time: 10/30/19 13:05
Prep Initial Wt./Vol.: 1.079 g
Prep Extract Vol: 50 mL

Analytical Batch: MMS10674
Analytical Method: SW6020A
Analyst: DMM
Analytical Date/Time: 11/08/19 18:41
Container ID: 1199895004-A

Prep Batch: MXX32947
Prep Method: SW3050B
Prep Date/Time: 10/30/19 13:05
Prep Initial Wt./Vol.: 1.079 g
Prep Extract Vol: 50 mL

Analytical Batch: MMS10669
Analytical Method: SW6020A
Analyst: BMZ
Analytical Date/Time: 11/04/19 20:03
Container ID: 1199895004-A

Prep Batch: MXX32947
Prep Method: SW3050B
Prep Date/Time: 10/30/19 13:05
Prep Initial Wt./Vol.: 1.079 g
Prep Extract Vol: 50 mL

Print Date: 11/12/2019 9:35:54AM

J flagging is activated

Results of **GM19-5**

Client Sample ID: **GM19-5**
Client Project ID: **20094 Grant Mine**
Lab Sample ID: 1199895005
Lab Project ID: 1199895

Collection Date: 10/23/19 10:15
Received Date: 10/29/19 09:32
Matrix: Soil/Solid (dry weight)
Solids (%):82.7
Location:

Results by **Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Antimony	0.565	U	1.13	0.350	mg/Kg	10		11/04/19 20:07
Arsenic	8.22		1.13	0.350	mg/Kg	10		11/04/19 20:07
Barium	168		0.338	0.106	mg/Kg	10		11/04/19 20:07
Cadmium	0.188	J	0.226	0.0699	mg/Kg	10		11/04/19 20:07
Chromium	28.3		0.451	0.147	mg/Kg	10		11/08/19 18:46
Lead	9.38		0.226	0.0699	mg/Kg	10		11/04/19 20:07
Mercury	0.0423	J	0.0902	0.0226	mg/Kg	10		11/04/19 20:07
Selenium	0.544	J	1.13	0.350	mg/Kg	10		11/04/19 20:07
Silver	0.127	J	0.226	0.0699	mg/Kg	10		11/04/19 20:07

Batch Information

Analytical Batch: MMS10674
Analytical Method: SW6020A
Analyst: DMM
Analytical Date/Time: 11/08/19 18:46
Container ID: 1199895005-A

Prep Batch: MXX32947
Prep Method: SW3050B
Prep Date/Time: 10/30/19 13:05
Prep Initial Wt./Vol.: 1.072 g
Prep Extract Vol: 50 mL

Analytical Batch: MMS10669
Analytical Method: SW6020A
Analyst: BMZ
Analytical Date/Time: 11/04/19 20:07
Container ID: 1199895005-A

Prep Batch: MXX32947
Prep Method: SW3050B
Prep Date/Time: 10/30/19 13:05
Prep Initial Wt./Vol.: 1.072 g
Prep Extract Vol: 50 mL

Print Date: 11/12/2019 9:35:54AM

J flagging is activated

Results of **GM19-6**

Client Sample ID: **GM19-6**
Client Project ID: **20094 Grant Mine**
Lab Sample ID: 1199895006
Lab Project ID: 1199895

Collection Date: 10/23/19 10:50
Received Date: 10/29/19 09:32
Matrix: Soil/Solid (dry weight)
Solids (%):79.1
Location:

Results by **Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Antimony	0.575	U	1.15	0.357	mg/Kg	10		11/04/19 20:12
Arsenic	13.9		1.15	0.357	mg/Kg	10		11/04/19 20:12
Barium	209		0.346	0.108	mg/Kg	10		11/04/19 20:12
Cadmium	0.205	J	0.230	0.0714	mg/Kg	10		11/04/19 20:12
Chromium	28.8		0.461	0.150	mg/Kg	10		11/08/19 18:50
Lead	9.53		0.230	0.0714	mg/Kg	10		11/04/19 20:12
Mercury	0.0332	J	0.0922	0.0230	mg/Kg	10		11/04/19 20:12
Selenium	0.696	J	1.15	0.357	mg/Kg	10		11/04/19 20:12
Silver	0.117	J	0.230	0.0714	mg/Kg	10		11/04/19 20:12

Batch Information

Analytical Batch: MMS10674
Analytical Method: SW6020A
Analyst: DMM
Analytical Date/Time: 11/08/19 18:50
Container ID: 1199895006-A

Prep Batch: MXX32947
Prep Method: SW3050B
Prep Date/Time: 10/30/19 13:05
Prep Initial Wt./Vol.: 1.097 g
Prep Extract Vol: 50 mL

Analytical Batch: MMS10669
Analytical Method: SW6020A
Analyst: BMZ
Analytical Date/Time: 11/04/19 20:12
Container ID: 1199895006-A

Prep Batch: MXX32947
Prep Method: SW3050B
Prep Date/Time: 10/30/19 13:05
Prep Initial Wt./Vol.: 1.097 g
Prep Extract Vol: 50 mL

Print Date: 11/12/2019 9:35:54AM

J flagging is activated

Results of **GM19-7**

Client Sample ID: **GM19-7**
Client Project ID: **20094 Grant Mine**
Lab Sample ID: 1199895007
Lab Project ID: 1199895

Collection Date: 10/23/19 11:00
Received Date: 10/29/19 09:32
Matrix: Soil/Solid (dry weight)
Solids (%):78.6
Location:

Results by **Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Antimony	0.620	U	1.24	0.385	mg/Kg	10		11/04/19 20:17
Arsenic	12.3		1.24	0.385	mg/Kg	10		11/04/19 20:17
Barium	216		0.373	0.117	mg/Kg	10		11/04/19 20:17
Cadmium	0.217	J	0.249	0.0771	mg/Kg	10		11/04/19 20:17
Chromium	30.4		0.497	0.162	mg/Kg	10		11/08/19 18:55
Lead	9.41		0.249	0.0771	mg/Kg	10		11/04/19 20:17
Mercury	0.0349	J	0.0995	0.0249	mg/Kg	10		11/04/19 20:17
Selenium	0.527	J	1.24	0.385	mg/Kg	10		11/04/19 20:17
Silver	0.0899	J	0.249	0.0771	mg/Kg	10		11/04/19 20:17

Batch Information

Analytical Batch: MMS10674
Analytical Method: SW6020A
Analyst: DMM
Analytical Date/Time: 11/08/19 18:55
Container ID: 1199895007-A

Prep Batch: MXX32947
Prep Method: SW3050B
Prep Date/Time: 10/30/19 13:05
Prep Initial Wt./Vol.: 1.023 g
Prep Extract Vol: 50 mL

Analytical Batch: MMS10669
Analytical Method: SW6020A
Analyst: BMZ
Analytical Date/Time: 11/04/19 20:17
Container ID: 1199895007-A

Prep Batch: MXX32947
Prep Method: SW3050B
Prep Date/Time: 10/30/19 13:05
Prep Initial Wt./Vol.: 1.023 g
Prep Extract Vol: 50 mL

Print Date: 11/12/2019 9:35:54AM

J flagging is activated

Results of **GM19-8**

Client Sample ID: **GM19-8**
Client Project ID: **20094 Grant Mine**
Lab Sample ID: 1199895008
Lab Project ID: 1199895

Collection Date: 10/23/19 11:05
Received Date: 10/29/19 09:32
Matrix: Soil/Solid (dry weight)
Solids (%):85.1
Location:

Results by **Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Antimony	0.575	U	1.15	0.356	mg/Kg	10		11/04/19 20:22
Arsenic	14.6		1.15	0.356	mg/Kg	10		11/04/19 20:22
Barium	211		0.345	0.108	mg/Kg	10		11/04/19 20:22
Cadmium	0.163	J	0.230	0.0712	mg/Kg	10		11/04/19 20:22
Chromium	28.7		0.460	0.149	mg/Kg	10		11/08/19 19:09
Lead	9.94		0.230	0.0712	mg/Kg	10		11/04/19 20:22
Mercury	0.0323	J	0.0919	0.0230	mg/Kg	10		11/04/19 20:22
Selenium	0.644	J	1.15	0.356	mg/Kg	10		11/04/19 20:22
Silver	0.113	J	0.230	0.0712	mg/Kg	10		11/04/19 20:22

Batch Information

Analytical Batch: MMS10674
Analytical Method: SW6020A
Analyst: DMM
Analytical Date/Time: 11/08/19 19:09
Container ID: 1199895008-A

Prep Batch: MXX32947
Prep Method: SW3050B
Prep Date/Time: 10/30/19 13:05
Prep Initial Wt./Vol.: 1.023 g
Prep Extract Vol: 50 mL

Analytical Batch: MMS10669
Analytical Method: SW6020A
Analyst: BMZ
Analytical Date/Time: 11/04/19 20:22
Container ID: 1199895008-A

Prep Batch: MXX32947
Prep Method: SW3050B
Prep Date/Time: 10/30/19 13:05
Prep Initial Wt./Vol.: 1.023 g
Prep Extract Vol: 50 mL

Print Date: 11/12/2019 9:35:54AM

J flagging is activated

Results of **GM19-9**

Client Sample ID: **GM19-9**
Client Project ID: **20094 Grant Mine**
Lab Sample ID: 1199895009
Lab Project ID: 1199895

Collection Date: 10/23/19 11:08
Received Date: 10/29/19 09:32
Matrix: Soil/Solid (dry weight)
Solids (%):83.5
Location:

Results by **Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Antimony	0.565	U	1.13	0.350	mg/Kg	10		11/04/19 20:26
Arsenic	14.8		1.13	0.350	mg/Kg	10		11/04/19 20:26
Barium	186		0.338	0.106	mg/Kg	10		11/04/19 20:26
Cadmium	0.254		0.226	0.0699	mg/Kg	10		11/04/19 20:26
Chromium	26.8		0.451	0.147	mg/Kg	10		11/08/19 19:14
Lead	10.4		0.226	0.0699	mg/Kg	10		11/04/19 20:26
Mercury	0.0450	J	0.0903	0.0226	mg/Kg	10		11/04/19 20:26
Selenium	0.517	J	1.13	0.350	mg/Kg	10		11/04/19 20:26
Silver	0.144	J	0.226	0.0699	mg/Kg	10		11/04/19 20:26

Batch Information

Analytical Batch: MMS10674
Analytical Method: SW6020A
Analyst: DMM
Analytical Date/Time: 11/08/19 19:14
Container ID: 1199895009-A

Prep Batch: MXX32947
Prep Method: SW3050B
Prep Date/Time: 10/30/19 13:05
Prep Initial Wt./Vol.: 1.061 g
Prep Extract Vol: 50 mL

Analytical Batch: MMS10669
Analytical Method: SW6020A
Analyst: BMZ
Analytical Date/Time: 11/04/19 20:26
Container ID: 1199895009-A

Prep Batch: MXX32947
Prep Method: SW3050B
Prep Date/Time: 10/30/19 13:05
Prep Initial Wt./Vol.: 1.061 g
Prep Extract Vol: 50 mL

Print Date: 11/12/2019 9:35:54AM

J flagging is activated

Results of **GM19-10**

Client Sample ID: **GM19-10**
Client Project ID: **20094 Grant Mine**
Lab Sample ID: 1199895010
Lab Project ID: 1199895

Collection Date: 10/23/19 10:58
Received Date: 10/29/19 09:32
Matrix: Soil/Solid (dry weight)
Solids (%):83.6
Location:

Results by **Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Antimony	0.545	U	1.09	0.339	mg/Kg	10		11/04/19 20:40
Arsenic	15.0		1.09	0.339	mg/Kg	10		11/04/19 20:40
Barium	184		0.328	0.103	mg/Kg	10		11/04/19 20:40
Cadmium	0.247		0.219	0.0679	mg/Kg	10		11/04/19 20:40
Chromium	25.7		0.438	0.142	mg/Kg	10		11/08/19 19:18
Lead	10.3		0.219	0.0679	mg/Kg	10		11/04/19 20:40
Mercury	0.0409	J	0.0876	0.0219	mg/Kg	10		11/04/19 20:40
Selenium	0.464	J	1.09	0.339	mg/Kg	10		11/04/19 20:40
Silver	0.136	J	0.219	0.0679	mg/Kg	10		11/04/19 20:40

Batch Information

Analytical Batch: MMS10674
Analytical Method: SW6020A
Analyst: DMM
Analytical Date/Time: 11/08/19 19:18
Container ID: 1199895010-A

Prep Batch: MXX32947
Prep Method: SW3050B
Prep Date/Time: 10/30/19 13:05
Prep Initial Wt./Vol.: 1.092 g
Prep Extract Vol: 50 mL

Analytical Batch: MMS10669
Analytical Method: SW6020A
Analyst: BMZ
Analytical Date/Time: 11/04/19 20:40
Container ID: 1199895010-A

Prep Batch: MXX32947
Prep Method: SW3050B
Prep Date/Time: 10/30/19 13:05
Prep Initial Wt./Vol.: 1.092 g
Prep Extract Vol: 50 mL

Print Date: 11/12/2019 9:35:54AM

J flagging is activated

Results of **19GM-DU3 A**

Client Sample ID: **19GM-DU3 A**
Client Project ID: **20094 Grant Mine**
Lab Sample ID: 1199895011
Lab Project ID: 1199895

Collection Date: 10/22/19 16:55
Received Date: 10/29/19 09:32
Matrix: Soil/Solid (dry weight)
Solids (%):85.3
Location:

Results by **ITRC Incremental Samp Method (2012)**

Parameter	Date Analyzed
Multi-Incremental Sub Sampling	10/31/19 10:23

Batch Information

Analytical Batch: SPT10926
Analytical Method: MI-ITRC ISM (Feb 2012)
Analyst: M.M
Analytical Date/Time: 10/31/19 10:23
Container ID: 1199895011-A

Results of **19GM-DU3 A**

Client Sample ID: **19GM-DU3 A**
Client Project ID: **20094 Grant Mine**
Lab Sample ID: 1199895011
Lab Project ID: 1199895

Collection Date: 10/22/19 16:55
Received Date: 10/29/19 09:32
Matrix: Soil/Solid (dry weight)
Solids (%):85.3
Location:

Results by **Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Antimony	0.565	U	1.13	0.352	mg/Kg	10		11/04/19 22:47
Arsenic	15.2		1.13	0.352	mg/Kg	10		11/04/19 22:47
Barium	178		0.340	0.107	mg/Kg	10		11/04/19 22:47
Cadmium	0.260		0.227	0.0703	mg/Kg	10		11/04/19 22:47
Chromium	26.2		0.454	0.147	mg/Kg	10		11/07/19 21:46
Lead	11.6		0.227	0.0703	mg/Kg	10		11/04/19 22:47
Mercury	0.0400	J	0.0907	0.0227	mg/Kg	10		11/04/19 22:47
Selenium	0.741	J	1.13	0.352	mg/Kg	10		11/04/19 22:47
Silver	0.117	J	0.227	0.0703	mg/Kg	10		11/04/19 22:47

Batch Information

Analytical Batch: MMS10672
Analytical Method: SW6020A
Analyst: BMZ
Analytical Date/Time: 11/07/19 21:46
Container ID: 1199895011-C

Prep Batch: MXX32952
Prep Method: SW3050B
Prep Date/Time: 10/31/19 14:55
Prep Initial Wt./Vol.: 10.336 g
Prep Extract Vol: 500 mL

Analytical Batch: MMS10669
Analytical Method: SW6020A
Analyst: BMZ
Analytical Date/Time: 11/04/19 22:47
Container ID: 1199895011-C

Prep Batch: MXX32952
Prep Method: SW3050B
Prep Date/Time: 10/31/19 14:55
Prep Initial Wt./Vol.: 10.336 g
Prep Extract Vol: 500 mL

Print Date: 11/12/2019 9:35:54AM

J flagging is activated

Results of **19GM-DU3 B**

Client Sample ID: **19GM-DU3 B**
Client Project ID: **20094 Grant Mine**
Lab Sample ID: 1199895012
Lab Project ID: 1199895

Collection Date: 10/22/19 17:00
Received Date: 10/29/19 09:32
Matrix: Soil/Solid (dry weight)
Solids (%):84.2
Location:

Results by **ITRC Incremental Samp Method (2012)**

Parameter	Date Analyzed
Multi-Incremental Sub Sampling	10/31/19 10:24

Batch Information

Analytical Batch: SPT10926
Analytical Method: MI-ITRC ISM (Feb 2012)
Analyst: M.M
Analytical Date/Time: 10/31/19 10:24
Container ID: 1199895012-A

Results of **19GM-DU3 B**

Client Sample ID: **19GM-DU3 B**
Client Project ID: **20094 Grant Mine**
Lab Sample ID: 1199895012
Lab Project ID: 1199895

Collection Date: 10/22/19 17:00
Received Date: 10/29/19 09:32
Matrix: Soil/Solid (dry weight)
Solids (%):84.2
Location:

Results by **Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Antimony	0.565	U	1.13	0.350	mg/Kg	10		11/04/19 22:52
Arsenic	18.9		1.13	0.350	mg/Kg	10		11/04/19 22:52
Barium	205		0.338	0.106	mg/Kg	10		11/04/19 22:52
Cadmium	0.284		0.226	0.0699	mg/Kg	10		11/04/19 22:52
Chromium	26.5		0.451	0.147	mg/Kg	10		11/07/19 21:51
Lead	11.0		0.226	0.0699	mg/Kg	10		11/04/19 22:52
Mercury	0.0401	J	0.0903	0.0226	mg/Kg	10		11/04/19 22:52
Selenium	0.694	J	1.13	0.350	mg/Kg	10		11/04/19 22:52
Silver	0.130	J	0.226	0.0699	mg/Kg	10		11/04/19 22:52

Batch Information

Analytical Batch: MMS10672
Analytical Method: SW6020A
Analyst: BMZ
Analytical Date/Time: 11/07/19 21:51
Container ID: 1199895012-C

Prep Batch: MXX32952
Prep Method: SW3050B
Prep Date/Time: 10/31/19 14:55
Prep Initial Wt./Vol.: 10.532 g
Prep Extract Vol: 500 mL

Analytical Batch: MMS10669
Analytical Method: SW6020A
Analyst: BMZ
Analytical Date/Time: 11/04/19 22:52
Container ID: 1199895012-C

Prep Batch: MXX32952
Prep Method: SW3050B
Prep Date/Time: 10/31/19 14:55
Prep Initial Wt./Vol.: 10.532 g
Prep Extract Vol: 500 mL

Print Date: 11/12/2019 9:35:54AM

J flagging is activated

Results of **19GM-DU3 C**

Client Sample ID: **19GM-DU3 C**
Client Project ID: **20094 Grant Mine**
Lab Sample ID: 1199895013
Lab Project ID: 1199895

Collection Date: 10/22/19 17:05
Received Date: 10/29/19 09:32
Matrix: Soil/Solid (dry weight)
Solids (%):84.3
Location:

Results by **ITRC Incremental Samp Method (2012)**

Parameter	Date Analyzed
Multi-Incremental Sub Sampling	10/31/19 10:24

Batch Information

Analytical Batch: SPT10926
Analytical Method: MI-ITRC ISM (Feb 2012)
Analyst: M.M
Analytical Date/Time: 10/31/19 10:24
Container ID: 1199895013-A

Results of **19GM-DU3 C**

Client Sample ID: **19GM-DU3 C**
Client Project ID: **20094 Grant Mine**
Lab Sample ID: 1199895013
Lab Project ID: 1199895

Collection Date: 10/22/19 17:05
Received Date: 10/29/19 09:32
Matrix: Soil/Solid (dry weight)
Solids (%):84.3
Location:

Results by **Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Antimony	0.565	U	1.13	0.351	mg/Kg	10		11/04/19 22:56
Arsenic	19.8		1.13	0.351	mg/Kg	10		11/04/19 22:56
Barium	176		0.340	0.106	mg/Kg	10		11/04/19 22:56
Cadmium	0.235		0.226	0.0702	mg/Kg	10		11/04/19 22:56
Chromium	25.9		0.453	0.147	mg/Kg	10		11/07/19 21:55
Lead	9.95		0.226	0.0702	mg/Kg	10		11/04/19 22:56
Mercury	0.0454	J	0.0906	0.0226	mg/Kg	10		11/04/19 22:56
Selenium	0.631	J	1.13	0.351	mg/Kg	10		11/04/19 22:56
Silver	0.137	J	0.226	0.0702	mg/Kg	10		11/04/19 22:56

Batch Information

Analytical Batch: MMS10672
Analytical Method: SW6020A
Analyst: BMZ
Analytical Date/Time: 11/07/19 21:55
Container ID: 1199895013-C

Prep Batch: MXX32952
Prep Method: SW3050B
Prep Date/Time: 10/31/19 14:55
Prep Initial Wt./Vol.: 10.476 g
Prep Extract Vol: 500 mL

Analytical Batch: MMS10669
Analytical Method: SW6020A
Analyst: BMZ
Analytical Date/Time: 11/04/19 22:56
Container ID: 1199895013-C

Prep Batch: MXX32952
Prep Method: SW3050B
Prep Date/Time: 10/31/19 14:55
Prep Initial Wt./Vol.: 10.476 g
Prep Extract Vol: 500 mL

Print Date: 11/12/2019 9:35:54AM

J flagging is activated

Results of **19GM-DU2**

Client Sample ID: **19GM-DU2**
Client Project ID: **20094 Grant Mine**
Lab Sample ID: 1199895014
Lab Project ID: 1199895

Collection Date: 10/23/19 10:30
Received Date: 10/29/19 09:32
Matrix: Soil/Solid (dry weight)
Solids (%):84.7
Location:

Results by **ITRC Incremental Samp Method (2012)**

Parameter	Date Analyzed
Multi-Incremental Sub Sampling	10/31/19 10:24

Batch Information

Analytical Batch: SPT10926
Analytical Method: MI-ITRC ISM (Feb 2012)
Analyst: M.M
Analytical Date/Time: 10/31/19 10:24
Container ID: 1199895014-A

Print Date: 11/12/2019 9:35:54AM

J flagging is activated

Results of **19GM-DU2**

Client Sample ID: **19GM-DU2**
Client Project ID: **20094 Grant Mine**
Lab Sample ID: 1199895014
Lab Project ID: 1199895

Collection Date: 10/23/19 10:30
Received Date: 10/29/19 09:32
Matrix: Soil/Solid (dry weight)
Solids (%):84.7
Location:

Results by **Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Antimony	0.601	J	1.11	0.345	mg/Kg	10		11/04/19 23:01
Arsenic	55.1		2.78	0.863	mg/Kg	25		11/07/19 22:05
Barium	174		0.334	0.105	mg/Kg	10		11/04/19 23:01
Cadmium	0.251		0.223	0.0690	mg/Kg	10		11/04/19 23:01
Chromium	26.8		0.445	0.145	mg/Kg	10		11/07/19 22:00
Lead	14.1		0.223	0.0690	mg/Kg	10		11/04/19 23:01
Mercury	0.0436	J	0.0891	0.0223	mg/Kg	10		11/04/19 23:01
Selenium	0.705	J	1.11	0.345	mg/Kg	10		11/04/19 23:01
Silver	0.280		0.223	0.0690	mg/Kg	10		11/04/19 23:01

Batch Information

Analytical Batch: MMS10672
Analytical Method: SW6020A
Analyst: BMZ
Analytical Date/Time: 11/07/19 22:00
Container ID: 1199895014-C

Prep Batch: MXX32952
Prep Method: SW3050B
Prep Date/Time: 10/31/19 14:55
Prep Initial Wt./Vol.: 10.609 g
Prep Extract Vol: 500 mL

Analytical Batch: MMS10672
Analytical Method: SW6020A
Analyst: BMZ
Analytical Date/Time: 11/07/19 22:05
Container ID: 1199895014-C

Prep Batch: MXX32952
Prep Method: SW3050B
Prep Date/Time: 10/31/19 14:55
Prep Initial Wt./Vol.: 10.609 g
Prep Extract Vol: 500 mL

Analytical Batch: MMS10669
Analytical Method: SW6020A
Analyst: BMZ
Analytical Date/Time: 11/04/19 23:01
Container ID: 1199895014-C

Prep Batch: MXX32952
Prep Method: SW3050B
Prep Date/Time: 10/31/19 14:55
Prep Initial Wt./Vol.: 10.609 g
Prep Extract Vol: 500 mL

Print Date: 11/12/2019 9:35:54AM

J flagging is activated

Results of **19GM-DU1**

Client Sample ID: **19GM-DU1**
Client Project ID: **20094 Grant Mine**
Lab Sample ID: 1199895015
Lab Project ID: 1199895

Collection Date: 10/23/19 12:30
Received Date: 10/29/19 09:32
Matrix: Soil/Solid (dry weight)
Solids (%):84.7
Location:

Results by **ITRC Incremental Samp Method (2012)**

Parameter	Date Analyzed
Multi-Incremental Sub Sampling	10/31/19 10:24

Batch Information

Analytical Batch: SPT10926
Analytical Method: MI-ITRC ISM (Feb 2012)
Analyst: M.M
Analytical Date/Time: 10/31/19 10:24
Container ID: 1199895015-A

Print Date: 11/12/2019 9:35:54AM

J flagging is activated

Results of **19GM-DU1**

Client Sample ID: **19GM-DU1**
Client Project ID: **20094 Grant Mine**
Lab Sample ID: 1199895015
Lab Project ID: 1199895

Collection Date: 10/23/19 12:30
Received Date: 10/29/19 09:32
Matrix: Soil/Solid (dry weight)
Solids (%):84.7
Location:

Results by **Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Antimony	0.560	U	1.12	0.346	mg/Kg	10		11/04/19 23:06
Arsenic	13.8		1.12	0.346	mg/Kg	10		11/04/19 23:06
Barium	184		0.335	0.105	mg/Kg	10		11/04/19 23:06
Cadmium	0.268		0.224	0.0693	mg/Kg	10		11/04/19 23:06
Chromium	26.8		0.447	0.145	mg/Kg	10		11/07/19 22:09
Lead	9.85		0.224	0.0693	mg/Kg	10		11/04/19 23:06
Mercury	0.0496	J	0.0894	0.0224	mg/Kg	10		11/04/19 23:06
Selenium	0.733	J	1.12	0.346	mg/Kg	10		11/04/19 23:06
Silver	0.115	J	0.224	0.0693	mg/Kg	10		11/04/19 23:06

Batch Information

Analytical Batch: MMS10672
Analytical Method: SW6020A
Analyst: BMZ
Analytical Date/Time: 11/07/19 22:09
Container ID: 1199895015-C

Prep Batch: MXX32952
Prep Method: SW3050B
Prep Date/Time: 10/31/19 14:55
Prep Initial Wt./Vol.: 10.564 g
Prep Extract Vol: 500 mL

Analytical Batch: MMS10669
Analytical Method: SW6020A
Analyst: BMZ
Analytical Date/Time: 11/04/19 23:06
Container ID: 1199895015-C

Prep Batch: MXX32952
Prep Method: SW3050B
Prep Date/Time: 10/31/19 14:55
Prep Initial Wt./Vol.: 10.564 g
Prep Extract Vol: 500 mL

Method Blank

Blank ID: MB for HBN 1801682 [MXX/32947]
Blank Lab ID: 1541150

Matrix: Soil/Solid (dry weight)

QC for Samples:
1199895001, 1199895002, 1199895003, 1199895004, 1199895005, 1199895006, 1199895007, 1199895008, 1199895009, 1199895010

Results by **SW6020A**

Parameter	Results	LOQ/CL	DL	Units
Antimony	0.500U	1.00	0.310	mg/Kg
Arsenic	0.500U	1.00	0.310	mg/Kg
Barium	0.150U	0.300	0.0940	mg/Kg
Cadmium	0.100U	0.200	0.0620	mg/Kg
Chromium	0.200U	0.400	0.130	mg/Kg
Lead	0.100U	0.200	0.0620	mg/Kg
Mercury	0.0400U	0.0800	0.0200	mg/Kg
Selenium	0.500U	1.00	0.310	mg/Kg
Silver	0.100U	0.200	0.0620	mg/Kg

Batch Information

Analytical Batch: MMS10669
Analytical Method: SW6020A
Instrument: Perkin Elmer Nexlon P5
Analyst: BMZ
Analytical Date/Time: 11/4/2019 7:06:55PM

Prep Batch: MXX32947
Prep Method: SW3050B
Prep Date/Time: 10/30/2019 1:05:34PM
Prep Initial Wt./Vol.: 1 g
Prep Extract Vol: 50 mL

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1199895 [MXX32947]
Blank Spike Lab ID: 1541151
Date Analyzed: 11/04/2019 19:11

Matrix: Soil/Solid (dry weight)

QC for Samples: 1199895001, 1199895002, 1199895003, 1199895004, 1199895005, 1199895006, 1199895007, 1199895008, 1199895009, 1199895010

Results by **SW6020A**

Blank Spike (mg/Kg)

Parameter	Spike	Result	Rec (%)	CL
Antimony	50	50.4	101	(72-124)
Arsenic	50	53.4	107	(82-118)
Barium	50	52.0	104	(86-116)
Cadmium	5	4.99	100	(84-116)
Chromium	20	22.8	114	(83-119)
Lead	50	52.9	106	(84-118)
Mercury	0.5	0.535	107	(74-126)
Selenium	50	56.5	113	(80-119)
Silver	5	5.46	109	(83-118)

Batch Information

Analytical Batch: **MMS10669**
Analytical Method: **SW6020A**
Instrument: **Perkin Elmer Nexion P5**
Analyst: **BMZ**

Prep Batch: **MXX32947**
Prep Method: **SW3050B**
Prep Date/Time: **10/30/2019 13:05**
Spike Init Wt./Vol.: 50 mg/Kg Extract Vol: 50 mL
Dupe Init Wt./Vol.: Extract Vol:

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Matrix Spike Summary

Original Sample ID: 1541153
MS Sample ID: 1541154 MS
MSD Sample ID: 1541155 MSD

Analysis Date: 11/04/2019 19:16
Analysis Date: 11/04/2019 19:20
Analysis Date: 11/04/2019 19:25
Matrix: Solid/Soil (Wet Weight)

QC for Samples: 1199895001, 1199895002, 1199895003, 1199895004, 1199895005, 1199895006, 1199895007, 1199895008, 1199895009, 1199895010

Results by **SW6020A**

		Matrix Spike (mg/Kg)				Spike Duplicate (mg/Kg)					
Parameter	Sample	Spike	Result	Rec (%)		Spike	Result	Rec (%)		CL	RPD (%)	RPD CL
Antimony	0.477U	46.4	17.1	37	*	49.0	20.3	41	*	72-124	16.70	(< 20)
Arsenic	9.63	46.4	60	109		49.0	59.8	102		82-118	0.36	(< 20)
Barium	163	46.4	227	138	*	49.0	230	136	*	86-116	1.33	(< 20)
Cadmium	0.135J	4.64	4.58	96		4.90	4.85	96		84-116	5.62	(< 20)
Chromium	24.0	18.6	44.4	110		19.6	46.7	116		83-119	5.01	(< 20)
Lead	7.92	46.4	55.2	102		49.0	57.3	101		84-118	3.75	(< 20)
Mercury	0.0341J	0.464	.489	98		0.490	0.505	96		74-126	3.22	(< 20)
Selenium	0.509J	46.4	46.5	99		49.0	51.2	104		80-119	9.61	(< 20)
Silver	0.0990J	4.64	4.68	99		4.90	5.03	101		83-118	7.37	(< 20)

Batch Information

Analytical Batch: MMS10669
Analytical Method: SW6020A
Instrument: Perkin Elmer Nexlon P5
Analyst: BMZ
Analytical Date/Time: 11/4/2019 7:20:59PM

Prep Batch: MXX32947
Prep Method: Soils/Solids Digest for Metals by ICP-MS
Prep Date/Time: 10/30/2019 1:05:34PM
Prep Initial Wt./Vol.: 1.08g
Prep Extract Vol: 50.00mL

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Bench Spike Summary

Original Sample ID: 1541153
MS Sample ID: 1541156 BND
MSD Sample ID:

Analysis Date: 11/04/2019 19:16
Analysis Date: 11/04/2019 19:30
Analysis Date:
Matrix: Solid/Soil (Wet Weight)

QC for Samples: 1199895001, 1199895002, 1199895003, 1199895004, 1199895005, 1199895006, 1199895007, 1199895008, 1199895009, 1199895010

Results by **SW6020A**

		Matrix Spike (mg/Kg)			Spike Duplicate (mg/Kg)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Antimony	0.477U	119	117	98				80-120		
Barium	163	239	403	101				80-120		

Batch Information

Analytical Batch: MMS10669
Analytical Method: SW6020A
Instrument: Perkin Elmer Nexlon P5
Analyst: BMZ
Analytical Date/Time: 11/4/2019 7:30:23PM

Prep Batch: MXX32947
Prep Method: Soils/Solids Digest for Metals by ICP-MS
Prep Date/Time: 10/30/2019 1:05:34PM
Prep Initial Wt./Vol.: 1.05g
Prep Extract Vol: 50.00mL

Print Date: 11/12/2019 9:35:59AM

Method Blank

Blank ID: MB for HBN 1801735 [MXX/32952]
Blank Lab ID: 1541416

Matrix: Soil/Solid (dry weight)

QC for Samples:
1199895011, 1199895012, 1199895013, 1199895014, 1199895015

Results by **SW6020A**

Parameter	Results	LOQ/CL	DL	Units
Antimony	0.500U	1.00	0.310	mg/Kg
Arsenic	0.500U	1.00	0.310	mg/Kg
Barium	0.150U	0.300	0.0940	mg/Kg
Cadmium	0.100U	0.200	0.0620	mg/Kg
Chromium	0.200U	0.400	0.130	mg/Kg
Lead	0.100U	0.200	0.0620	mg/Kg
Mercury	0.0400U	0.0800	0.0200	mg/Kg
Selenium	0.500U	1.00	0.310	mg/Kg
Silver	0.100U	0.200	0.0620	mg/Kg

Batch Information

Analytical Batch: MMS10669
Analytical Method: SW6020A
Instrument: Perkin Elmer Nexlon P5
Analyst: BMZ
Analytical Date/Time: 11/4/2019 9:13:36PM

Prep Batch: MXX32952
Prep Method: SW3050B
Prep Date/Time: 10/31/2019 2:55:27PM
Prep Initial Wt./Vol.: 1 g
Prep Extract Vol: 50 mL

Analytical Batch: MMS10675
Analytical Method: SW6020A
Instrument: Perkin Elmer Nexlon P5
Analyst: DMM
Analytical Date/Time: 11/9/2019 7:42:46PM

Prep Batch: MXX32952
Prep Method: SW3050B
Prep Date/Time: 10/31/2019 2:55:27PM
Prep Initial Wt./Vol.: 1 g
Prep Extract Vol: 50 mL

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1199895 [MXX32952]
Blank Spike Lab ID: 1541417
Date Analyzed: 11/04/2019 21:18

Matrix: Soil/Solid (dry weight)

QC for Samples: 1199895011, 1199895012, 1199895013, 1199895014, 1199895015

Results by **SW6020A**

Blank Spike (mg/Kg)

Parameter	Spike	Result	Rec (%)	CL
Antimony	50	48.9	98	(72-124)
Arsenic	50	50.3	101	(82-118)
Barium	50	49.7	99	(86-116)
Cadmium	5	4.88	98	(84-116)
Lead	50	50.2	100	(84-118)
Mercury	0.5	0.515	103	(74-126)
Selenium	50	52.3	105	(80-119)
Silver	5	5.49	110	(83-118)
Chromium	20	21.3	107	(83-119)

Batch Information

Analytical Batch: **MMS10669**
Analytical Method: **SW6020A**
Instrument: **Perkin Elmer Nexlon P5**
Analyst: **BMZ**

Prep Batch: **MXX32952**
Prep Method: **SW3050B**
Prep Date/Time: **10/31/2019 14:55**
Spike Init Wt./Vol.: 50 mg/Kg Extract Vol: 50 mL
Dupe Init Wt./Vol.: Extract Vol:

Analytical Batch: **MMS10675**
Analytical Method: **SW6020A**
Instrument: **Perkin Elmer Nexlon P5**
Analyst: **DMM**

Prep Batch: **MXX32952**
Prep Method: **SW3050B**
Prep Date/Time: **10/31/2019 14:55**
Spike Init Wt./Vol.: 20 mg/Kg Extract Vol: 50 mL
Dupe Init Wt./Vol.: Extract Vol:

SGS North America Inc.
200 West Potter Drive Anchorage, AK 95518
t 907.562.2343 f 907.561.5301 www.us.sgs.com

Matrix Spike Summary

Original Sample ID: 1541422
MS Sample ID: 1541423 MS
MSD Sample ID: 1541424 MSD

Analysis Date: 11/04/2019 21:37
Analysis Date: 11/04/2019 21:41
Analysis Date: 11/04/2019 21:46
Matrix: Solid/Soil (Wet Weight)

QC for Samples: 1199895011, 1199895012, 1199895013, 1199895014, 1199895015

Results by **SW6020A**

		Matrix Spike (mg/Kg)			Spike Duplicate (mg/Kg)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Antimony	0.494U	49.8	28.7	58 *	47.1	27.6	59 *	72-124	3.96	(< 20)
Arsenic	5.37	49.8	58.4	107	47.1	53.9	103	82-118	8.11	(< 20)
Barium	41.7	49.8	96.3	110	47.1	87.9	98	86-116	9.13	(< 20)
Cadmium	0.0674J	4.98	4.95	98	4.71	4.59	96	84-116	7.64	(< 20)
Lead	4.12	49.8	53.8	100	47.1	51.9	102	84-118	3.60	(< 20)
Mercury	0.0658J	0.498	.586	105	0.471	0.555	104	74-126	5.45	(< 20)
Selenium	0.494U	49.8	53.2	107	47.1	49.6	105	80-119	7.10	(< 20)
Silver	0.0990U	4.98	5.36	108	4.71	5.27	112	83-118	1.67	(< 20)
Chromium	29.1	19.9	50.5	108	18.8	44.4	81 *	83-119	13.00	(< 20)

Batch Information

Analytical Batch: MMS10669
Analytical Method: SW6020A
Instrument: Perkin Elmer Nexion P5
Analyst: BMZ
Analytical Date/Time: 11/4/2019 9:41:46PM

Prep Batch: MXX32952
Prep Method: Soils/Solids Digest for Metals by ICP-MS
Prep Date/Time: 10/31/2019 2:55:27PM
Prep Initial Wt./Vol.: 1.00g
Prep Extract Vol: 50.00mL

Analytical Batch: MMS10675
Analytical Method: SW6020A
Instrument: Perkin Elmer Nexion P5
Analyst: DMM
Analytical Date/Time: 11/9/2019 8:10:56PM

Prep Batch: MXX32952
Prep Method: Soils/Solids Digest for Metals by ICP-MS
Prep Date/Time: 10/31/2019 2:55:27PM
Prep Initial Wt./Vol.: 1.00g
Prep Extract Vol: 50.00mL

Print Date: 11/12/2019 9:36:04AM

Bench Spike Summary

Original Sample ID: 1541422
MS Sample ID: 1541425 BND
MSD Sample ID:

Analysis Date: 11/09/2019 20:06
Analysis Date: 11/09/2019 20:20
Analysis Date:
Matrix: Solid/Soil (Wet Weight)

QC for Samples: 1199895011, 1199895012, 1199895013, 1199895014, 1199895015

Results by **SW6020A**

		Matrix Spike (mg/Kg)			Spike Duplicate (mg/Kg)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Chromium	29.1	124	155	102				80-120		

Batch Information

Analytical Batch: MMS10675
Analytical Method: SW6020A
Instrument: Perkin Elmer Nexlon P5
Analyst: DMM
Analytical Date/Time: 11/9/2019 8:20:19PM

Prep Batch: MXX32952
Prep Method: Soils/Solids Digest for Metals by ICP-MS
Prep Date/Time: 10/31/2019 2:55:27PM
Prep Initial Wt./Vol.: 1.01g
Prep Extract Vol: 50.00mL

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Method Blank

Blank ID: MB for HBN 1801666 [SPT/10924]
Blank Lab ID: 1541084

Matrix: Soil/Solid (dry weight)

QC for Samples:
1199895001, 1199895002, 1199895005, 1199895006, 1199895008, 1199895009

Results by **SM21 2540G**

Parameter	Results	LOQ/CL	DL	Units
Total Solids	100			%

Batch Information

Analytical Batch: SPT10924
Analytical Method: SM21 2540G
Instrument:
Analyst: MER
Analytical Date/Time: 10/29/2019 4:21:00PM

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Duplicate Sample Summary

Original Sample ID: 1199895002
Duplicate Sample ID: 1541085
Analysis Date: 10/29/2019 16:21
Matrix: Soil/Solid (dry weight)

QC for Samples:

1199895001, 1199895002, 1199895005, 1199895006, 1199895008, 1199895009

Results by **SM21 2540G**

NAME	Original	Duplicate	Units	RPD (%)	RPD CL
Total Solids	82.1	82.3	%	0.26	(< 15)

Batch Information

Analytical Batch: SPT10924
Analytical Method: SM21 2540G
Instrument:
Analyst: MER

Print Date: 11/12/2019 9:36:06AM

Duplicate Sample Summary

Original Sample ID: 1199899001
Duplicate Sample ID: 1541086
QC for Samples:
1199895005, 1199895006, 1199895008, 1199895009

Analysis Date: 10/29/2019 16:21
Matrix: Soil/Solid (dry weight)

Results by **SM21 2540G**

NAME	Original	Duplicate	Units	RPD (%)	RPD CL
Total Solids	95.1	95.3	%	0.23	(< 15)

Batch Information

Analytical Batch: SPT10924
Analytical Method: SM21 2540G
Instrument:
Analyst: MER

Print Date: 11/12/2019 9:36:06AM

Method Blank

Blank ID: MB for HBN 1801712 [SPT/10925]
Blank Lab ID: 1541290

Matrix: Soil/Solid (dry weight)

QC for Samples:
1199895003, 1199895004, 1199895007, 1199895010, 1199895011, 1199895012, 1199895013, 1199895014, 1199895015

Results by **SM21 2540G**

Parameter	Results	LOQ/CL	DL	Units
Total Solids	100			%

Batch Information

Analytical Batch: SPT10925
Analytical Method: SM21 2540G
Instrument:
Analyst: MER
Analytical Date/Time: 10/30/2019 3:59:00PM

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Duplicate Sample Summary

Original Sample ID: 1196478007
Duplicate Sample ID: 1541291
QC for Samples:
1199895003

Analysis Date: 10/30/2019 15:59
Matrix: Soil/Solid (dry weight)

Results by **SM21 2540G**

NAME	Original	Duplicate	Units	RPD (%)	RPD CL
Total Solids	91.9	92.4	%	0.55	(< 15)

Batch Information

Analytical Batch: SPT10925
Analytical Method: SM21 2540G
Instrument:
Analyst: MER

Print Date: 11/12/2019 9:36:10AM

Duplicate Sample Summary

Original Sample ID: 1199895003
Duplicate Sample ID: 1541292

Analysis Date: 10/30/2019 15:59
Matrix: Soil/Solid (dry weight)

QC for Samples:

1199895003, 1199895004, 1199895007, 1199895010, 1199895011, 1199895012, 1199895013, 1199895014, 1199895015

Results by **SM21 2540G**

NAME	Original	Duplicate	Units	RPD (%)	RPD CL
Total Solids	82.5	84.1	%	1.90	(< 15)

Batch Information

Analytical Batch: SPT10925
Analytical Method: SM21 2540G
Instrument:
Analyst: MER

Print Date: 11/12/2019 9:36:10AM

1199895

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS
2355 Hill Road
Fairbanks, AK 99709
(907) 479-0600
www.shannonwilson.com

CHAIN-OF[illegible]CORD

Laboratory SGS
Attn:

profile: 337923

Turn Around Time:	Quote No:	J-Flags:
☒ Normal ☐ Rush		☒ Yes ☐ No
Please Specify		

Analytical Methods (include preservative if used)

Sample Identity	Lab No.	Time	Date Sampled	RCRA Metals + Antimony 6020	Total Number of Containers	Remarks/Matrix Composition/Grab? Sample Containers
GM19-1		14:30	10-22-19	X	1	Grab Samples
GM19-2		14:35	10-22-19	X	1	
GM19-3		14:40	10-22-19	X	1	
GM19-4		10:10	10-23-19	X	1	
GM19-5		10:15	10-23-19	X	1	
GM19-6		10:50	10-23-19	X	1	
GM19-7		11:00	10-23-19	X	1	
GM19-8		11:05	10-23-19	X	1	
GM19-9		11:08	10-23-19	X	1	
GM19-10		10:58	10-23-19	X	1	

Project Information	
Number:	20094
Name:	Grant Mine
Contact:	JMSL
Ongoing Project?	Yes ☒ No ☐
Sampler:	ALF, APW, RW

Sample Receipt	
Total No. of Containers:	15
COC Seals/Intact? Y/N/NA	
Received Good Cond./Cold	
Temp:	2.7
Delivery Method:	Hand

Notes:

Relinquished By: 1.	Relinquished By: 2.	Relinquished By: 3.
Signature: Time: 13:24	Signature: Time: 12:30	Signature: Time:
Printed Name: Andrew Frick Date: 10-25-19	Printed Name: Castilleja Kurzis Date: 10/28	Printed Name: Date:
Company: S&W	Company: SGS	Company:

Received By: 1.	Received By: 2.	Received By: 3.
Signature: Time: 13:21	Signature: Time:	Signature: Time: 0937
Printed Name: Castilleja Kurzis Date: 10/24	Printed Name: Date:	Printed Name: JShumway Date: 10/29/19
Company: SGS	Company:	Company: SGS

Distribution: White - w/shipment - returned to Shannon & Wilson w/ laboratory report
Yellow - w/shipment - for consignee files
Pink - Shannon & Wilson - job file

IF/IB DB1 1.6° No. 411514

1199895

SHANNON & WILSON, INC. GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS — CHAIN-OF-CUSTODY RECORD

2355 Hill Road
Fairbanks, AK 99709
(907) 479-0600
www.shannonwilson.com

Laboratory SGS
Attn:

profile: 337923

Turn Around Time:	Quote No:	J-Flags:
[X] Normal [ ] Rush		[X] Yes [ ] No
Please Specify		

Analytical Methods (include preservative if used)

	Sample Identity	Lab No.	Time	Date Sampled	RCRA Metals + Antimony 6020	Total Number of Containers	Remarks/Matrix Composition/Grab? Sample Containers
11 A-D	19GM-DU3 A		16:55	10-22-19	X	1	Multi-Incremental Samples
12 A-D	19GM-DU3 B		17:00	"	X	1	
13 A-D	19GM-DU3 C		17:05	"	X	1	
14 A-D	19GM-DU2		10:30	10-23-19	X	1	
15 A-D	19GM-DU1		12:30	10-23-19	X	1	

Project Information	Sample Receipt
Number: 20094	Total No. of Containers: See Page 1
Name: Grant Mine	COC Seals/Intact? Y/N/NA
Contact: MSL	Received Good Cond./Cold
Ongoing Project? Yes [X] No [ ]	Temp: 2.7
Sampler: ALF	Delivery Method:

Notes:

Relinquished By: 1.	Relinquished By: 2.	Relinquished By: 3.
Signature: Time: 13:24	Signature: Time: 12:30	Signature: Time:
Printed Name: Andrew Frick Date: 10-24-19	Printed Name: castilleja kuzis Date: 10/28	Printed Name: Date:
Company: S&W	Company: SGS	Company:

Received By: 1.	Received By: 2.	Received By: 3.
Signature: Time: 13:21	Signature: Time:	Signature: Time: 0932
Printed Name: Castilleja Kuzis Date: 10/24	Printed Name: Date:	Printed Name: J Shumway Date: 10/24/19
Company: SGS	Company:	Company: SGS

Distribution: White - w/shipment - returned to Shannon & Wilson w/ laboratory report
Yellow - w/shipment - for consignee files
Pink - Shannon & Wilson - job file

IF/IB 061 16° No. 411441

e-Sample Receipt Form

SGS Workorder #: **1199895**

Review Criteria	Condition (Yes, No, N/A)	Exceptions Noted below
Chain of Custody / Temperature Requirements		N/A Exemption permitted if sampler hand carries/delivers.
Were Custody Seals intact? Note # & location	Yes	1 front 1 back
COC accompanied samples?	Yes	
DOD: Were samples received in COC corresponding coolers?	N/A	
N/A **Exemption permitted if chilled & collected <8 hours ago, or for samples where chilling is not required		
Temperature blank compliant* (i.e., 0-6 °C after CF)?	Yes	Cooler ID: 1 @ 1.6 °C Therm. ID: D61
If samples received without a temperature blank, the "cooler temperature" will be documented instead & "COOLER TEMP" will be noted to the right. "ambient" or "chilled" will be noted if neither is available.		Cooler ID: @ °C Therm. ID:
		Cooler ID: @ °C Therm. ID:
		Cooler ID: @ °C Therm. ID:
		Cooler ID: @ °C Therm. ID:
*If >6°C, were samples collected <8 hours ago?	N/A	
If <0°C, were sample containers ice free?	N/A	
Note: Identify containers received at non-compliant temperature . Use form FS-0029 if more space is needed.		
Holding Time / Documentation / Sample Condition Requirements		Note: Refer to form F-083 "Sample Guide" for specific holding times.
Were samples received within holding time?	Yes	
Do samples **match COC**** (i.e.,sample IDs,dates/times collected)?	Yes	
**Note: If times differ <1hr, record details & login per COC.		
***Note: If sample information on containers differs from COC, SGS will default to COC information		
Were analytical requests clear? (i.e., method is specified for analyses with multiple option for analysis (Ex: BTEX, Metals)	Yes	
		N/A ***Exemption permitted for metals (e.g,200.8/6020A).
Were proper containers (type/mass/volume/preservative***)used?	Yes	
Volatile / LL-Hg Requirements		
Were Trip Blanks (i.e., VOAs, LL-Hg) in cooler with samples?	N/A	
Were all water VOA vials free of headspace (i.e., bubbles ≤ 6mm)?	N/A	
Were all soil VOAs field extracted with MeOH+BFB?	N/A	

Note to Client: Any "No", answer above indicates non-compliance with standard procedures and may impact data quality.

Additional notes (if applicable):

e-Sample Receipt Form FBK

SGS Workorder #:	1199895	1199895

Review Criteria	Condition (Yes, No, N/A)	Exceptions Noted below
Chain of Custody / Temperature Requirements		Yes — Exemption permitted if sampler hand carries/delivers.
Were Custody Seals intact? Note # & location	N/A	
COC accompanied samples?	Yes	
DOD: Were samples received in COC corresponding coolers?	N/A	
☐ **Exemption permitted if chilled & collected <8 hours ago, or for samples where chilling is not required		
Temperature blank compliant* (i.e., 0-6 °C after CF)?	Yes	Cooler ID: 1 @ 2.7 °C Therm. ID: 65
If samples received without a temperature blank, the "cooler temperature" will be documented instead & "COOLER TEMP" will be noted to the right. "ambient" or "chilled" will be noted if neither is available.		Cooler ID: @ °C Therm. ID:
		Cooler ID: @ °C Therm. ID:
		Cooler ID: @ °C Therm. ID:
If >6°C, were samples collected <8 hours ago?		
If <0°C, were sample containers ice free?		
Note: Identify containers received at non-compliant temperature . Use form FS-0029 if more space is needed.		
Holding Time / Documentation / Sample Condition Requirements		Note: Refer to form F-083 "Sample Guide" for specific holding times.
Do samples **match COC**** (i.e.,sample IDs,dates/times collected)?	N/C	
**Note: If times differ <1hr, record details & login per COC.		
***Note: If sample information on containers differs from COC, SGS will default to COC information		
Were samples in good condition (no leaks/cracks/breakage)?	Yes	
Were analytical requests clear? (i.e., method is specified for analyses with multiple option for analysis (Ex: BTEX, Metals)	Yes	
Were Trip Blanks (i.e., VOAs, LL-Hg) in cooler with samples?	N/A	
Were all water VOA vials free of headspace (i.e., bubbles ≤ 6mm)?	N/A	
Were all soil VOAs field extracted with MeOH+BFB?	N/A	
For Rush/Short Hold Time, was RUSH/Short HT email sent?	N/A	

Note to Client: Any "No", answer above indicates non-compliance with standard procedures and may impact data quality.

Additional notes (if applicable):

SGS Profile #	337923	337923

Sample Containers and Preservatives

Container Id	Preservative	Container Condition	Container Id	Preservative	Container Condition
1199895001-A	No Preservative Required	OK			
1199895002-A	No Preservative Required	OK			
1199895003-A	No Preservative Required	OK			
1199895004-A	No Preservative Required	OK			
1199895005-A	No Preservative Required	OK			
1199895006-A	No Preservative Required	OK			
1199895007-A	No Preservative Required	OK			
1199895008-A	No Preservative Required	OK			
1199895009-A	No Preservative Required	OK			
1199895010-A	No Preservative Required	OK			
1199895011-A	No Preservative Required	OK			
1199895011-B	No Preservative Required	OK			
1199895011-C	No Preservative Required	OK			
1199895011-D	No Preservative Required	OK			
1199895012-A	No Preservative Required	OK			
1199895012-B	No Preservative Required	OK			
1199895012-C	No Preservative Required	OK			
1199895012-D	No Preservative Required	OK			
1199895013-A	No Preservative Required	OK			
1199895013-B	No Preservative Required	OK			
1199895013-C	No Preservative Required	OK			
1199895013-D	No Preservative Required	OK			
1199895014-A	No Preservative Required	OK			
1199895014-B	No Preservative Required	OK			
1199895014-C	No Preservative Required	OK			
1199895014-D	No Preservative Required	OK			
1199895015-A	No Preservative Required	OK			
1199895015-B	No Preservative Required	OK			
1199895015-C	No Preservative Required	OK			
1199895015-D	No Preservative Required	OK			

Container Condition Glossary

Containers for bacteriological, low level mercury and VOA vials are not opened prior to analysis and will be assigned condition code OK unless evidence indicates than an inappropriate container was submitted.

OK - The container was received at an acceptable pH for the analysis requested.
BU - The container was received with headspace greater than 6mm.
DM - The container was received damaged.
FR - The container was received frozen and not usable for Bacteria or BOD analyses.
IC - The container provided for microbiology analysis was not a laboratory-supplied, pre-sterilized container and therefore was not suitable for analysis.
NC- The container provided was not preserved or was under-preserved. The method does not allow for additional preservative added after collection.
PA - The container was received outside of the acceptable pH for the analysis requested. Preservative was added upon receipt and the container is now at the correct pH. See the Sample Receipt Form for details on the amount and lot # of the preservative added.
PH - The container was received outside of the acceptable pH for the analysis requested. Preservative was added upon receipt, but was insufficient to bring the container to the correct pH for the analysis requested. See the Sample Receipt Form for details on the amount and lot # of the preservative added.
QN - Insufficient sample quantity provided.

Laboratory Data Review Checklist

Completed By:

Ashley Jaramillo

Title:

Chemist

Date:

November 21, 2019

CS Report Name:

20094 Grant Mine

Report Date:

November 12, 2019

Consultant Firm:

Shannon & Wilson, Inc.

Laboratory Name:

SGS North America, Inc.

Laboratory Report Number:

1199895

ADEC File Number:

100.38.182

Hazard Identification Number:

731

1199895

1. Laboratory

   a. Did an ADEC CS approved laboratory receive and perform all of the submitted sample analyses?

   (•) Yes ( ) No Comments:

   Analyses were performed by the SGS laboratory in Anchorage, AK.

   b. If the samples were transferred to another "network" laboratory or sub-contracted to an alternate laboratory, was the laboratory performing the analyses ADEC CS approved?

   ( ) Yes (•) No Comments:

   Not applicable, no samples were transferred or subcontracted to an alternate laboratory.

2. Chain of Custody (CoC)

   a. CoC information completed, signed, and dated (including released/received by)?

   (•) Yes ( ) No Comments:

   b. Correct Analyses requested?

   (•) Yes ( ) No Comments:

3. Laboratory Sample Receipt Documentation

   a. Sample/cooler temperature documented and within range at receipt (0° to 6° C)?

   (•) Yes ( ) No Comments:

   b. Sample preservation acceptable – acidified waters, Methanol preserved VOC soil (GRO, BTEX, Volatile Chlorinated Solvents, etc.)?

   (•) Yes ( ) No Comments:

   c. Sample condition documented – broken, leaking (Methanol), zero headspace (VOC vials)?

   (•) Yes ( ) No Comments:

   The laboratory noted that samples were received in good condition.

d. If there were any discrepancies, were they documented? For example, incorrect sample containers/preservation, sample temperature outside of acceptable range, insufficient or missing samples, etc.?

○ Yes ◉ No Comments:

Not applicable, no discrepancies were noted by the laboratory during sample login.

e. Data quality or usability affected?

Comments:

The data quality and usability were not affected.

4. Case Narrative

a. Present and understandable?

◉ Yes ○ No Comments:

b. Discrepancies, errors, or QC failures identified by the lab?

○ Yes ◉ No Comments:

Metals MS/MSD recoveries for barium and antimony do not meet QC criteria. The post digestion spike was successful. See section 6.b.iii for discussion.

c. Were all corrective actions documented?

◉ Yes ○ No Comments:

See above.

d. What is the effect on data quality/usability according to the case narrative?

Comments:

Case narrative does not discuss effect on data quality, it only discusses discrepancies and what was done in light of them. Any notable data quality issues mentioned in the case narrative are discussed above in 4b or elsewhere within this ADEC checklist.

5. Samples Results

a. Correct analyses performed/reported as requested on COC?

◉ Yes ○ No Comments:

b. All applicable holding times met?

◉ Yes ○ No Comments:

c. All soils reported on a dry weight basis?

(•) Yes ( ) No Comments:

d. Are the reported LOQs less than the Cleanup Level or the minimum required detection level for the project?

(•) Yes ( ) No Comments:

e. Data quality or usability affected?

( ) Yes (•) No Comments:

See above.

6. QC Samples

a. Method Blank

i. One method blank reported per matrix, analysis and 20 samples?

(•) Yes ( ) No Comments:

ii. All method blank results less than limit of quantitation (LOQ)?

(•) Yes ( ) No Comments:

iii. If above LOQ, what samples are affected?

Comments:

N/A; see above.

iv. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

( ) Yes (•) No Comments:

N/A; see above.

v. Data quality or usability affected?

Comments:

No; see above.

b. Laboratory Control Sample/Duplicate (LCS/LCSD)

i. Organics – One LCS/LCSD reported per matrix, analysis and 20 samples? (LCS/LCSD required per AK methods, LCS required per SW846)

○ Yes ◉ No Comments:

N/A; organics were not analyzed.

ii. Metals/Inorganics – one LCS and one sample duplicate reported per matrix, analysis and 20 samples?

◉ Yes ○ No Comments:

An LCS and a MS/MSD were reported metals analysis.

iii. Accuracy – All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)

○ Yes ◉ No Comments:

The MS and/or MSD recovery for barium, antimony, and chromium did not meet laboratory QC criteria. However, the parent sample used for the MS/MSD analyses was not a project sample. Therefore, data quality/usability not affected.

iv. Precision – All relative percent differences (RPD) reported and less than method or laboratory limits? And project specified DQOs, if applicable. RPD reported from LCS/LCSD, MS/MSD, and or sample/sample duplicate. (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)

◉ Yes ○ No Comments:

v. If %R or RPD is outside of acceptable limits, what samples are affected?

Comments:

N/A; The parent sample for the MS and MSD recovery failures were not associated with the samples collected for this project. In addition, post digestion spikes for these MS and MSD samples were with laboratory QC criteria. Project samples are not affected by these QC failures.

vi. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

○ Yes ◉ No Comments:

See above.

vii. Data quality or usability affected? (Use comment box to explain.)

Comments:

No; see above.

c. Surrogates – Organics Only

i. Are surrogate recoveries reported for organic analyses – field, QC and laboratory samples?

○ Yes ◉ No Comments:

N/A; organics were not analyzed.

ii. Accuracy – All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods 50-150 %R; all other analyses see the laboratory report pages)

○ Yes ◉ No Comments:

N/A; organics were not analyzed.

iii. Do the sample results with failed surrogate recoveries have data flags? If so, are the data flags clearly defined?

○ Yes ◉ No Comments:

N/A; organics were not analyzed.

iv. Data quality or usability affected?

Comments:

No; see above.

d. Trip blank – Volatile analyses only (GRO, BTEX, Volatile Chlorinated Solvents, etc.): Water and Soil

i. One trip blank reported per matrix, analysis and for each cooler containing volatile samples?
(If not, enter explanation below.)

○ Yes ◉ No Comments:

N/A; volatiles were not analyzed.

ii. Is the cooler used to transport the trip blank and VOA samples clearly indicated on the COC? (If not, a comment explaining why must be entered below)

◉ Yes ○ No Comments:

N/A; volatiles were not analyzed.

iii. All results less than LOQ?

◉ Yes ○ No Comments:

N/A; volatiles were not analyzed.

iv. If above LOQ, what samples are affected?

Comments:

None; see above.

v. Data quality or usability affected?

Comments:

No; see above.

e. Field Duplicate

i. One field duplicate submitted per matrix, analysis and 10 project samples?

(•) Yes ( ) No Comments:

The samples submitted with this work order contain a replicate ISM sample. The results of the three replicates are used to calculate a relative standard deviation (RSD) to assess the overall representativeness of the data. The formula used to calculate $RSD(\%) = \frac{Standard\ Deviation}{Arithmetic\ Mean\ of\ Target\ Analyte} \times 100$

ii. Submitted blind to lab?

(•) Yes ( ) No Comments:

The ISM replicate samples 19GM-DU3 *A*, *B*, *C* were submitted with this work order.

iii. Precision – All relative percent differences (RPD) less than specified DQOs? (Recommended: 30% water, 50% soil)

RPD (%) = Absolute value of: $\frac{(R_1-R_2)}{((R_1+R_2)/2)} \times 100$

Where R_1 = Sample Concentration
R_2 = Field Duplicate Concentration

(•) Yes ( ) No Comments:

The RSD calculated for the ISM replicates *A*, *B*, and *C* of the sample *19GM-DU3* were within the recommended DQO of 30% for all analytes, were calculable.

iv. Data quality or usability affected? (Use the comment box to explain why or why not.)

Comments:

No, see above.

f. Decontamination or Equipment Blank (If not applicable, a comment stating why must be entered below).

( ) Yes ( ) No (•) Not Applicable

Samples were collected with disposable equipment.

i. All results less than LOQ?

○ Yes ◉ No Comments:

N/A; an equipment blank was not submitted.

ii. If above LOQ, what samples are affected?

Comments:

N/A; an equipment blank was not submitted.

iii. Data quality or usability affected?

Comments:

No; see above.

7. Other Data Flags/Qualifiers (ACOE, AFCEE, Lab Specific, etc.)

a. Defined and appropriate?

○ Yes ◉ No Comments:

Additional data flags or qualifiers are not required.

Outlier Tests for Selected Uncensored Variables

User Selected Options

Date/Time of Computation	ProUCL 5.13/2/2020 10:56:27 AM
From File	ProUCL Input File.xls
Full Precision	OFF

Dixon's Outlier Test for Arsenic (ed)

Number of Observations = 14
10% critical value: 0.492
5% critical value: 0.546
1% critical value: 0.641

1. Observation Value 148 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.693

For 10% significance level, 148 is an outlier.
For 5% significance level, 148 is an outlier.
For 1% significance level, 148 is an outlier.

2. Observation Value 18 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.071

For 10% significance level, 18 is not an outlier.
For 5% significance level, 18 is not an outlier.
For 1% significance level, 18 is not an outlier.

Dixon's Outlier Test for Arsenic (gm)

Number of Observations = 12
10% critical value: 0.49
5% critical value: 0.546
1% critical value: 0.642

1. Observation Value 110 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.595

For 10% significance level, 110 is an outlier.
For 5% significance level, 110 is an outlier.
For 1% significance level, 110 is not an outlier.

2. Observation Value 8.22 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.087

For 10% significance level, 8.22 is not an outlier.
For 5% significance level, 8.22 is not an outlier.
For 1% significance level, 8.22 is not an outlier.

Goodness-of-Fit Test Statistics for Uncensored Full Data Sets without Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.13/2/2020 10:58:23 AM
From File	ProUCL Input File_a.xls
Full Precision	OFF
Confidence Coefficient	0.95

Arsenic (ed)

Raw Statistics

Number of Valid Observations	13
Number of Missing Observations	1
Number of Distinct Observations	13
Minimum	18
Maximum	67
Mean of Raw Data	37.46
Standard Deviation of Raw Data	16.23
Khat	5.756
Theta hat	6.509
Kstar	4.479
Theta star	8.364
Mean of Log Transformed Data	3.534
Standard Deviation of Log Transformed Data	0.445

Normal GOF Test Results

Correlation Coefficient R	0.971
Shapiro Wilk Test Statistic	0.927
Shapiro Wilk Critical (0.05) Value	0.866
Approximate Shapiro Wilk P Value	0.389
Lilliefors Test Statistic	0.151
Lilliefors Critical (0.05) Value	0.234

Data appear Normal at (0.05) Significance Level

Gamma GOF Test Results

Correlation Coefficient R	0.982
A-D Test Statistic	0.323
A-D Critical (0.05) Value	0.736
K-S Test Statistic	0.16
K-S Critical(0.05) Value	0.237

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

Correlation Coefficient R	0.981
Shapiro Wilk Test Statistic	0.942
Shapiro Wilk Critical (0.05) Value	0.866
Approximate Shapiro Wilk P Value	0.611
Lilliefors Test Statistic	0.16
Lilliefors Critical (0.05) Value	0.234

Data appear Lognormal at (0.05) Significance Level

Arsenic (gm)

Raw Statistics

Number of Valid Observations	11
Number of Missing Observations	1
Number of Distinct Observations	11
Minimum	8.22
Maximum	55.1
Mean of Raw Data	20.99
Standard Deviation of Raw Data	16.16
Khat	2.634
Theta hat	7.97
Kstar	1.976
Theta star	10.62
Mean of Log Transformed Data	2.842
Standard Deviation of Log Transformed Data	0.619

Normal GOF Test Results

Correlation Coefficient R	0.835
Shapiro Wilk Test Statistic	0.699
Shapiro Wilk Critical (0.05) Value	0.85
Approximate Shapiro Wilk P Value	6.9649E-4
Lilliefors Test Statistic	0.372
Lilliefors Critical (0.05) Value	0.251

Data not Normal at (0.05) Significance Level

Gamma GOF Test Results

Correlation Coefficient R	0.921
A-D Test Statistic	1.114
A-D Critical (0.05) Value	0.735
K-S Test Statistic	0.347
K-S Critical(0.05) Value	0.258

Data not Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

Correlation Coefficient R	0.921
Shapiro Wilk Test Statistic	0.844
Shapiro Wilk Critical (0.05) Value	0.85
Approximate Shapiro Wilk P Value	0.0394
Lilliefors Test Statistic	0.313
Lilliefors Critical (0.05) Value	0.251

Data not Lognormal at (0.05) Significance Level

Non-parametric GOF Test Results

Data do not follow a discernible distribution at (0.05) Level of Significanc

Wilcoxon-Mann-Whitney Sample 1 vs Sample 2 Comparison Test for Uncensor Full Data Sets without NDs

User Selected Options	
Date/Time of Computation	ProUCL 5.13/2/2020 3:26:59 PM
From File	002) ProUCL Input File_a.xls
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0.000
Selected Null Hypothesis	Sample 1 Mean/Median >= Sample 2 Mean/Median (Form 2)
Alternative Hypothesis	Sample 1 Mean/Median < Sample 2 Mean/Median

Sample 1 Data: GM Arsenic Data

Sample 2 Data: Ester Dome BK Arsenic Data

Raw Statistics

	Sample 1	Sample 2
Number of Valid Observations	11	13
Number of Distinct Observations	11	13
Minimum	8.22	18
Maximum	55.1	67
Mean	20.99	37.46
Median	14.6	33
SD	16.16	16.23
SE of Mean	4.873	4.5

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Sample 1 >= Mean/Median of Sample 2

Sample 1 Rank Sum W-Stat	91
WMW U-Stat	25
Mean (U)	71.5
SD(U) - Adj ties	17.26
WMW U-Stat Critical Value (0.05)	43
Standardized WMW U-Stat	-2.723
Approximate P-Value	0.00323

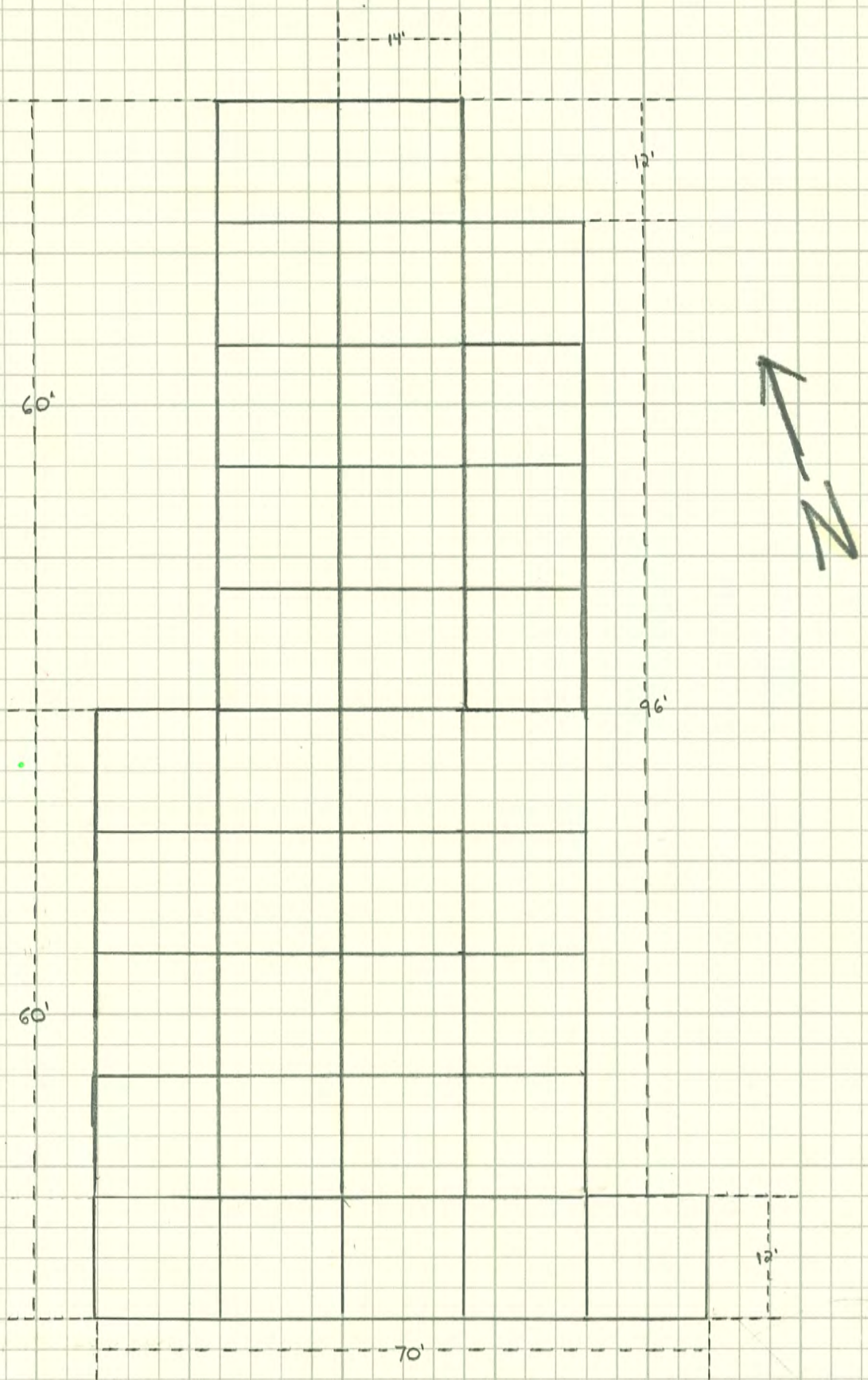
Conclusion with Alpha = 0.05

Reject H0, Conclude Sample 1 < Sample 2

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

JOB NAME Grant Mine JOB NO. 31-1-20094
SUBJECT ISM Sampling DATE 10/22/2019
BY APW CHK'D ALF SHEET 1 of 3

Grant Mine Tillings Impoundment - DU 1



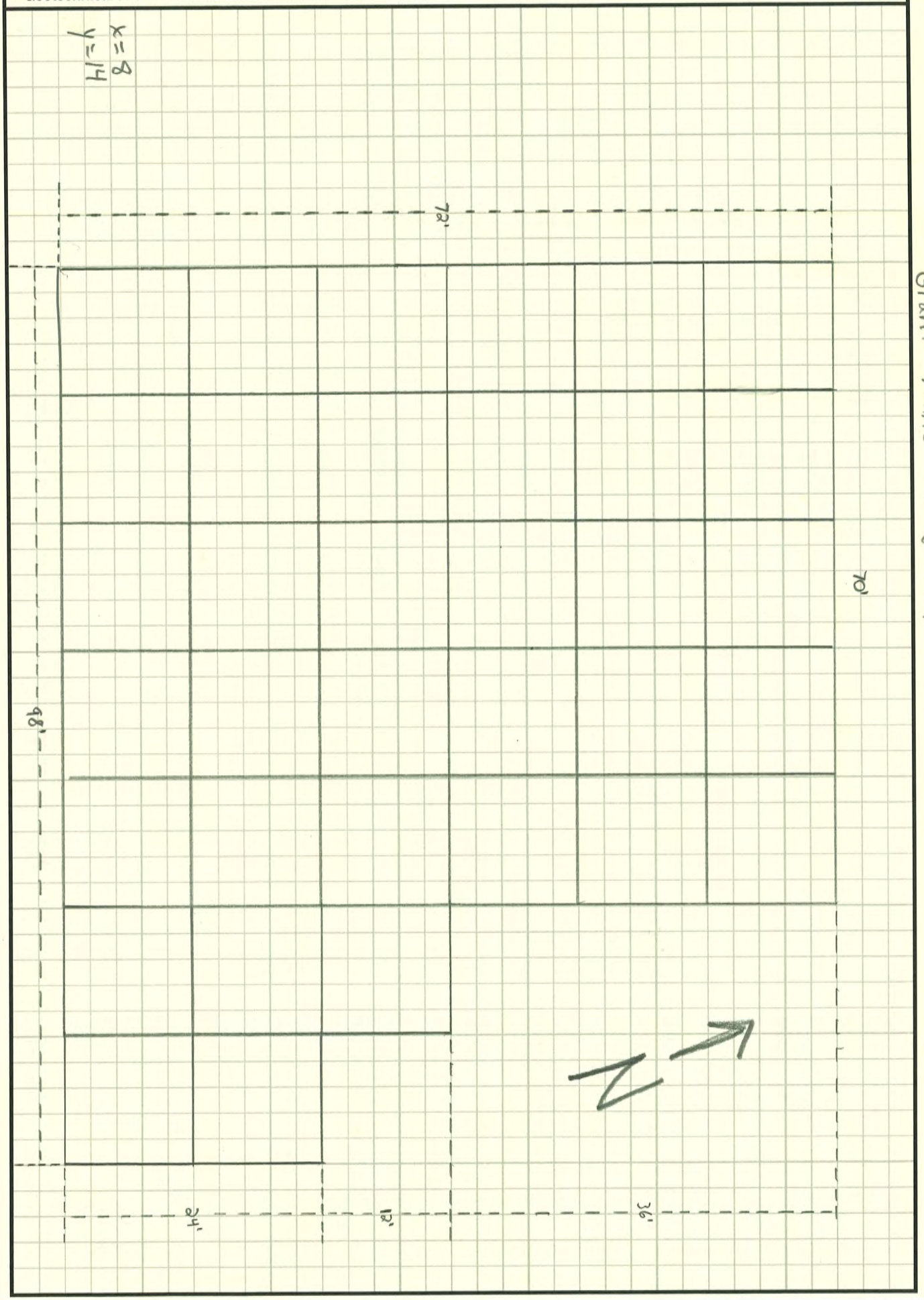
X coordinate: 5
Y coordinate: 10

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

JOB NAME Grant Mine
SUBJECT M.I. Sampling Grids
BY APW CHK'D ALF

JOB NO. 20094
DATE 10-22-19
SHEET 2 of 3

1" = 4'
8 x 11



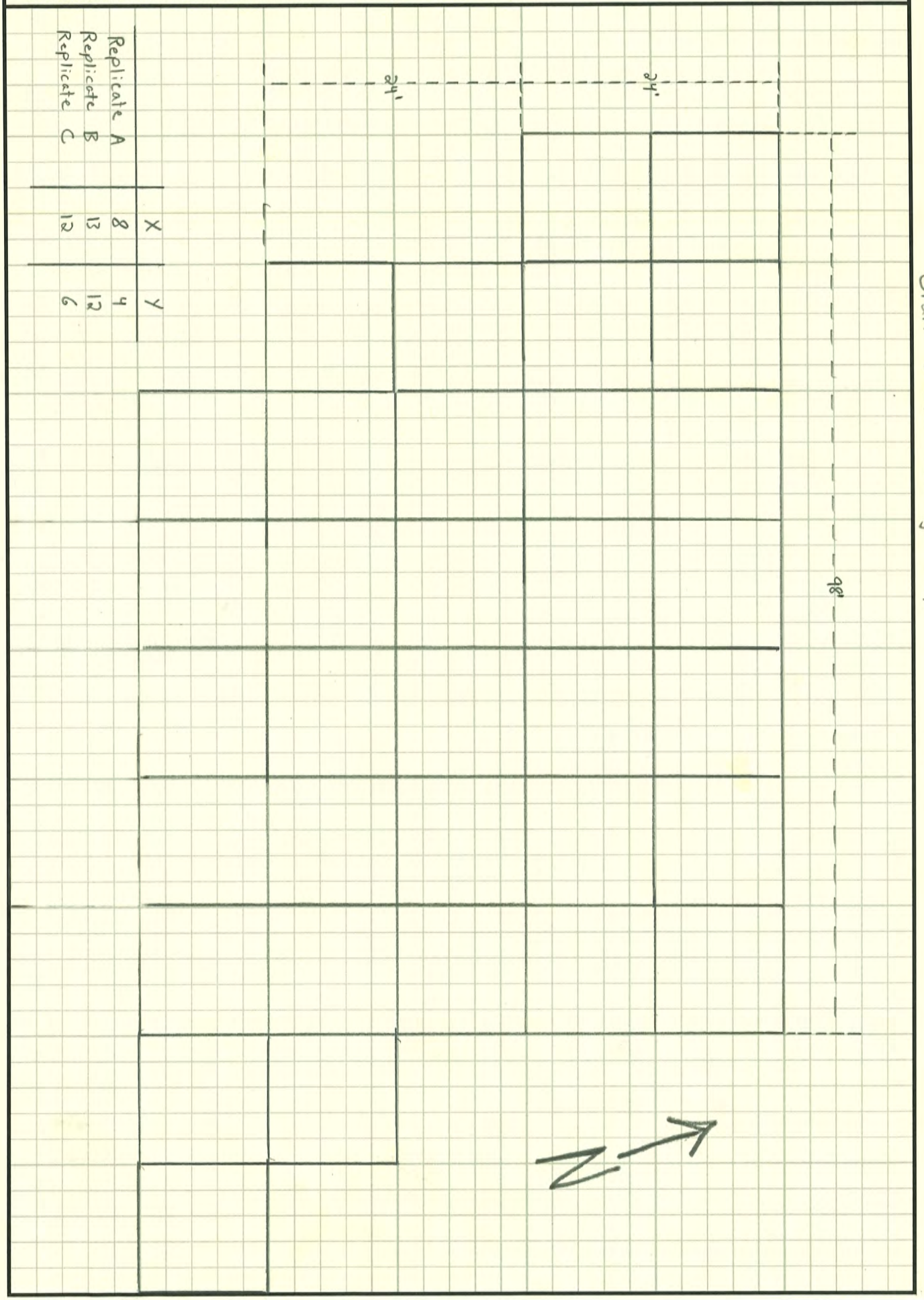
Grant Mine Tailings Impoundment - DU 2

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

JOB NAME Grant Mine
SUBJECT M.I. Sampling Grid
BY APW CHK'D ALF

JOB NO. 20094
DATE 10-22-19
SHEET 3 of 3

	X	Y
Replicate A	8	4
Replicate B	13	12
Replicate C	12	6



Grant Mine Tailings Impoundment - DU 3

THE STATE of ALASKA
GOVERNOR MIKE DUNLEAVY

Department of Environmental Conservation

SPILL PREVENTION & RESPONSE
Contaminated Sites Program

610 University Avenue
Fairbanks, Alaska 99709
Main: 907.451.2143
Fax: 907.451.2155
www.dec.alaska.gov

File: 100.38.182

April 20, 2020

Electronic Distribution Only
Roger Burggraf
Grant Mine
3180 Peger Road, Suite 270
Fairbanks, Alaska 99709

RE: Agency Comments - Draft Closure and Capping Plan, Grant Mine Primary Mine – Tailings Impoundment, and
Post-Excavation Sampling, Secondary Tailings Impoundment, Grant Mine, Ester Dome, Alaska

Dear Mr. Burggraf:

The Alaska Department of Natural Resources (ADNR), Alaska Department of Environmental Conservation (ADEC) Solid Waste Division (SWP), and ADEC Contaminated Sites Program (CSP) have reviewed the closure and capping plan (the plan) submitted by Shannon & Wilson on March 5, 2020. Our comments also will refer to the sample report for the Secondary Tailings Impoundment. Our comments are relevant to these two reports only and do not constitute a final approval for closure. We understand our review is for the concept of a cap, and will provide a final review once we receive the complete plan with the engineered drawings. We have consolidated our comments here.

1. Final engineered drawings are not in the plan (currently in review with DNR Dam Safety). The ADNR, ADEC-SWP, and -CSP need to review final design plans before granting a final approval.

2. Page 3 (1) has the incorrect citation. Should be AS 27.19.100(7).

3. The closure plan suggests that "Capping does not preclude future mining." If mining is allowed within the finished capped tailings impoundment area, coordination with ADEC must be made to confirm practices do not contribute to a future release of contaminants.

4. ADNR, as the landowner, will require restrictions on any activity that would disturb the soil cap. The cap area (primary tailings) should be finished in a way that is unattractive for recreational users. For example: root wads and logs scattered throughout to minimize off road use.

5. ADNR prefers that the existing fence be removed from around the primary tailings site.

6. DOT&PF maintains St. Patrick's Road, and the plan indicates they would clean sediment from culverts. Functioning culverts are important for redirecting water flow from the sides of the property around the impoundment and across the road. Previous reports indicated the culverts needed to be repaired and monitored every 5 years to ensure drainage is directed away from the capped tailings impoundment. We request that this be a part of the post-closure monitoring plan.

7. An Institutional Control Management Plan should be developed in collaboration with the landowner to describe what ICs will be implemented and how they will be managed prior to an approved closure of this contaminated site (Grant Mine Site, Hazard ID: 731).

This letter constitutes a conditional approval for the closure and capping plan based on the details provided by Shannon & Wilson. Shannon & Wilson also has coordinated with ADEC's Quality Assurance staff to develop a defensible background number for comparison to remaining arsenic levels in the area where the Secondary Tailings Impoundment was excavated. We approve the closure of the secondary tailings impoundment based upon the post-excavation sample results.

Sincerely,

Laura Jacobs
Environmental Program Specialist,

Alyssa Millard
Natural Resource Specialist, and

Doug Buteyn
Environmental Program Manager

cc (via email): Mark Lockwood, Shannon & Wilson
Dana Fjare, Shannon & Wilson
Patty Burns, MLW-SAIL, ADNR
Alyssa Millard, MLW-SAIL, ADNR
Doug Buteyn, Solid Waste Program, ADEC