ILLEGAL DUMPING MITIGATION STRATEGY CLOSURE REPORT

LOWER NICOLA INDIAN BAND: NICOLA MAMEET IR #1, JOEYASKA IR #2, AND ZOHT IR #4, BRITISH COLUMBIA

PREPARED FOR

THE LOWER NICOLA INDIAN BAND (LNIB)

PREPARED BY

GANDALF CONSULTING LTD.

January 2021

PROJECT NO: 6040 LN

EXECUTIVE SUMMARY

Gandalf Consulting Ltd. (Gandalf) was retained by the Lower Nicola Indian Band (LNIB) to assist in the implementation of an Illegal Dumping Mitigation Strategy involving surface waste cleanup at six known illegal dump sites. The project was undertaken with the support of the First Nation Land Management Resource Centre. The locations addressed consisted of

- APEC 1 – Lot 9 Residential Dump on Joeyaska IR #2
- APEC 3 – Lot 6 Residential Dump on Joeyaska IR #2
- APEC 4 – Lot 11 Dump Site on Zoht IR #4
- APEC 5 – Four Mile Dump on Mameet IR #1
- APEC 6 – Buried Dump 1 Mameet Lake Ranch Road South on Mameet IR #1
- APEC 7 – Buried Dump 2 Mameet Lake Ranch Road North on Mameet IR #1

In 2018/2019 Gandalf conducted a Phase 2 Environmental Site Assessment (Phase 2 ESA) that identified soil and groundwater contamination. The results of the Phase 2 ESA are contained in the report titled "Phase II Environmental Site Assessment (ESA) Lower Nicola Indian Band: Nicola Mameet IR NO. 1, Joeyaska IR No. 2, Pipseul IR No. 3, and Zoht IR No. 4, British Columbia", authored by Gandalf Consulting Ltd. and dated May 2019 (Project No. 6050LN). To manage and mitigate risk, Gandalf recommended source (surface and potentially buried garbage) removal and the implementation of dumping mitigation strategies.

Soil contamination was identified at APECs 5 and 6; a limited contaminated soil remediation program comprising the removal of shallow surface contamination from APEC 5 was also proposed.

The LNIB's designated contractor Shulus Forest Enterprises Limited (SFE) carried out the surface waste and contaminated soil removal program between September 21st and November 25th, 2020. Approximately 362.32 tonnes of waste material and 7.81 tonnes of recyclables were removed from the illegal dump sites. Approximately 291.57 tonnes of contaminated soil were removed from APEC 5 and disposed of at the Thompson-Nicola Regional District landfill.

Gandalf conducted pre-cleanup soil sampling to evaluate the risk of contaminant exposure at all APECs as reported in the Phase 2 ESA. As part of the mitigation strategy Gandalf conducted post-cleanup soil sampling at APECs 5 and 6. The results of the closure soil sampling indicate that there is a low risk of contaminant exposure for potential receptors at these APECs.

LNIB is continuing to enforce its mitigation strategy at these sites through a combination of road decommissioning, access gates, sign posting and installation of security cameras.

The goals of the mitigation strategy and cleanup program have been met.

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1 INTRODUCTION

Gandalf Consulting Ltd. (Gandalf) has supported the Lower Nicola Indian Band (LNIB) to address legacy issues associated with illegal dumping on Band lands. The LNIB sought to implement their Illegal Dumping Mitigation Strategy that included surface waste cleanup at six known illegal dump sites and supported by the First Nation Land Management Resource Centre.

2 BACKGROUND

The LNIB has participated in and supported a series of environmental investigations including a Phase 2 Environmental Site Assessment (Phase 2 ESA) conducted by Gandalf in 2018/2019 that evaluated the presence of contaminated soil and groundwater at various Areas of Potential Environmental Concern (APECs) including illegal dumping locations on or adjacent to Band lands. Contaminated soil and groundwater were identified and to manage risk Gandalf recommended source (and potentially buried waste removal) removal and the implementation of dumping mitigation strategies. The results of the Phase 2 ESA are contained in the report titled "Phase II Environmental Site Assessment (ESA) Lower Nicola Indian Band: Nicola Mameet IR NO. 1, Joeyaska IR No. 2, Pipseul IR No. 3, and Zoht IR No. 4, British Columbia", authored by Gandalf Consulting Ltd. and dated May 2019 (Project No. 6050LN).

The following APECs were identified as illegal dump sites:

- APEC 1 – Lot 9 Residential Dump on Joeyaska IR #2
- APEC 3 – Lot 6 Residential Dump on Joeyaska IR #2
- APEC 4 – Lot 11 Dump Site on Zoht IR #4
- APEC 5 – Four Mile Dump on Mameet IR #1
- APEC 6 – Buried Dump 1 Mameet Lake Ranch Road South on Mameet IR #1
- APEC 7 – Buried Dump 2 Mameet Lake Ranch Road North on Mameet IR #1

The locations of the APECs are shown in **Figures 1, 2,** and **3.**

Soil contamination was identified during the Phase 2 ESA at two locations proposed for waste cleanup (IR#1 APEC 5: Four Mile Dump and IR#1 APEC 6: Buried Dump 1 Mamit Lake Ranch Road South). A limited contaminated soil remediation program comprising the removal of shallow surface contamination from the IR#1 APEC 5: Four Mile Dump illegal dump site was also proposed.

In 2020, the LNIB, with their designated contractor Shulus Forest Enterprises Limited (SFE) and the support of the First Nation Land Management Resource Centre, implemented a program to address legacy issues associated with illegal dumping that included the removal of surface waste from the six illegal dump site locations. Additionally, the LNIB undertook the excavation of contaminated surface soils from IR#1 APEC 5: Four Mile Dump.

3 SCOPE OF WORK

Gandalf conducted the following scope of work:

- Prior to beginning waste removal, conduct a Site walkover with LNIB and SFE representatives to confirm the locations of identified contamination and to review the waste removal work.
- Conduct pre-waste removal soil sampling to characterize soils for disposal.
- Support landfill acceptance of waste soil.
- Conduct field reviews during waste removal work and provide support as necessary.
- Following the completion of waste removal activities, attend locations requiring further sampling to complete confirmatory soil sampling.
- Prepare a report documenting the surface waste and contaminated soil removal program including presenting the results of the soil investigations.

To support the LNIB for their ongoing environmental management goals, the soil sampling program was used as a demonstration and training exercise to familiarize LNIB staff with field sampling methods. This training acted as capacity building to enhance the Band's ability to evaluate environmental risks and pollution.

The soil sampling was carried out in general accordance with accepted practices and Sections 58 and 59 of the British Columbia Contaminated Sites Regulation (CSR).

4 PROJECT PERSONNEL

Gandalf's project team consisted of the following personnel:

Senior Reviewer	Mr. Bob Symington, M.Sc., P.Geo.
Project Engineer	Mr. Paul Gardner, M.A.Sc, P.Eng.
Project Coordinator	Mr. Xavier Sandoval, B.Sc, A.Sc.T, A.Ag

Mr. Symington was appointed a Standards Approved Professional in 2008 as administered by the Contaminated Sites Approved Professional (CSAP) Society. Mr. Symington was a founding director of the CSAP Society and past chair of the Performance Assessment Committee of CSAP.

Mr. Symington provided senior oversight and technical review relating to contaminated land management and hydrogeology for the project. Mr. Symington had overall responsibility to ensure the contamination investigations met the project objectives. Mr. Symington participated in key project meetings with the Band and provided overall oversight of project quality including technical review of the final report.

Mr. Paul Gardner, P.Eng. (EGBC), is a CSAP Standards Approved Professional with more than 15 years' experience as an environmental scientist and project manager providing solutions

regarding asset management including the investigation and remediation of permitted and uncontrolled landfill or waste disposal sites for First Nations and other clients.

Mr. Gardner acted as Field Engineer for the project. Mr. Gardner prepared the sampling and analysis plan, conducted soil sampling, and provided field training.

Mr. Xavier Sandoval is an Applied Science Technologist and Articling Agrologist with over 5 years' experience as an environmental scientist in the field of contaminated sites and has participated in numerous environmental investigation and remediation projects for a variety of clients.

Mr. Sandoval provided technical and administrative support for the project. Mr. Sandoval conducted closure sampling, documented site conditions, and drafted figures, tables, and the closure report.

5 SITE DESCRIPTION

5.1 Nicola Mameet IR#1

Nicola Mameet IR No. 1 is located along Highway 8 and 97C, approximately 8 km west of Merritt. This reserve is approximately 4,560 hectares (ha) and is used for residential, agricultural, and institutional purposes, and was formerly used for industrial purposes.

The reserve contains an oil and gas pipeline right-of-way, former rail line right-of-way, road networks including Highway 8 (Nicola Highway) and Highway 97C (Mamit Lake Road), residences, sawmills, a fire hall, band administration buildings, schools and daycare, community centers, gas stations, gravel pits, concrete and asphalt plants, motor speedway, fuel storage tanks, and unsanctioned dump sites.

The location of IR #1 and associated APECs is shown in **Figure 1** in **Appendix I**.

5.2 Joeyaska IR#2

Joeyaska IR No. 2 is located approximately 5 km east of Merritt. The reserve is approximately 130 ha, used for residential and agricultural purposes and considered for commercial and light industrial development.

Receptors at Nicola Mamit IR# 2 near APECs include people in residences breathing the air, drinking water, consuming plants including those grown in private gardens or gathered in the wild (e.g., watercress), and consuming animals (agricultural cattle).

The location of IR #2 and associated APECs is shown in **Figure 2** in **Appendix I**.

5.3 Zoht IR#4

Zoht IR#4 is located 0.5 km directly north of the township of Nicola and 9 km northeast of Merritt. The reserve is approximately 200 ha and is used for residential and agricultural purposes with a post-manufacturing mill. Receptors at IR#4 near APECs include people (in industrial sites) breathing the air and drinking water.

The location of IR #4 and associated APECs is shown in **Figure 3** in **Appendix I**.

6 REGULATORY

The reserves are currently considered to be federal lands and the results of the soil sampling were evaluated in comparison to federal guidelines including:

- Canadian Environmental Soil Quality Guidelines for Protection of Environment and Human Health
- Canadian Sediment Quality Guidelines for the Protection of Aquatic Life (updated 2001)
- Guidelines for Canadian Drinking Water Quality (potable water) (Health Canada 2010)
- Federal Interim Groundwater Quality Guidelines (non-potable water) (Revised June 2016)
- Health Canada – Guidance for Soil Vapour Intrusion Assessment (Sept. 2010)
- Canada Wide Standards for Petroleum Hydrocarbons in Soil (CWS for PHC) (2008)

Soil analytical results were compared to CCME Canadian Environmental Quality Guidelines (CEQG) in soil. For comparative purposes, the results were also compared to the standards set out in the Province of British Columbia's Contaminated Sites Regulation (CSR) Schedule 3.1.

Residential/Parkland use (RL/PL) guidelines and standards were conservatively considered applicable at the APECs, including undeveloped land, in case of future development. The CSR differentiates between standards for low-density residential (RL_{LD}) and high-density residential (RL_{HD}). RL_{LD} standards were considered more likely applicable.

Since free-ranging cattle was observed at or near some APECs, CSR Agricultural (AL) standards for the protection of livestock ingesting soil and fodder (Livestock Ingestion) and the protection of groundwater used for livestock watering (Livestock Watering) were also considered at these locations.

Gandalf conceptually evaluated the associated potential exposure risks if guideline values were exceeded.

7 SURFACE WASTE AND CONTAMINATED SOIL REMOVAL PROGRAM

7.1 Site Activities

The overall program was initiated Sept 9th, 2020 and completed on Nov 25th, 2020 and consisted broadly of the following activities.

- On September 9th,2020 a planning conference call was conducted between LNIB, SFE and Gandalf to broadly outline the program schedule.
- On September 16th, 2020 Gandalf conducted a Site walkover with LNIB and SFE representatives to review the proposed work program. Gandalf also collected pre-waste removal soil samples from IR#1 APEC 5: Four Mile Dump.
- Site works by SFE began on September 21, 2020 with the removal of waste material from APECs 6 and 7, and were completed on November 25, 2020, with the removal of contaminated soil from APEC 5.
- On October 1st, 2020 Gandalf conducted a Site walkover with LNIB and SFE representatives to review works completed. On October 16th, 2020 Gandalf conducted additional surface sampling at the buried dump 1 Mamit Lake Ranch road south (IR#1 APEC 6).
- On December 3rd, 2020, Gandalf conducted additional surface soil sampling at the Four Mile Dump (IR#1 APEC 5).

7.2 Disposal Records

A total of 7.81 tonnes of recyclable materials (mostly scrap metal and clean fill material) and 362.3 tonnes of waste material (mostly household garbage) were removed from the dump sites. Approximately 208 m^3 (291.7 cubic metres) of contaminated soil was removed from IR#1 APEC 5 and transported to the Thompson-Nicola Regional District Landfill and replaced with approximately 200 m^3 of clean fill. The dates, types, and volumes of materials removed from each APEC are summarised in **Table 1 in Appendix II.** The load summary for the contaminated soil removed from APEC 5 is appended to this report in **Appendix III**.

7.3 APEC 1 – Lot 9 Residential Dump at Joeyaska IR #2

During the Phase 2 ESA Gandalf completed 2 test pits and collected 2 soil samples from each. All soil samples had reported concentrations less than the applicable guidelines and standards for petroleum hydrocarbons and volatile substances. Elevated concentrations of chromium and nickel above the CCME guideline but below the CSR background levels were identified and are presented on **Figure 4** in **Appendix I** along with pre-remedial photos.

Elevated copper concentrations were found in 3 of 4 samples analyzed; however, after performing statistical analysis, Gandalf did not consider the elevated soil results for copper to be indicative of anthropogenic contamination, and therefore concluded that no contamination is likely present associated with the APEC.

A total of 27.09 tonnes of surface waste was removed, including recyclables. Recyclables included scrap metals (transported offsite by Tas Trucking Ltd., truck #107) and five tires without rims. Waste included household garbage.

Following waste removal, 2 truckloads of rip rap were brought in to restore the area. Post remedial drone and ground photos are shown in **Figure 5** in **Appendix I**.

7.4 APEC 3 – Lot 6 Residential Dump at Joeyaska IR #2

During the Phase 2 ESA Gandalf completed 2 test pits with 2 soil samples at each. All soil samples had reported concentrations less than the applicable guidelines or standards for metals, petroleum hydrocarbons, and volatile substances. Soil sample results and pre-removal pictures are presented in **Figure 6** in **Appendix I**.

A total of 50.31 tonnes of waste and 2.25 tonnes of recyclables was removed, including 2 cars sent to Reliable Towing. Recyclables included metal (clean fill), 15 tires with rims and 29 tires without rims. Waste included household garbage.

Post remedial drone photos are presented in **Figure 7** in **Appendix I**.

7.5 APEC 4 – Lot 11 Dump at Zoht IR #4

During the Phase 2 ESA Gandalf completed 4 test pits with 2 soil samples at each. All soil samples had reported concentrations less than the applicable guidelines or standards for metals, petroleum hydrocarbons, and volatile substances. Soil sample results and pre-removal pictures are presented in **Figure 8 of Appendix I**.

A total of 27.77 tonnes of waste and 0.16 tonnes of recyclables were removed. Recyclables included metals (clean fill). Waste included household garbage. Following waste removal, the disturbed ground was graded and seeded with native grass species.

Post remedial drone photos are presented in **Figure 9** in **Appendix I.**

7.6 APEC 5 – Four Mile Dump at Nicola Mameet IR #1

During the Phase 2 ESA Gandalf completed 4 test pits and two boreholes with 2 soil samples analyzed from each. All soil samples had reported concentrations less than the applicable guidelines or standards for petroleum hydrocarbons, volatile substances, and glycols. Soil sample results and pre-removal pictures are presented in **Figure 10** in **Appendix I**

Five of 12 samples analyzed had copper concentrations greater than the federal guideline; 2 of these had results less than the regional CSR background level. Elevated concentrations of nickel were also found in one of the soil samples.

On September 16th, 2020 Gandalf conducted a Site walkover with LNIB and SFE representatives to review the proposed work program. Gandalf also collected pre-waste removal soil samples from IR#1 APEC 5: Four Mile Dump. The soil sampling results are presented in **Table 2** of **Appendix 2** and on **Figure 11** of **Appendix 1** and were located to assist in the delineation of the soils to be removed. Sample SS-2 failed for copper but was removed during the remedial activities.

Approximately 291.57 tonnes (208 m^3) of contaminated soil were removed by SFE and transported to the Thompson-Nicola Regional District landfill site (the load records are presented in **Appendix III**). The Site was restored with clean fill.

Gandalf visited the site and conducted closure sampling on December 3, 2020; one closure sample had an iron concentration exceeding CSR standards for the protection of human health. However, this exceedance is likely related to the local geology (i.e., estimated regional background levels as per BC ENV Protocol 4) and the nearby volcanogenic iron formation (Iron Mountain). Elevated concentrations of iron were found in all samples, and Gandalf concludes that iron present in the closure soil samples is not of anthropogenic origin. The results of the closure sampling of surficial soils at the site are presented in **Table 2** of **Appendix II**.

Closure soil sample results and post-removal photos are presented in **Figure11** in **Appendix I.**

7.7 APEC 6 – Buried Dump 1 Mameet Lake Ranch Road South

Gandalf completed 4 test pits during the Phase 2 ESA, with two soil samples analyzed from each. Two of the samples had copper and zinc concentrations above the CSR regional background level and applicable guidelines or standards and one sample had elevated lead concentrations. Additionally, one sample had polycyclic aromatic hydrocarbons (PAH) exceedances above federal guidelines. Soil sample results and pre-removal pictures are presented in **Figure 12** in **Appendix I**

While the elevated soil results were considered to be indicative of anthropogenic contamination, the contamination was found in deep (>1m) soils. Because of its depth and geotechnical constraints at this site, only surface soil and waste were removed, and the site was restored with a layer of clean fill.

Approximately 98.87 tonnes of waste and 2.19 tonnes of recyclables were removed. Recyclables included metals (clean fill) and 16 tires with rims. Waste included household garbage, dirty electronics, concrete, and asphalt.

Gandalf conducted shallow soil sampling on October 16th, 2020. Two closure samples analyzed had vanadium concentrations slightly exceeding the CSR standards for the protection of drinking water but lower than the CCME guideline. No anthropogenic wide area sources of vanadium were identified, and exceedances are more likely related to the local geology (i.e., estimated regional background, as per BC ENV Protocol 4). Gandalf does not consider Vanadium to be of anthropogenic origin and elevated concentrations are suspected regional background and not associated with the APEC. The closure soil sample results are presented in **Table 3** in **Appendix II**.

One closure sample analyzed had zinc concentration exceeding the CSR standards for the protection of livestock ingesting soil and fodder (200 mg/kg) but lower than the CCME guideline (250 mg/kg). No anthropogenic sources of zinc were identified, and exceedances are more likely related to the local geology (i.e., silver-lead-zinc deposits in the vicinity of Merritt, related to the Nicola Group rocks). Gandalf does not consider Zinc to be of anthropogenic origin and elevated concentrations are suspected regional background and not associated with the APEC.

Closure soil sample results and post-removal photos and drone photos are presented in **Figure13** in **Appendix I.**

7.8 APEC 7 – Buried Dump 2 Mameet Lake Ranch Road North

Gandalf completed 4 test pits with two soil samples analyzed from each during the Phase 2 ESA. All soil samples had reported concentrations of hydrocarbons, volatile substances, and glycols less than the applicable guidelines or standards. Elevated Vanadium concentrations were found in one deep (>1m) sample; however, this result was considered to be anomalous and not indicative of anthropogenic contamination. Soil sample results and pre-removal photos are presented in **Figure 14** in **Appendix I**

Approximately 158.19 tonnes of waste and 3.21 tonnes of recyclables were removed. Recyclables included metals (clean fill and appliances). Waste included household garbage, dirty electronics, soil, concrete, and asphalt.

Post remedial drone and ground-level photos are shown in **Figure 15** in **Appendix I**

8 QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC)

As part of the QA/QC program, proper sample collection, identification, storage, transport, documentation, and analysis protocols were followed.

A field duplicate sample was collected and analysed for the purpose of calculating relative percent difference (RPD). The RPD is calculated to compare the differences between a sample and its duplicate, thus quantifying the reproducibility or precision of the data. The RPD is calculated by taking the absolute value of the difference between the sample and the duplicate, dividing it by the average of the sample and duplicate, and then multiplying by 100 to obtain a percentage:

$$RPD = \frac{(\text{sample concentration} - \text{duplicate concentration})}{[(\text{sample concentration} + \text{duplicate concentration})/2]} \times 100\%$$

BC ENV guidelines recommend that further review is conducted on RPD values greater than 20% in water and 30% in soil. However, if the concentration of the analyte is less than five times the method detection limit, or if the analyte is influenced by matrix variability and heterogeneity (such as metals in soil), then a RPD value greater than 35% may be reasonable. If the RPD is greater than 50%, it is generally necessary to determine the cause and how it affects the findings of the investigation. RPD values for the soil field duplicate sample 4M7 from APEC 5 (Four Mile Dump) are all below 25% and in most cases below 10%. RPD values are presented in **Table 4**.

The laboratory used duplicate/RPD analysis, reference materials, control, surrogate and matrix spikes, and method blanks as part of its QA/QC program. The laboratory QA/QC results are included in the laboratory certificates of analysis in **Appendix IV** and were reviewed by Gandalf to ensure they were within acceptable ranges. No issues were noted in the lab QA/QC program.

Based on the results of the field and laboratory QA/QC programs, the quality of the sample collection and laboratory analyses for all samples are deemed to be acceptable and the results of this investigation are considered to be valid.

9 DISCUSSION

Historic waste management practices on Band lands included the use of informal legacy dump locations that were not designed or engineered, and waste was still present on the surface. Surface waste at legacy dump sites functioned as a 'sign-post' that illegal dumping was tolerated at these locations.

Illegal dumping is a priority at the LNIB, and they sought to implement a mitigation strategy to address issues associated with poor waste disposal practices including public education, waste diversion and recycling, and illegal dumping on Band lands.

Consequently, the LNIB has successfully implemented an Illegal Dumping Mitigation Strategy that included surface waste cleanup, contaminated soil removal, and site restoration at six known illegal dump sites.

Shulus Forest Enterprises undertook a surface waste and contaminated soil removal and site restoration program following Gandalf's proposed recommendations.

Gandalf conducted pre-cleanup soil sampling to evaluate the risk of contaminant exposure at all APECs as reported in the Phase 2 ESA. As part of the mitigation strategy Gandalf conducted post-cleanup soil sampling at APECs 5 and 6. The results of the closure soil sampling indicate that there is a low risk of contaminant exposure for potential receptors at these APECs.

LNIB is continuing to enforce its mitigation strategy at these sites and has undertaken a combination of road decommissioning, access gates, sign posting and installation of security cameras.

The goals of the mitigation strategy and cleanup program have been met.

10 DISCLAIMER:

This Illegal Dumping Mitigation Strategy Closure Report (Closure Report) has been prepared for the Lower Nicola Indian Band ("the Client"). It is intended to provide the Client with an understanding of the potential hazards that the properties may pose to human health, or to the general environment due to chemical contamination. It describes what Gandalf Consulting Ltd. believes are reasonable concerns about how the property could potentially become involved in various environmental problems resulting from hazardous waste and hazardous materials. Gandalf Consulting Ltd. has neither created nor contributed to the creation or existence of any hazardous, radioactive, toxic, irritant, pollutant, or otherwise dangerous substance, or condition at the Site.

The Closure Report was prepared in a manner consistent with that level of care and skill normally exercised by other members of the engineering and science professions currently practising under similar conditions, subject to the time limits and financial and physical constraints applicable to the services. The Closure Report was based on information collected during our investigation, our present understanding of the Site conditions, and our professional judgement in light of such information available at the time of the review. The Closure Report does not provide a legal opinion regarding compliance with applicable laws. With respect to regulatory compliance issues, it should be noted that regulatory statutes and the interpretation of regulatory statutes are subject to change. While the Closure Report can be used as a guide by Client, it must be understood that it is neither a rejection nor an endorsement of the property.

The Closure Report was prepared by Gandalf Consulting Ltd. for the account of the Client. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Gandalf Consulting Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this Closure Report.

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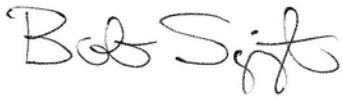
REPORT CREDITS



R.M. (Bob) Symington, M.Sc., P.Geo.

Report Preparation .....X. Sandoval, B.Sc., A.Sc.T, A.Ag

Senior Review.....R.M. Symington. MSc. P.Geo, Approved Professional

APPENDIX I

FIGURES

APECs △

APEC 1: Rocky Pines Car Crushing

APEC 5: Mamit Lake Road Four Mile Dump

APEC 6: Buried Dump 1 Mamit Lake Ranch Road South

APEC 7: Buried Dump 2 Mamit Lake Ranch Road North

APEC 8: Mamit Lake Road Target Shooting Area

APEC 11: Lot 146 Sawmill

APEC 13: Lot 105 Lot 72-1 Abandoned House

APEC 16: Lot 208 AST (213E Hwy 8)

APEC 20: BC Plan 215 Nicola River Dump

APEC 24: Lot 17, 18, 86, and South of Lots 3, 4, and 5

APEC 28: Band Fire Hall Burn Pile

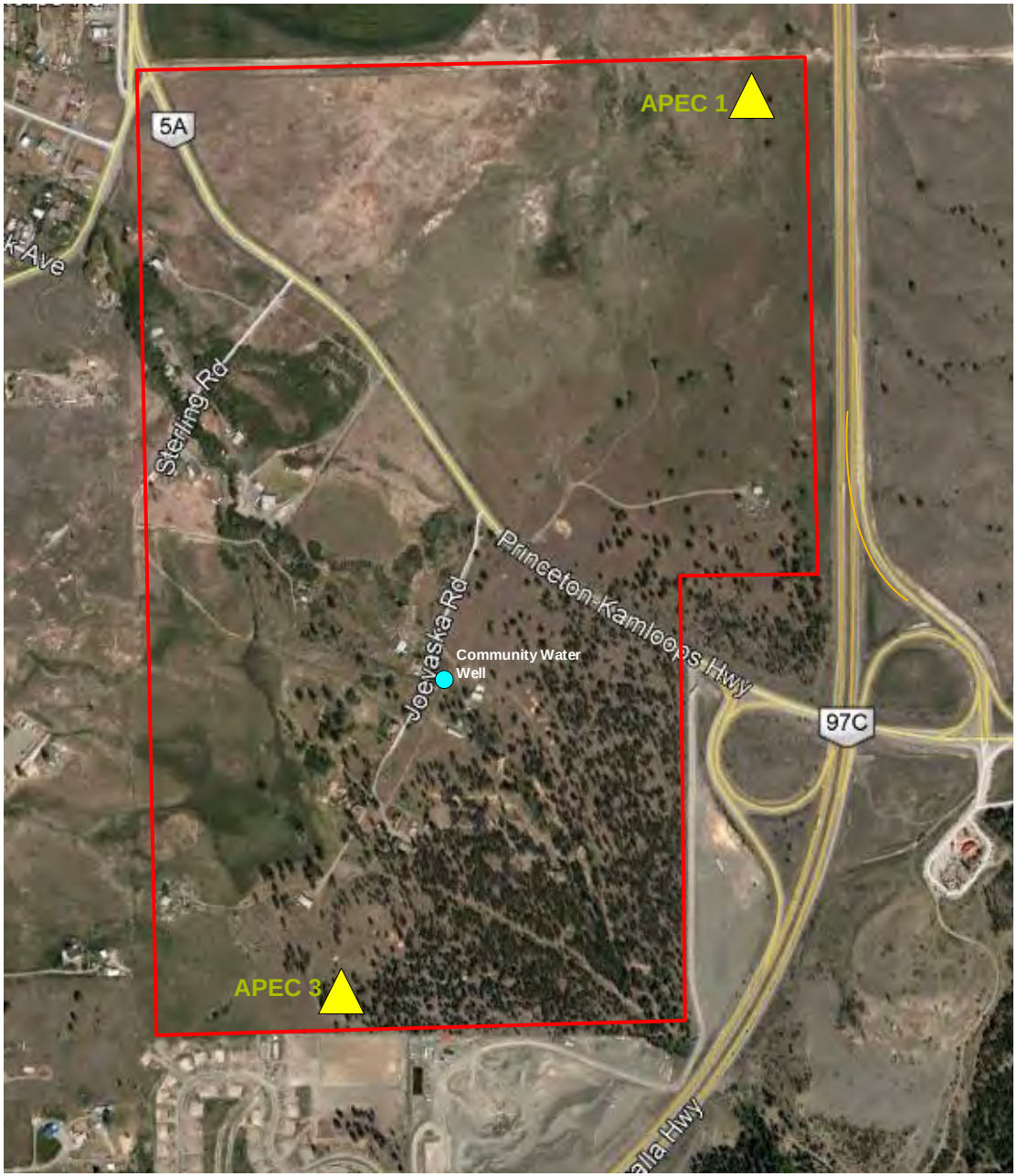
APEC 32: Former Shulus School AST

APEC 33: Soil Contamination Charlotte Joe Residence

Offsite APEC 34: CP Rail Right of Way

APECs labeled in green have been addressed

PREPARED BY: Gandalf Consulting Ltd. PO Box 48806 Vancouver, BC	LOWER NICOLA INDIAN BAND
	IR#: 1
PROJECT NUMBER: 6040LN	APEC #: N/A
SOURCE: Google Earth, Columbia Phase I 2011 & Phase I Update 2015, Lower Nicola Indian Band Online Map	FIGURE #: 1
LAT/LONG: 50°9'5.53"N, 120°51'11.31"W	APEC LOCATIONS ON IR #1
DRAWN BY: GM DATE DRAWN: JAN-2019	
REVISED BY: XS DATE REVISED: DEC-2020	



0 km 0.125 0.25 0.5 1

APECs

APEC 1: Lot 9 Residential Dump

APEC 3: Lot 6 Residential Dump

APECs labeled in green have been addressed

PREPARED BY: Gandalf Consulting Ltd. PO Box 48806 Vancouver, BC	LOWER NICOLA INDIAN BAND
	IR#: 2
PROJECT NUMBER: 6040LN	APEC #: N/A
SOURCE: Google Earth, Columbia Phase I 2011 & Phase I Update 2015, Lower Nicola Indian Band Online Map	FIGURE #: 2
LAT/LONG: 50°5'30.30"N, 120°45'13.14"W	APEC LOCATIONS ON IR #2
DRAWN BY: GM DATE DRAWN: JAN-2019	
REVISED BY: XS DATE REVISED: DEC-2020	

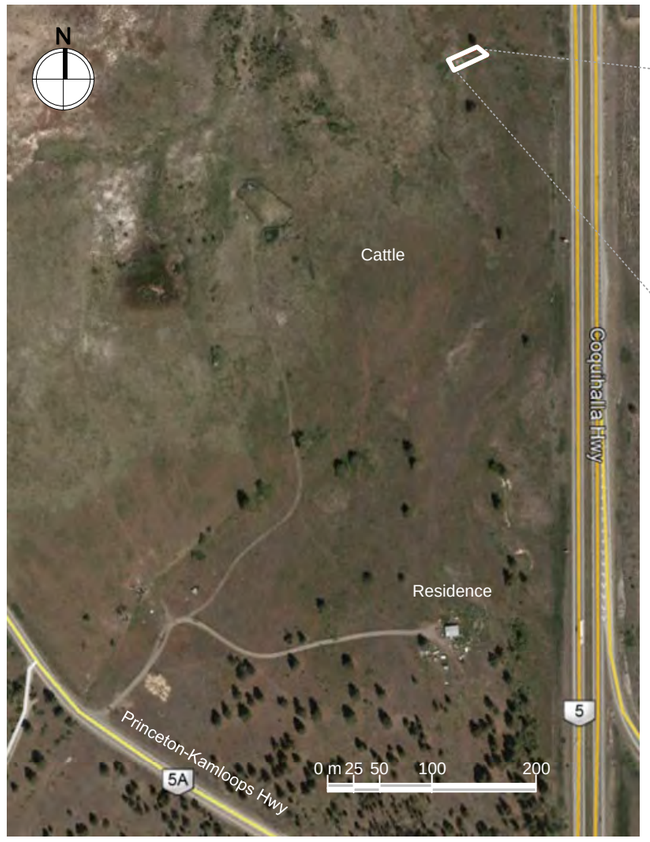
APECs

APEC 1: Post Mill Plan 59794

APEC 4: Lot 11 Dump Site Offsite APEC 5: Dump #1

APECs labeled in green have been addressed

PREPARED BY: Gandalf Consulting Ltd. PO Box 48806 Vancouver, BC	LOWER NICOLA INDIAN BAND
	IR#: 4
PROJECT NUMBER: 6040LN	APEC #: N/A
SOURCE: Google Earth, Columbia Phase I 2011 & Phase I Update 2015, Lower Nicola Indian Band Online Map	FIGURE #: 3
LAT/LONG: 50°10'50.27"N, 120°39'55.90"W	APEC LOCATIONS ON IR #4
DRAWN BY: GM DATE DRAWN: JAN-2019	
REVISED BY: XS DATE REVISED: DEC-2020	



TP1 18-Jul-2018	CCME	CSR
0.3 m	pH >< Metals > (Cr 67, Cu 70.6, Ni 71.0) PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~	pH - Metals > (Cr) PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~
2.3 m	pH >< Metals > (Cu 76.7) PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~

TP2 18-Jul-2018	CCME	CSR
0.3 m	pH >< Metals > (Cu 63.6, Ni 49.1) PHC < BTEX < PAH < VOC < ~~Glycol~~ ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < ~~Glycol~~ ~~Nitrates~~
1.5 m	pH > Metals < PHC < BTEX < PAH < VOC < ~~Glycol~~ ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < ~~Glycol~~ ~~Nitrates~~

Chromium (Cr)
CCME guideline: 64 mg/kg
CSR background: 70 kg/kg

Copper (Cu)
CCME guideline: 63 mg/kg
CSR background: 75 kg/kg

Nickel (Ni)
CCME guideline: 45 mg/kg
CSR background: 85 kg/kg

Analysis

Metals: Al, Sb, As, Ba, Be, Bi, Bo, Cd, Cr, Co, Cu, Fe, Pb, Li, Mn, Hg, Mo, Ni, Se, Ag, Sr, Tl, Sn, W, U, V, Zn, Zr

PHC: F1 (nC6-nC12), F2 (>nC10-nC16), F3 (>nC16-nC34), F4 (>nC34-nC50)

BTEX: benzene, toluene, ethylbenzene, total xylenes

PAH: acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(j)fluoranthene, benzo(b+j)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, 1-methylnaphthalene, 2-methylnaphthalene, naphthalene, phenanthrene, pyrene, quinoline

VOC: 1,1,1,2-tetrachloroethane, 1,1,1-trichloroethane, 1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane, 1,1-dichloroethane, 1,1-dichloroethylene, 1,2,4-trimethylbenzene, 1,2-dibromoethane, 1,2-dichlorobenzene, 1,2-dichloroethane, 1,2-dichloropropane, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 2-butanone (MEK), 4-methyl-2-pentanone (MIBK), bromodichloromethane, bromoform, bromomethane, carbon tetrachloride, chlorobenzene, chloroethane, chloroform, chloromethane, cis-1,2-dichloroethylene, cis-1,3-dichloropropylene, dibromochloromethane, dichloromethane, tetrachloroethylene (PERC), trans-1,2-dichloroethylene, trans-1,3-dichloropropylene, trichloroethylene (TCE), trichlorofluoromethane, vinyl chloride

Glycol: propylene glycol, monoethylene glycol, diethylene glycol, triethylene glycol, tetraethylene glycol

Nitrates: nitrates, soluble

~~Parameter~~ Not analysed

Test pit

Monitoring well

Borehole

Locations approximate; not surveyed

Exceedance(s) in soil of CCME guidelines other than pH

Exceedance(s) in soil of CSR standards but not CCME guidelines

Soil pH outside of CCME guideline range

No exceedance(s) in soil

Land use: residential (nearby) with livestock. Standards applied: CCME RL or RL/PL, CSR RL_{LD} and AL livestock

PREPARED BY:
Gandalf Consulting Ltd.
PO Box 48806
Vancouver, BC

LOWER NICOLA INDIAN BAND

IR#: 2

PROJECT NUMBER: 6040LN

APEC #: 1

SOURCE: Google Earth, Columbia Stage 1 2011

FIGURE #: 4

LAT/LONG: 50°5'52.33"N, 120°45'1.43"W

DRAWN BY: GM DATE DRAWN: Aug-2018
REVISED BY: XS DATE REVISED: Dec-2020

JOEYASKA LOT 9
RESIDENTIAL DUMP
PRE-REMEDIATION

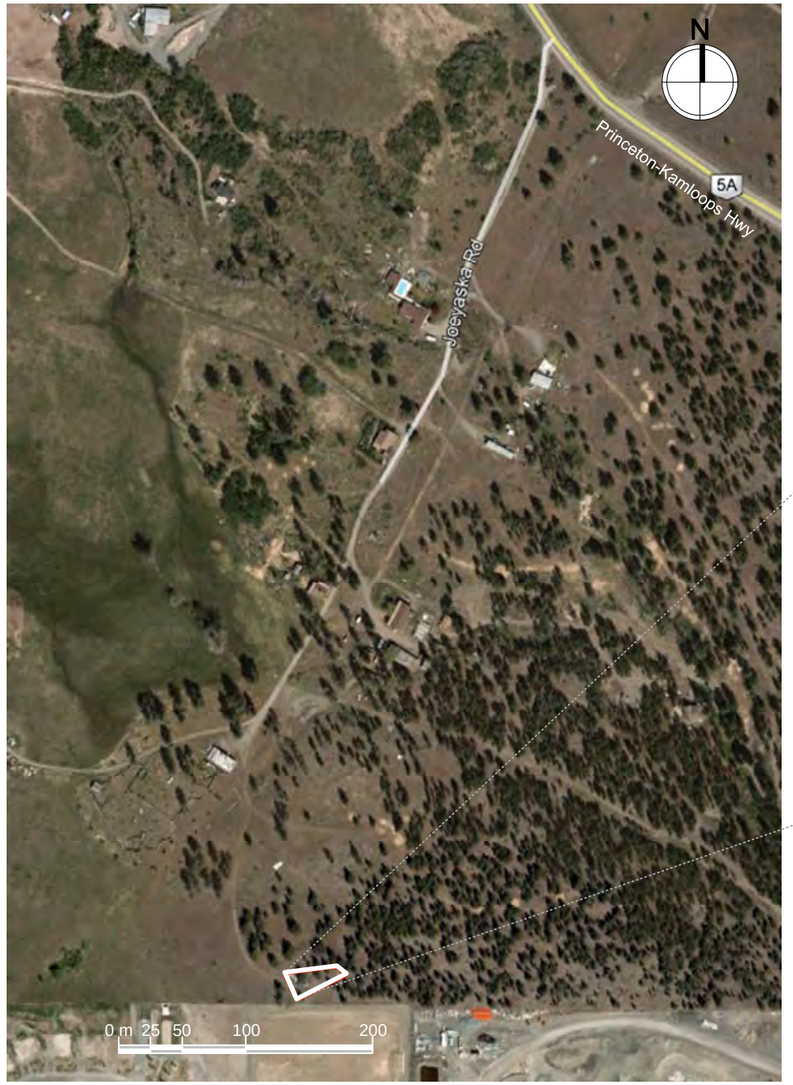
View of site after clean-up

Approximate area of former surface waste

View of site after clean-up

Aerial drone view of site after clean-up

PREPARED BY: Gandalf Consulting Ltd. PO Box 48806 Vancouver, BC	LOWER NICOLA INDIAN BAND
	IR#: 2
PROJECT NUMBER: 6040LN	APEC #: 1
SOURCE: Google Earth, Columbia Stage 1 2011	FIGURE #: 5
LAT/LONG: 50°5'52.33"N, 120°45'1.43"W	JOEYASKA LOT 9 RESIDENTIAL DUMP POST-REMEDIATION
DRAWN BY: GM DATE DRAWN: Aug-2018	
REVISED BY: XS DATE REVISED: Dec-2020	



Analysis

Metals: Al, Sb, As, Ba, Be, Bi, Bo, Cd, Cr, Co, Cu, Fe, Pb, Li, Mn, Hg, Mo, Ni, Se, Ag, Sr, Tl, Sn, W, U, V, Zn, Zr

PHC: F1 (nC6-nC12), F2 (>nC10-nC16), F3 (>nC16-nC34), F4 (>nC34-nC50)

BTEX: benzene, toluene, ethylbenzene, total xylenes

PAH: acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(j)fluoranthene, benzo(b+j)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, 1-methylnaphthalene, 2-methylnaphthalene, naphthalene, phenanthrene, pyrene, quinoline

VOC: 1,1,1,2-tetrachloroethane, 1,1,1-trichloroethane, 1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane, 1,1-dichloroethane, 1,1-dichloroethylene, 1,2,4-trimethylbenzene, 1,2-dibromoethane, 1,2-dichlorobenzene, 1,2-dichloroethane, 1,2-dichloropropane, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 2-butanone (MEK), 4-methyl-2-pentanone (MIBK), bromodichloromethane, bromoform, bromomethane, carbon tetrachloride, chlorobenzene, chloroethane, chloroform, chloromethane, cis-1,2-dichloroethylene, cis-1,3-dichloropropylene, dibromochloromethane, dichloromethane, tetrachloroethylene (PERC), trans-1,2-dichloroethylene, trans-1,3-dichloropropylene, trichloroethylene (TCE), trichlorofluoromethane, vinyl chloride

Glycol: propylene glycol, monoethylene glycol, diethylene glycol, triethylene glycol, tetraethylene glycol

Nitrates: nitrates, soluble

~~Parameter~~ Not analysed

Test pit

Monitoring well

Borehole

Locations approximate; not surveyed

Exceedance(s) in soil of CCME guidelines other than pH

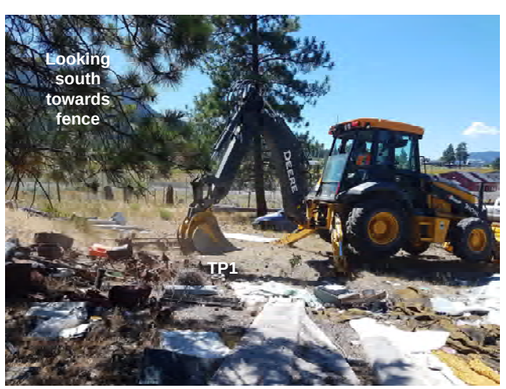
Exceedance(s) in soil of CSR standards but not CCME guidelines

Soil pH outside of CCME guideline range

No exceedance(s) in soil

TP1 18-Jul-2018	CCME	CSR
0.1 m	pH >< Metals < PHC < BTEX < PAH < VOC < ~~Glycol~~ ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < ~~Glycol~~ ~~Nitrates~~
2.0 m	pH > Metals < PHC < BTEX < PAH < VOC < ~~Glycol~~ ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < ~~Glycol~~ ~~Nitrates~~

TP2 18-Jul-2018	CCME	CSR
0.3 m	pH >< Metals < PHC < BTEX < PAH < VOC < ~~Glycol~~ ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < ~~Glycol~~ ~~Nitrates~~
2.9 m	pH > Metals < PHC < BTEX < PAH < VOC < ~~Glycol~~ ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < ~~Glycol~~ ~~Nitrates~~



Land use: residential (nearby) with livestock. Standards applied: CCME RL or RL/PL, CSR RL_{LD} and AL livestock

PREPARED BY:
Gandalf Consulting Ltd.
PO Box 48806
Vancouver, BC

LOWER NICOLA INDIAN BAND

IR#: 2

PROJECT NUMBER: 6040LN

APEC #: 3

SOURCE: Google Earth, Columbia Stage 1 2011

FIGURE #: 6

LAT/LONG: 50°5'9.28"N, 120°45'32.55"W

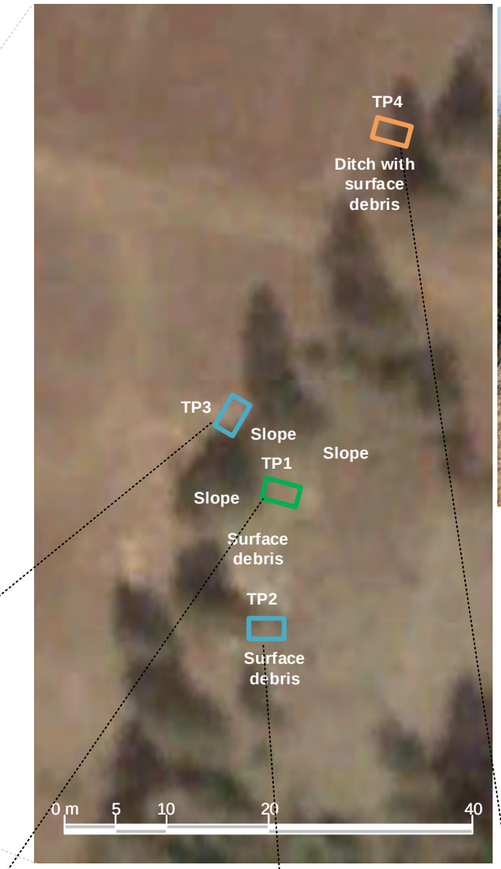
JOEYASKA LOT 6 RESIDENTIAL DUMP PRE-REMEDIATION

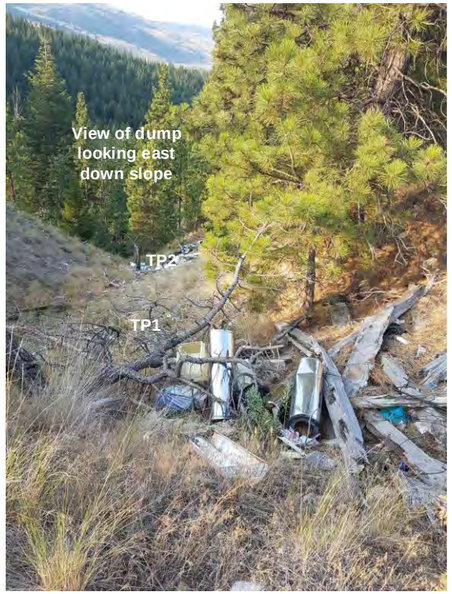
DRAWN BY: GM DATE DRAWN: Aug-2018

REVISED BY: XS DATE REVISED: Dec-2020

Aerial drone view after clean-up

PREPARED BY: Gandalf Consulting Ltd. PO Box 48806 Vancouver, BC	LOWER NICOLA INDIAN BAND
	IR#: 2
PROJECT NUMBER: 6040LN	APEC #: 3
SOURCE: Google Earth, Columbia Stage 1 2011	FIGURE #: 7
LAT/LONG: 50°5'9.28"N, 120°45'32.55"W	JOEYASKA LOT 6 RESIDENTIAL DUMP POST-REMEDIATION
DRAWN BY: XS DATE DRAWN: Dec-2020 REVISED BY: DATE REVISED:	





TP3 25-Jul-2018	CCME	CSR
0.3 m	pH > Metals < PHC < BTEX < PAH < VOC < ~~Glycol~~ ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < ~~Glycol~~ ~~Nitrates~~
2.7 m	pH > Metals < PHC < BTEX < PAH < VOC < ~~Glycol~~ ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < ~~Glycol~~ ~~Nitrates~~

TP1 25-Jul-2018	CCME	CSR
0.4 m	pH > Metals < PHC < BTEX < PAH < VOC < ~~Glycol~~ ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < ~~Glycol~~ ~~Nitrates~~
2.5 m	pH > Metals < PHC < BTEX < PAH < VOC < ~~Glycol~~ ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < ~~Glycol~~ ~~Nitrates~~

TP2 25-Jul-2018	CCME	CSR
0.3 m	pH > Metals < PHC < BTEX < PAH < VOC < ~~Glycol~~ ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < ~~Glycol~~ ~~Nitrates~~
2.0 m	pH > Metals < PHC < BTEX < PAH < VOC < ~~Glycol~~ ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < ~~Glycol~~ ~~Nitrates~~

TP4 25-Jul-2018	CCME	CSR
1.5 m	pH > Metals < PHC < BTEX < PAH < VOC < ~~Glycol~~ ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < ~~Glycol~~ ~~Nitrates~~
2.0 m	pH > Metals < PHC < BTEX < PAH < VOC < ~~Glycol~~ ~~Nitrates~~	pH - Metals > (V) PHC < BTEX < PAH < VOC < ~~Glycol~~ ~~Nitrates~~

Analysis

Metals: Al, Sb, As, Ba, Be, Bi, Bo, Cd, Cr, Co, Cu, Fe, Pb, Li, Mn, Hg, Mo, Ni, Se, Ag, Sr, Tl, Sn, W, U, V, Zn, Zr

PHC: F1 (nC6-nC12), F2 (>nC10-nC16), F3 (>nC16-nC34), F4 (>nC34-nC50)

BTEX: benzene, toluene, ethylbenzene, total xylenes

PAH: acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(j)fluoranthene, benzo(b+j)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, 1-methylnaphthalene, 2-methylnaphthalene, naphthalene, phenanthrene, pyrene, quinoline

VOC: 1,1,1,2-tetrachloroethane, 1,1,1-trichloroethane, 1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane, 1,1-dichloroethane, 1,1-dichloroethylene, 1,2,4-trimethylbenzene, 1,2-dibromoethane, 1,2-dichlorobenzene, 1,2-dichloroethane, 1,2-dichloropropane, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 2-butanone (MEK), 4-methyl-2-pentanone (MIBK), bromodichloromethane, bromoform, bromomethane, carbon tetrachloride, chlorobenzene, chloroethane, chloroform, chloromethane, cis-1,2-dichloroethylene, cis-1,3-dichloropropylene, dibromochloromethane, dichloromethane, tetrachloroethylene (PERC), trans-1,2-dichloroethylene, trans-1,3-dichloropropylene, trichloroethylene (TCE), trichlorofluoromethane, vinyl chloride

Glycol: propylene glycol, monoethylene glycol, diethylene glycol, triethylene glycol, tetraethylene glycol

Nitrates: nitrates, soluble

~~Parameter~~ Not analysed

Test pit

Monitoring well

Borehole

Locations approximate; not surveyed

Exceedance(s) in soil of CCME guidelines other than pH

Exceedance(s) in soil of CSR standards but not CCME guidelines

Soil pH outside of CCME guideline range

No exceedance(s) in soil

Land use: vacant, potential future residential, livestock. Standards applied: CCME RL or RL/PL, CSR RL_{LD} and AL livestock

PREPARED BY:
Gandalf Consulting Ltd.
PO Box 48806
Vancouver, BC

LOWER NICOLA INDIAN BAND

IR#: 4

PROJECT NUMBER: 6040LN

APEC #: 4

SOURCE: Google Earth, Columbia Stage 1 2011

FIGURE #: 8

LAT/LONG: 50°11'17.44"N, 120°39'50.63"W

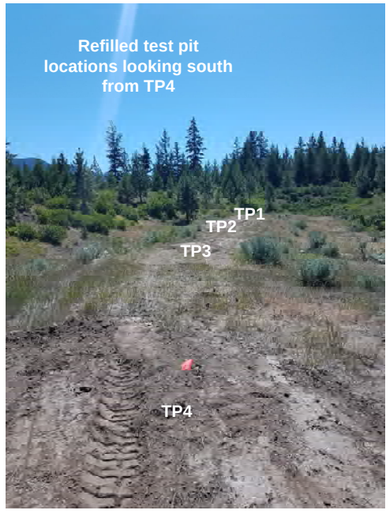
DRAWN BY: GM DATE DRAWN: Aug-2018

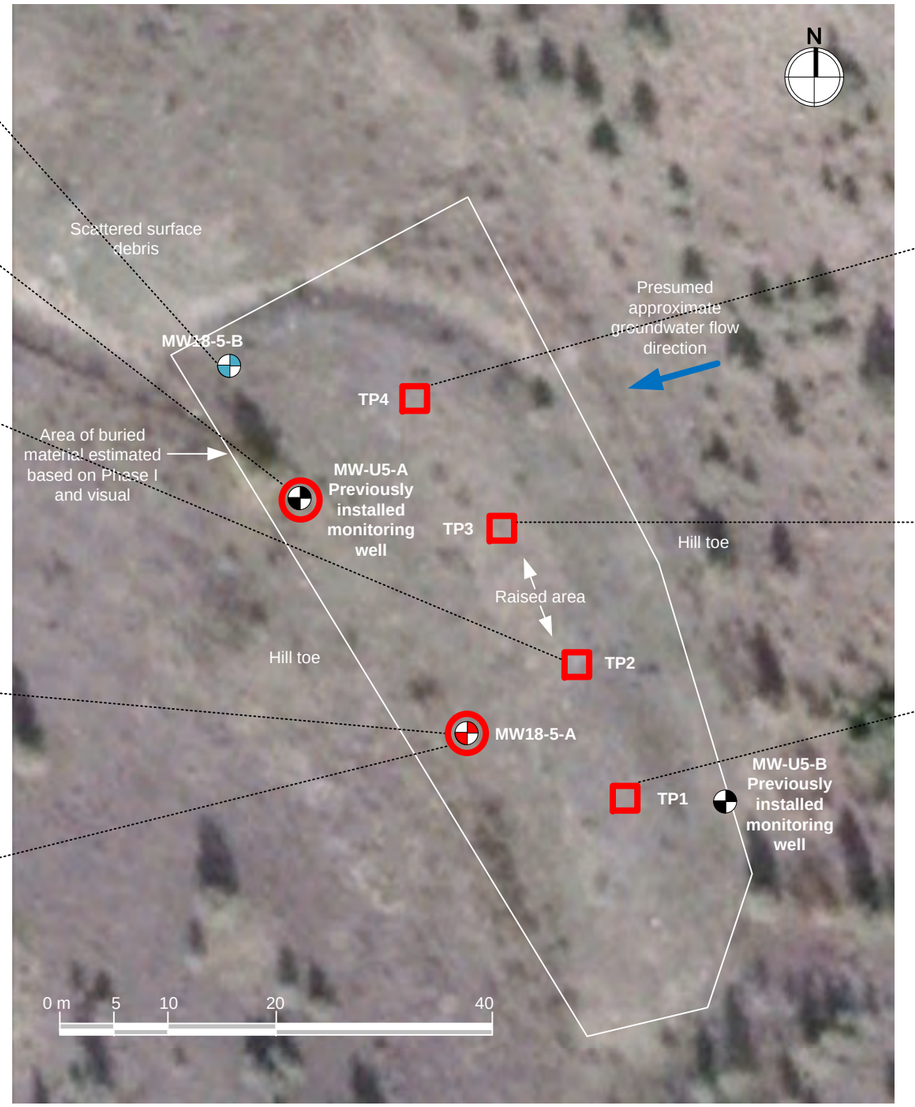
REVISED BY: XS DATE REVISED: Dec-2020

ZOHT LOT 11 DUMP SITE PRE-REMEDIATION

Aerial drone view of site after clean-up

PREPARED BY: Gandalf Consulting Ltd. PO Box 48806 Vancouver, BC	LOWER NICOLA INDIAN BAND
	IR#: 4
PROJECT NUMBER: 6040LN	APEC #: 4
SOURCE: Google Earth, Columbia Stage 1 2011	FIGURE #: 9
LAT/LONG: 50°11'17.44"N, 120°39'50.63"W	ZOHT LOT 11 DUMP SITE POST-REMEDIATION
DRAWN BY: XS DATE DRAWN: Dec-2020 REVISED BY: DATE REVISED:	





MW5-B 16-Jul-2018	CCME	CSR
Soil 0-0.8 m	pH >< Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~
Soil 3.0-3.7 m	pH > Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~

MW-U5-A 8-Nov-2018	FCSAP, CCME, Health Canada, CSR
Groundwater	Metals > (Mn 418, Zn 11) PHC < BTEX < PAH < Anions > (Cl^- 149, NO_2^- 0.46, SO_4^{2-} 213, F^- 0.22)

TP2 16-Jul-2018	CCME	CSR
Soil 0.3 m	pH >< Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~
Soil 2.3 m	pH >< Metals > (Cu 71.3) PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~

MW18-5-A 16-Jul-2018	CCME	CSR
Soil 0-0.9 m	pH >< Metals > (Cu 67.6) PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~
Soil 4.0-5.2 m	pH > Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~

MW18-5-A 8-Nov-2018	FCSAP, CCME, Health Canada, CSR
Groundwater	Metals > (Mn 262) PHC < BTEX < PAH < Anions > (Cl^- 150, SO_4^{2-} 170, F^- 0.16)

TP4 16-Jul-2018	CCME	CSR
0.3 m	pH >< Metals > (Cu 88.3) PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~
2.7 m	pH >< Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~

TP3 16-Jul-2018	CCME	CSR
0.3 m	pH >< Metals > (Cu 102, Ni 48.3) PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~
2.9 m	pH >< Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~

TP1 16-Jul-2018	CCME	CSR
0.3 m	pH >< Metals > (Cu 83.1) PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~
1.7 m	pH >< Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~

Analysis {in soil only} [in groundwater only]:

Metals: Al, Sb, As, Ba, Be, Bo, Cd, Cr, Co, Cu, Fe, Pb, Li, Mn, Hg, Mo, Ni, Se, Ag, Sr, Tl, Sn, W, U, V, Zn, (Bi, Zr), [Ca, K, Na, Ti]

PHC: F1 (nC6-nC12), F2 (>nC10-nC16), F3 (>nC16-nC34), F4 (>nC34-nC50), [F1 minus BTEX/VPHw]

BTEX: benzene, toluene, ethylbenzene, total xylenes

PAH: acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(j)fluoranthene, benzo(b+j)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, 1-methylnaphthalene, 2-methylnaphthalene, naphthalene, phenanthrene, pyrene, quinoline, [acridine]

VOC: {1,1,1,2-tetrachloroethane, 1,1,1-trichloroethane, 1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane, 1,1-dichloroethane, 1,1-dichloroethylene, 1,2,4-trimethylbenzene, 1,2-dibromoethane, 1,2-dichlorobenzene, 1,2-dichloroethane, 1,2-dichloropropane, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 2-butanone (MEK), 4-methyl-2-pentanone (MIBK), bromodichloromethane, bromoform, bromomethane, carbon tetrachloride, chlorobenzene, chloroethane, chloroform, chloromethane, cis-1,2-dichloroethylene, cis-1,3-dichloropropylene, dibromochloromethane, dichloromethane, tetrachloroethylene (PERC), trans-1,2-dichloroethylene, trans-1,3-dichloropropylene, trichloroethylene (TCE), trichlorofluoromethane, vinyl chloride}

Glycol: {propylene glycol, monoethylene glycol, diethylene glycol, triethylene glycol, tetraethylene glycol}

Nitrates: {nitrates, soluble}

Anions: [bromide, chloride, fluoride, nitrate as nitrogen, nitrite as nitrogen, sulphate]

~~Parameter~~ Not analysed

Test pit

Monitoring well

Borehole

Groundwater sample location

Locations approximate; not surveyed

Exceedance(s) of CCME guidelines other than pH

Exceedance(s) of CSR standards but not CCME guidelines

Soil pH outside of CCME guideline range

Groundwater parameter(s) exceed aesthetic objective only

No exceedance(s)

Groundwater Standards

Manganese (Mn)
Health Canada Aesthetic Objective: 50 µg/L

Zinc (Zn)
CCME CEQG AW (FW): 7 µg/L

Chloride (Cl^-)
FCSAP FIGWQG (FW): 120 mg/L
CCME CEQG AW (FW): 120 mg/L

Fluoride (F^-)
FCSAP FIGWQG (FW): 0.12 mg/L
CCME CEQG AW (FW): 0.12 mg/L

Nitrite as Nitrogen (NO_2^-)
FCSAP FIGWQG (FW): 0.06 mg/L
CCME CEQG AW (FW): 0.06 mg/L

Sulphate (SO_4^{2-})
FCSAP FIGWQG (FW): 100 mg/L

Soil Standards

Copper (Cu)
CCME guideline: 63 mg/kg
CSR background: 75 kg/kg

Nickel (Ni)
CCME guideline: 45 mg/kg
CSR background: 85 kg/kg

Land use: potential residential with livestock. Standards applied: CCME RL or RL/PL, CSR RL_{LD} and AL livestock; AW (FW), DW

PREPARED BY:
Gandalf Consulting Ltd.
PO Box 48806
Vancouver, BC

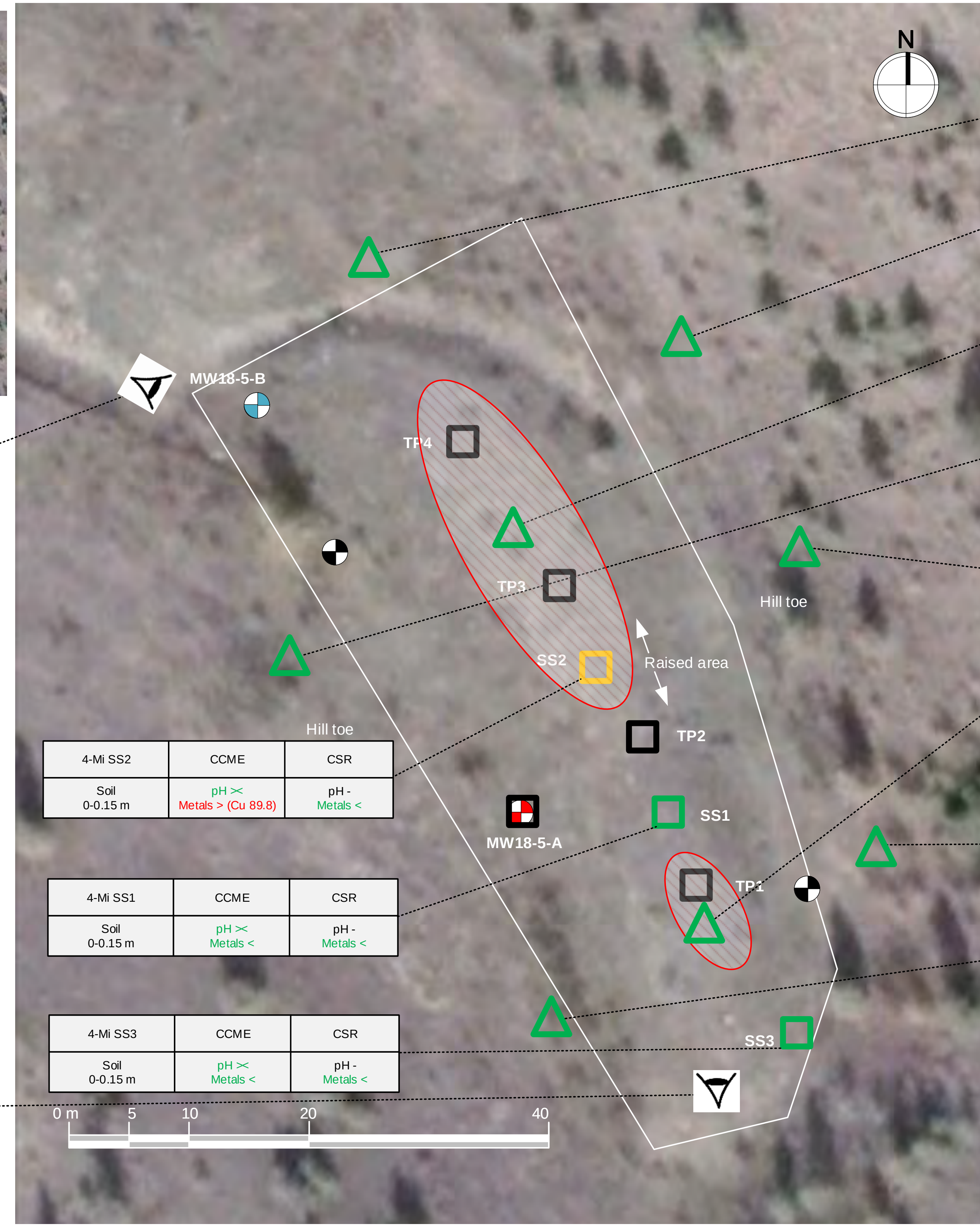
LOWER NICOLA INDIAN BAND
IR#: 1
APEC #: 5
FIGURE #: 10

PROJECT NUMBER: 6040LN
SOURCE: Google Earth, Columbia Stage 1 2011
LAT/LONG: 50°10'25.06"N, 120°50'55.43"W
DRAWN BY: GM DATE DRAWN: Aug-2018
REVISED BY: XS DATE REVISED: Dec-2020

MAMIT LAKE ROAD FOUR MILE DUMP PRE-REMEDIATION

Looking southeast from road post-remediation

Looking north from south end of mound post-remediation



4-Mi SS2	CCME	CSR
Soil 0-0.15 m	pH >< Metals > (Cu 89.8)	pH - Metals <

4-Mi SS1	CCME	CSR
Soil 0-0.15 m	pH >< Metals <	pH - Metals <

4-Mi SS3	CCME	CSR
Soil 0-0.15 m	pH >< Metals <	pH - Metals <

4M1 3-Dec-2020	CCME	CSR
Soil 0.3 m	Metals <	Metals <

4M1 3-Dec-2020	CCME	CSR
Soil 0.3 m	Metals <	Metals <

4M1 3-Dec-2020	CCME	CSR
Soil 0.3 m	Metals <	Metals <

4M1 3-Dec-2020	CCME	CSR
Soil 0.3 m	Metals <	Metals <

4M1 3-Dec-2020	CCME	CSR
Soil 0.3 m	Metals <	Metals <

4M1 3-Dec-2020	CCME	CSR
Soil 0.3 m	Metals <	Metals <

4M1 3-Dec-2020	CCME	CSR
Soil 0.3 m	Metals <	Metals <

4M1 3-Dec-2020	CCME	CSR
Soil 0.3 m	Metals <	Metals <

Soil Standards

Copper (Cu)
CCME guideline: 63 mg/kg
CSR background: 75 kg/kg

Nickel (Ni)
CCME guideline: 45 mg/kg
CSR background: 85 kg/kg

Land use: potential residential with livestock. Standards applied: CCME RL or RL/PL, CSR RL_{LD} and AL livestock; AW (FW), DW

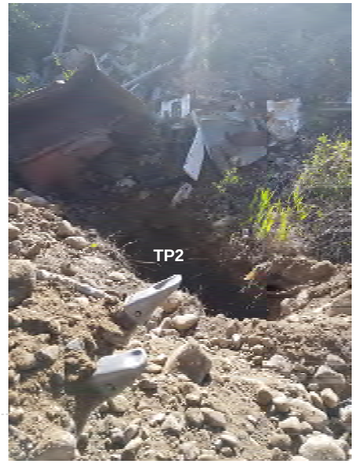
Shallow Soil Sample
Test pit
Monitoring well
Approximate Area for Removal of Shallow Soil Contamination

Locations approximate; not surveyed

Shallow soil contamination was present over two areas along mound.
Approximately the top 0.75 m removed and surface replacement with clean imported soil.

Objective was the removal of shallow soil contamination (metals > CCME and CSR regional background)

PREPARED BY: Gandalf Consulting Ltd. PO Box 48806 Vancouver, BC	LOWER NICOLA INDIAN BAND
	IR#: 1
PROJECT NUMBER: 6040LN	APEC #: 5
SOURCE: Google Earth, Columbia Stage 1 2011	FIGURE #: 11
LAT/LONG: 50°10'25.06"N, 120°50'55.43"W	MAMIT LAKE ROAD FOUR MILE DUMP POST-REMEDIATION
DRAWN BY: GM DATE DRAWN: Aug-2018	
REVISED BY: XS DATE REVISED: Dec-2020	



TP2 17-Jul-2018	CCME	CSR
Soil 0.3 m	pH >< Metals > PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~	pH - Metals > PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~
Soil 1.5 m	pH >< Metals > (Cu 1160, Pb 330, Zn 495) PHC < BTEX < PAH > (IACR 9.6, B(a)p TPE 0.79, phenanthrene 0.09) VOC < Glycol < ~~Nitrates~~	pH - Metals > (Cu, Pb, Zn) PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~

TP1 17-Jul-2018	CCME	CSR
Soil 0.3 m	pH >< Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~
Soil 2.3 m	pH >< Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~	pH - Metals > (V) PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~

TP4 17-Jul-2018	CCME	CSR
Soil 0.2 m	pH >< Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~	pH - Metals > (V) PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~
Soil 1.0 m	pH >< Metals > (Cu 141, Zn 311) PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~	pH - Metals > (Zn) PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~

MW18-6-A 7-Nov-2018	FCSAP, CCME, Health Canada, CSR
Groundwater	Metals > (Mn 206, Zn 17) PHC < BTEX < PAH > (fluoranthene 0.08, pyrene 0.08) Anions > (F^- 0.25)

TP3 17-Jul-2018	CCME	CSR
Soil 0.1 m	pH >< Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~
Soil 2.2 m	pH > Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~	pH - Metals > (V) PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~

Soil Standards:

Copper (Cu)
CCME guideline: 63 mg/kg
CSR background: 75 kg/kg

Lead (Pb)
CCME guideline: 140 mg/kg
CSR background: 15 kg/kg

Zinc (Zn)
CCME guideline: 250 mg/kg
CSR background: 100 kg/kg

Index of Additive Cancer Risk (IACR)
CCME guideline: 1.0

Benzo[a]pyrene Total Potency Equivalent (B(a)P TPE)
CCME guideline: 5.3 or 0.6

Phenanthrene
CCME guideline: 0.046 mg/kg

Groundwater Standards

Manganese (Mn)
Health Canada Aesthetic Objective: 50 µg/L

Zinc (Zn)
CCME CEQG AW (FW): 7 µg/L

Fluoride (F^-)
FCSAP FIGWQG (FW): 0.12 mg/L
CCME CEQG AW (FW): 0.12 mg/L

Fluoranthene
CSAP FIGWQG (FW): 0.04 µg/L
CCME CEQG AW (FW): 0.04 µg/L

Pyrene
CSAP FIGWQG (FW): 0.025 µg/L
CCME CEQG AW (FW): 0.025 µg/L

Analysis {in soil only} [in groundwater only]:

Metals: Al, Sb, As, Ba, Be, Bo, Cd, Cr, Co, Cu, Fe, Pb, Li, Mn, Hg, Mo, Ni, Se, Ag, Sr, Tl, Sn, W, U, V, Zn, (Bi, Zr), [Ca, K, Na, Ti]

PHC: F1 (nC6-nC12), F2 (>nC10-nC16), F3 (>nC16-nC34), F4 (>nC34-nC50), [F1 minus BTEX/VPHw]

BTEX: benzene, toluene, ethylbenzene, total xylenes

PAH: acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(j)fluoranthene, benzo(b+j)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, 1-methylnaphthalene, 2-methylnaphthalene, naphthalene, phenanthrene, pyrene, quinoline, [acridine]

VOC: {1,1,1,2-tetrachloroethane, 1,1,1-trichloroethane, 1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane, 1,1-dichloroethane, 1,1-dichloroethylene, 1,2,4-trimethylbenzene, 1,2-dibromoethane, 1,2-dichlorobenzene, 1,2-dichloroethane, 1,2-dichloropropane, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 2-butanone (MEK), 4-methyl-2-pentanone (MIBK), bromodichloromethane, bromoform, bromomethane, carbon tetrachloride, chlorobenzene, chloroethane, chloroform, chloromethane, cis-1,2-dichloroethylene, cis-1,3-dichloropropylene, dibromochloromethane, dichloromethane, tetrachloroethylene (PERC), trans-1,2-dichloroethylene, trans-1,3-dichloropropylene, trichloroethylene (TCE), trichlorofluoromethane, vinyl chloride}

Glycol: {propylene glycol, monoethylene glycol, diethylene glycol, triethylene glycol, tetraethylene glycol}

Nitrates: {nitrates, soluble}

Anions: [bromide, chloride, fluoride, nitrate as nitrogen, nitrite as nitrogen, sulphate]

~~Parameter~~ Not analysed

Test pit

Monitoring well

Borehole

Groundwater sample location

Locations approximate; not surveyed

Exceedance(s) of CCME guidelines other than pH

Exceedance(s) of CSR standards but not CCME guidelines

Soil pH outside of CCME guideline range

Groundwater parameter(s) exceed aesthetic objective only

No exceedance(s)

Land use: potential residential with livestock. Standards applied: CCME RL or RL/PL, CSR RL_{LD} and AL livestock; AW (FW), DW

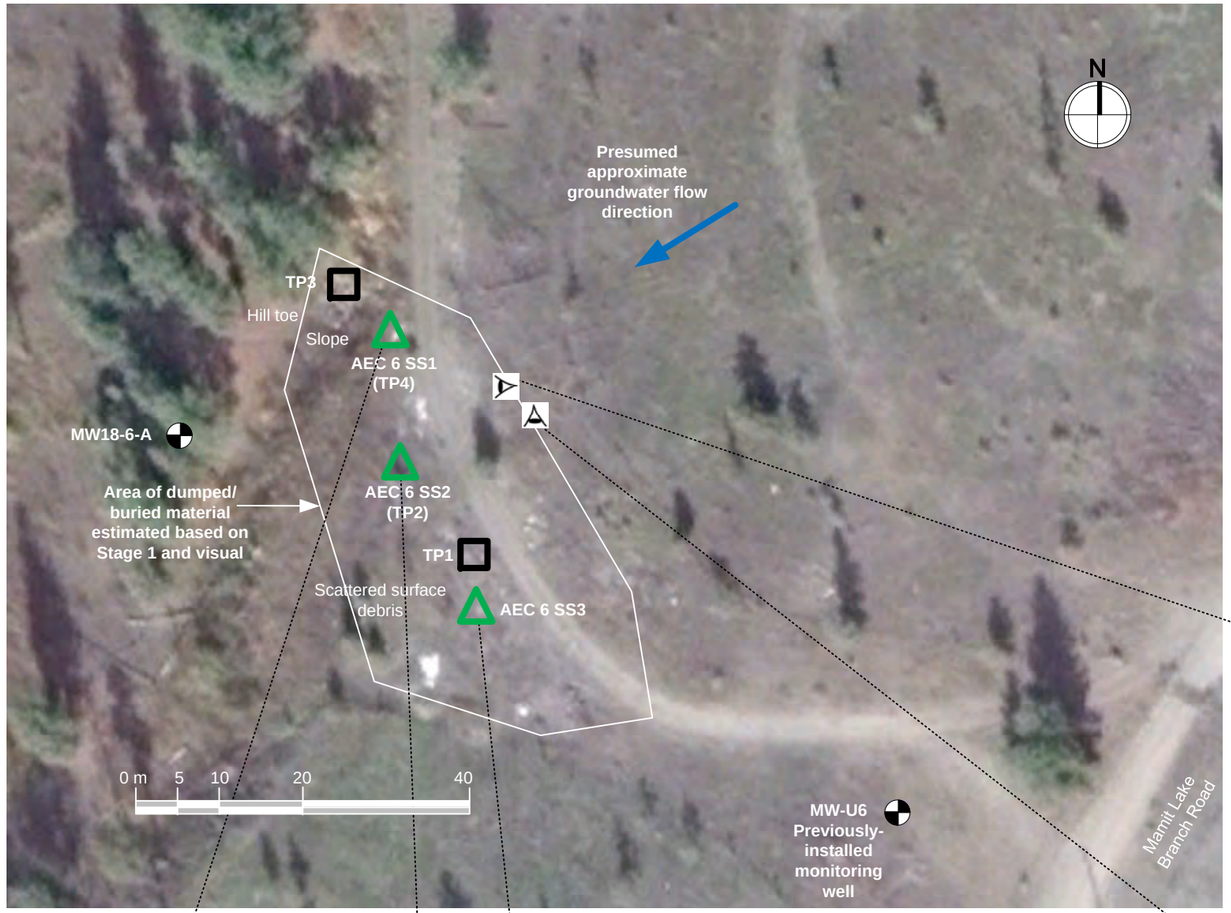
PREPARED BY:
Gandalf Consulting Ltd.
PO Box 48806
Vancouver, BC

LOWER NICOLA INDIAN BAND
IR#: 1

PROJECT NUMBER: 6040LN
APEC #: 6
SOURCE: Google Earth, Columbia Stage 1 2011
FIGURE #: 12
LAT/LONG: 50°9'20.94"N, 120°51'46.11"W

DRAWN BY: GM DATE DRAWN: Aug-2018
REVISED BY: XS DATE REVISED: Dec-2020

BURIED DUMP 1
MAMIT LAKE RANCH ROAD SOUTH PRE-REMEDIATION



Locations approximate; not surveyed

SS1 16-Oct-2020	CCME	CSR
Soil 0.15 m	Metals <	Metals < *

SS2 16-Oct-2020	CCME	CSR
Soil 0.15 m	Metals <	Metals < *

SS3 16-Oct-2020	CCME	CSR
Soil 0.15 m	Metals <	Metals <

Shallow Soil Sample

Test pit

Monitoring well

* Vanadium and Zinc are not considered to be of anthropogenic origin. Elevated concentrations are suspected regional background and not associated with the APECs.

Soil Standards:

Copper (Cu)
CCME guideline: 63 mg/kg
CSR background: 75 kg/kg

Lead (Pb)

CCME guideline: 140 mg/kg
CSR background: 15 kg/kg

Zinc (Zn)

CCME guideline: 250 mg/kg
CSR background: 100 kg/kg

Vanadium (V)

CCME guideline: 130 mg/kg
CSR background: 85 mg/kg

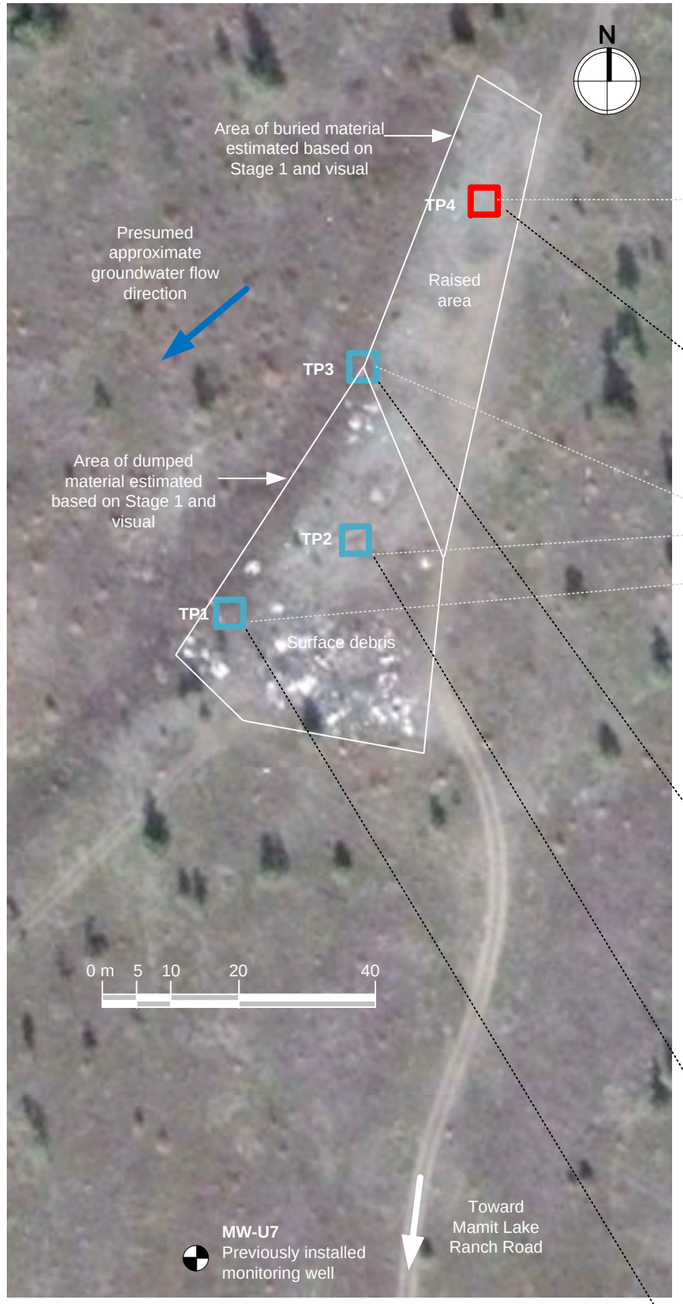
Aerial drone view of site after clean-up

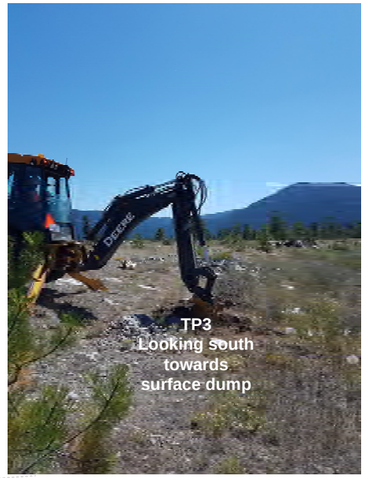
Looking south after remediation

Looking west after remediation

Land use: potential residential with livestock. Standards applied: CCME RL or RL/PL, CSR RL_{LD} and AL livestock; AW (FW), DW

PREPARED BY: Gandalf Consulting Ltd. PO Box 48806 Vancouver, BC	LOWER NICOLA INDIAN BAND
	IR#: 1
PROJECT NUMBER: 6040LN	APEC #: 6
SOURCE: Google Earth, Columbia Stage 1 2011	FIGURE #: 13
LAT/LONG: 50°9'20.94"N, 120°51'46.11"W	BURIED DUMP 1 MAMIT LAKE RANCH ROAD SOUTH POST-REMEDIATION
DRAWN BY: XS DATE DRAWN: Dec-2020	
REVISED BY: DATE REVISED:	





TP4 16-Jul-2018	CCME	CSR
0.7 m	pH > Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~
2.5 m	pH > Metals > (V 147) PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~	pH - Metals > (V) PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~

TP3 16-Jul-2018	CCME	CSR
0.5 m	pH > Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~
2.2 m	pH > Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~

TP2 16-Jul-2018	CCME	CSR
0.7 m	pH > Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~
2.5 m	pH > Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~

TP1 16-Jul-2018	CCME	CSR
0.7 m	pH > Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~	pH - Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~
2.0 m	pH > Metals < PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~	pH - Metals > (V) PHC < BTEX < PAH < VOC < Glycol < ~~Nitrates~~

View of Surface Waste

<u>Analysis</u>

Metals: Al, Sb, As, Ba, Be, Bi, Bo, Cd, Cr, Co, Cu, Fe, Pb, Li, Mn, Hg, Mo, Ni, Se, Ag, Sr, Tl, Sn, W, U, V, Zn, Zr

PHC: F1 (nC6-nC12), F2 (>nC10-nC16), F3 (>nC16-nC34), F4 (>nC34-nC50)

BTEX: benzene, toluene, ethylbenzene, total xylenes

PAH: acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(j)fluoranthene, benzo(b+j)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, 1-methylnaphthalene, 2-methylnaphthalene, naphthalene, phenanthrene, pyrene, quinoline

VOC: 1,1,1,2-tetrachloroethane, 1,1,1-trichloroethane, 1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane, 1,1-dichloroethane, 1,1-dichloroethylene, 1,2,4-trimethylbenzene, 1,2-dibromoethane, 1,2-dichlorobenzene, 1,2-dichloroethane, 1,2-dichloropropane, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 2-butanone (MEK), 4-methyl-2-pentanone (MIBK), bromodichloromethane, bromoform, bromomethane, carbon tetrachloride, chlorobenzene, chloroethane, chloroform, chloromethane, cis-1,2-dichloroethylene, cis-1,3-dichloropropylene, dibromochloromethane, dichloromethane, tetrachloroethylene (PERC), trans-1,2-dichloroethylene, trans-1,3-dichloropropylene, trichloroethylene (TCE), trichlorofluoromethane, vinyl chloride

Glycol: propylene glycol, monoethylene glycol, diethylene glycol, triethylene glycol, tetraethylene glycol

Nitrates: nitrates, soluble

~~Parameter~~ Not analysed

Test pit

Monitoring well

Borehole

Locations approximate; not surveyed

Exceedance(s) in soil of CCME guidelines other than pH

Exceedance(s) in soil of CSR standards but not CCME guidelines

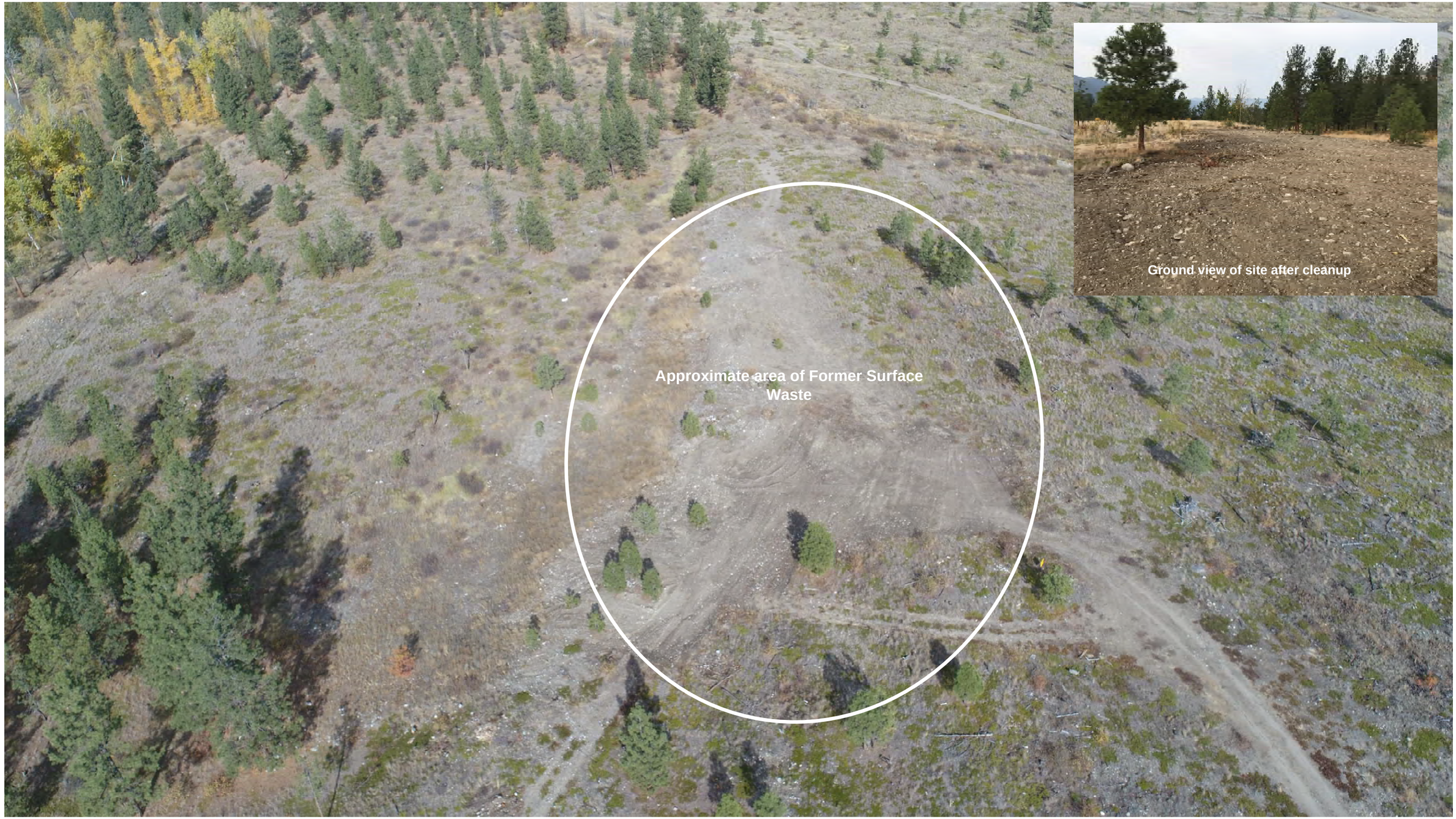
Soil pH outside of CCME guideline range

No exceedance(s) in soil

<u>Vanadium (V)</u>
CCME guideline: 130 mg/kg
CSR background: 85 mg/kg

Land use: potential residential with livestock. Standards applied: CCME RL or RL/PL, CSR RL_{LD} and AL livestock

PREPARED BY: Gandalf Consulting Ltd. PO Box 48806 Vancouver, BC	LOWER NICOLA INDIAN BAND
	IR#: 1
PROJECT NUMBER: 6040LN	APEC #: 7
SOURCE: Google Earth, Columbia Stage 1 2011	FIGURE #: 14
LAT/LONG: 50°9'43.82"N, 120°51'40.53"W	BURIED DUMP 2 MAMIT LAKE RANCH ROAD NORTH PRE-REMEDIATION
DRAWN BY: GM DATE DRAWN: Aug-2018 REVISED BY: XS DATE REVISED: Dec-2020	



Ground view of site after cleanup

Aerial drone view of site after cleanup

PREPARED BY: Gandalf Consulting Ltd. PO Box 48806 Vancouver, BC	LOWER NICOLA INDIAN BAND
	IR#: 1
PROJECT NUMBER: 6040LN	APEC #: 7
SOURCE: Google Earth, Columbia Stage 1 2011	FIGURE #: 15
LAT/LONG: 50°9'43.82"N, 120°51'40.53"W	BURIED DUMP 2 MAMIT LAKE RANCH ROAD NORTH POST-REMEDIATION
DRAWN BY: XS DATE DRAWN: Dec-2020 REVISED BY: DATE REVISED:	

APPENDIX II

TABLES

Table 1 Legacy Dump Waste Removal Summary

Lower Nicola Indian Band Reserves #1, 2, & 4

RESERVE LOCATION	SITE DESCRIPTION	LATITUDE	LONGITUDE	DATE STARTED	DATE FINISHED	AMOUNT RECYCLABLES (t)	AMOUNT WASTE (t)	NOTE
IR No. 1 Nicola Mamit	APEC 7: Buried Dump 2 Mamit Lake Ranch Road North	50.162172	-120.861259	21-Sep-20	24-Sep-20	2.44	118.38	Recyclables included metals (clean fill and appliances). Waste included household garbage, dirty electronics, soil (clean fill), concrete/asphalt
IR No. 1 Nicola Mamit	APEC 6: Buried Dump 1 Mamit Lake Ranch Road South	50.156003	-120.862767	24-Sep-20	25-Sep-20	2.19	98.87	Recyclables included metals (clean fill) and 16 tires with rims. Waste included household garbage, dirty electronics, soil (clean fill), concrete/asphalt
IR No. 1 Nicola Mamit	APEC 6: Buried Dump 1 Mamit Lake Ranch Road South	50.156003	-120.862767	28-Sep-20	28-Sep-20	0.77	39.9	Recyclables included metals (scrap and freezers). Waste included household garbage and 2 mattresses.
IR No. 1 Nicola Mamit	APEC 7: Buried Dump 2 Mamit Lake Ranch Road North	50.162172	-120.861259	28-Sep-20	28-Sep-20			
IR No. 2 Joeyaska	APEC 3: Lot 6 Residential Dump	50.174119	-120.666852	28-Sep-20	29-Sep-20	2.25	50.31	2 cars sent to Reliable Towing. Recyclables included metal (clean fill), 15 tires with rims, 29 tires without rims; Waste included household garbage
IR No. 2 Joeyaska	APEC 1: Lot 9 Residential Dump	50.097871	-120.750397	30-Sep-20	30-Sep-20		27.09	Recyclables included scrap metal (Tas Trucking Ltd, truck #107), 5 tires without rims. Waste included household garbage. Following waste removal 2 truck loads of rip rap were brought in to restore area.
IR No. 4 Zoht	APEC 4: Lot 11 Dump	50.188403	-120.663151	04-Oct-20	05-Oct-20	0.16	27.77	Recyclables inlcuded metals (clean fill). Waste included household garbage. Following waste removal the disturbed ground was restored with 5 bags of grass seed purchased.
IR No. 1 Nicola Mamit	APEC 5: Four Mile Dump	50.173616	-120.848711	23-Nov-20	25-Nov-20	0	0	Approximately 291.57 tonnes (208 m3) of contaminated soil removed. Limited surface waste removed. Site restored with clean fill.
					Total	**7.81**	**362.32**	

Table 2 Soil Metal Results -- Mamit Lake Road Four Mile Dump
Lower Nicola Indian Band Reserves #1 APEC 5

Reserve #														1					
APEC #														5					
APEC Name														Mamit Lake Road Four Mile Dump					
Applied Standards														CCME RL/PL & CSR RL_{LD} + livestock					
Sample Location														SS1	SS2	SS3	4M1	4M2	4M3
Client Sample ID														4-mi-SS1	4-mi-SS2	4-mi-SS3	4M1	4M2	4M3
Date Sampled														16-Sep-2020	16-Sep-2020	16-Sep-2020	3-Dec-20	3-Dec-20	3-Dec-20
Depth (m)														0.15	0.15	0.15	0.3	0.3	0.3
Lab sample ID														VA20B5391-001	VA20B5391-003	VA20B5391-005	VA20C2524-001	VA20C2524-002	VA20C2524-003
Parameter	CAS #	Detection Limit	CCME CEQG	CSR Sched. 3.1 Part 1 Matrix Numerical Standards (RL)				*CSR Sched. 3.1 Part 2 GHH (RL)*	*CSR Sched. 3.1 Part 3 GEH (RL)*	CSR Sched. 3.1 Part 1 Matrix Numerical Standards (AL)		CSR Protocol 4 Background	Units						
			RL/PL	**HH-Soil Intake**	**E-Toxicity**	**HH-DW**	**E-AW Fresh**			E-Livestock I	E-Livestock W								
Physical Tests																			
pH (1:2 soil:water)	-	0.05	6 to 8	NS	NS	NS	NS	NS	NS	NS	NS	NS	pH	7.39	8.37	7.23	6.7	9.02	7.16
Metals (Soil)																			
Aluminum (Al)	7429-90-5	10	NG	NS	NS	NS	NS	40000	NS	NS	NS	30000	mg/kg	19400	27200	17300	19100	30200	12400
Antimony (Sb)	7440-36-0	0.1	20	NS	NS	NS	NS	250	20	NS	NS	4	mg/kg	0.34	0.6	0.3	0.28	0.43	0.28
Arsenic (As)	7440-38-2	0.1	12	20	25	10	10	NS	NS	25	10	15	mg/kg	3.8	6.58	2.54	2.7	2.36	4.24
Barium (Ba)	7440-39-3	0.5	500	8500	700	350	3500	NS	NS	400	NS	200	mg/kg	134	213	173	176	239	56.8
Beryllium (Be)	7440-41-7	0.1	4	85	150	1*	1*	NS	NS	NS	8.5*	0.5	mg/kg	0.47	0.6	0.44	0.48	0.75	0.3
Bismuth (Bi)	7440-69-9	0.5	NG	NS	NS	NS	NS	NS	NS	NS	NS	NS	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Boron (Bo)	7440-42-8	0.5	NG	NS	NS	NS	NS	8500	NS	NS	NS	1	mg/kg	<5.0	5.2	7	5.9	7.9	<5.0
Cadmium (Cd)	7440-43-9	0.01	10	20	30	1*	1*	NS	NS	10	4.5*	0.4	mg/kg	0.17	0.211	0.244	0.218	0.281	0.082
Chromium (Cr)	7440-47-3	1	64	100	200	60	60	NS	NS	150	60	70	mg/kg	29.4	43.9	25	29.9	43.6	22.6
Cobalt (Co)	7440-48-4	0.1	50	25	45	25	25	NS	NS	250	150	20	mg/kg	11.5	19.2	12.0	12.8	18.1	11.2
Copper (Cu)	7440-50-8	0.2	63	3500	150*	250*	75*	NS	NS	150	75*	75	mg/kg	47.3	**89.8**	41.5	47	78.5	27.2
Iron (Fe)	7439-89-6	10	NG	NS	NS	NS	NS	35000	NS	NS	NS	30000	mg/kg	29000	38700	24800	27400	*36200*	29000
Lead (Pb)	7439-92-1	0.1	140	120	550	120*	200*	NS	NS	350	150*	15	mg/kg	4.43	5.64	7.36	4.92	8.52	2.65
Lithium (Li)	7439-93-2	0.5	NG	NS	NS	NS	NS	30	NS	NS	NS	NS	mg/kg	8	14.0	6	6.3	10.1	7.2
Manganese (Mn)	7439-96-5	1	NG	6000	2000	2000	NS	NS	NS	NS	NS	1000	mg/kg	5730	13900	4520	740	905	511
Mercury (Hg)	7439-97-6	0.01	6.6	10	40	NS	NS	NS	NS	0.6	NS	0.075	mg/kg	<0.05	0.066	<0.05	<0.0500	<0.0500	<0.0500
Molybdenum (Mo)	7439-98-7	0.2	10	200	80	15	650	NS	NS	NS	3.5	2	mg/kg	0.74	1.24	1.09	1.01	1.11	0.61
Nickel (Ni)	7440-02-0	0.5	45	450	150	70*	90*	NS	NS	250	70*	85	mg/kg	21.2	42.4	20.8	22.5	37.7	20.2
Selenium (Se)	7782-49-2	0.1	1	200	1.5	1	1	NS	NS	2	1	4	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Silver (Ag)	7440-22-4	0.5	20	NS	NS	NS	NS	200	20	NS	NS	1	mg/kg	<0.10	0.14	<0.10	<0.10	0.16	<0.10
Strontium (Sr)	7440-24-6	1	NG	NS	NS	NS	NS	9500	NS	NS	NS	250	mg/kg	55.3	114	54.8	57.9	70.2	57.1
Thallium (Tl)	7440-28-0	0.1	1	NS	NS	NS	NS	NS	9	NS	NS	NS	mg/kg	0.087	0.108	0.088	0.098	0.156	<0.050
Tin (Sn)	7440-31-5	0.2	50	NS	NS	NS	NS	25000	50	NS	NS	4	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Tungsten (W)	7440-33-7	0.05	NG	NS	NS	NS	NS	15	NS	NS	NS	NS	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Uranium (U)	7440-61-1	0.2	23	100	500	30	150	NS	NS	35	300	NS	mg/kg	0.678	0.892	0.511	0.6	0.988	0.354
Vanadium (V)	7440-62-2	1	130	200	150	100	NS	NS	NS	NS	350	85	mg/kg	84.8	103	68	71.4	71.1	72.5
Zinc (Zn)	7440-66-6	1	250	10000	450	200*	150*	NS	NS	200	150*	100	mg/kg	56.9	75.8	74	76.8	101	48.9
Zirconium (Zr)	7440-67-7	0.1	NG	NS	NS	NS	NS	NS	NS	NS	NS	NS	mg/kg	9.3	11.7	8.4	8	21.3	6.8

CCME = Canadian Council of Ministers of the Environment
CEQG = Canadian Environmental Quality Guidelines
CSR = BC Contaminated Sites Regulation
AL = Agricultural Land Use
RL = Residential Land Use
RL_{LD} = Residential Land Use (Low Density)
PL = Park Land Use
NG = No Guideline
* pH-Dependent Standard (Lowest Shown)

HH = Site-specific factor for the protection of human health
E = Site-specific factor for the protection of the environment
HH-Soil Intake = Intake of contaminated soil
HH-DW = Groundwater used for drinking water
E-Toxicity = Toxicity to soil invertebrates and plants
E-AW Fresh = Groundwater flow to water used by aquatic life
E-Livestock I = Livestock ingesting soil and fodder
E-Livestock W = Groundwater used for livestockwatering
NS = No Standard

Protocol 4: CSR Protocol 4 Table 1 value: Regional estimates for background concentrations in soil for inorganic substances, Thompson/Nicola/Okanagan

100	Exceeds CCME CEQG
100	Exceeds CSR RL_{LD} Matrix Standard(s)
100	Exceeds CSR RL_{LD} Generic Standard(s)
100	Exceeds CSR AL Livestock Standard(s)

Table 2 Soil Metal Results -- Mamit Lake Road Four Mile Dump
Lower Nicola Indian Band Reserves #1 APEC 5

Reserve #														1					
APEC #														5					
APEC Name														Mamit Lake Road Four Mile Dump					
Applied Standards														CCME RL/PL & CSR RL_{LD} + livestock					
Sample Location														4M4	4M5	4M6	4M7	4M7	4M8
Client Sample ID														4M4	4M5	4M6	4M7	4MX	4M8
Date Sampled														3-Dec-20	3-Dec-20	3-Dec-20	3-Dec-20	3-Dec-20	3-Dec-20
Depth (m)														0.3	0.3	0.3	0.3	0.3	0.3
Lab sample ID														VA20C2524-004	VA20C2524-005	VA20C2524-006	VA20C2524-007	VA20C2524-009	VA20C2524-008
Parameter	CAS #	Detection Limit	CCME CEQG	CSR Sched. 3.1 Part 1 Matrix Numerical Standards (RL)				*CSR Sched. 3.1 Part 2 GHH (RL)*	*CSR Sched. 3.1 Part 3 GEH (RL)*	CSR Sched. 3.1 Part 1 Matrix Numerical Standards (AL)		CSR Protocol 4 Background	Units						
			RL/PL	**HH-Soil Intake**	**E-Toxicity**	**HH-DW**	**E-AW Fresh**			E-Livestock I	E-Livestock W								
Physical Tests																			
pH (1:2 soil:water)	-	0.05	6 to 8	NS	NS	NS	NS	NS	NS	NS	NS	NS	pH	7.35	7.05	7.36	8.99	8.97	7.14
Metals (Soil)																			
Aluminum (Al)	7429-90-5	10	NG	NS	NS	NS	NS	40000	NS	NS	NS	30000	mg/kg	15200	15000	21000	13400	13100	25200
Antimony (Sb)	7440-36-0	0.1	20	NS	NS	NS	NS	250	20	NS	NS	4	mg/kg	0.32	0.32	0.38	0.28	0.29	0.43
Arsenic (As)	7440-38-2	0.1	12	20	25	10	10	NS	NS	25	10	15	mg/kg	4.28	3.14	3.49	4.87	4.12	3.19
Barium (Ba)	7440-39-3	0.5	500	8500	700	350	3500	NS	NS	400	NS	200	mg/kg	98.9	150	179	52.6	64.7	221
Beryllium (Be)	7440-41-7	0.1	4	85	150	1*	1*	NS	NS	NS	8.5*	0.5	mg/kg	0.49	0.46	0.54	0.33	0.33	0.63
Bismuth (Bi)	7440-69-9	0.5	NG	NS	NS	NS	NS	NS	NS	NS	NS	NS	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Boron (Bo)	7440-42-8	0.5	NG	NS	NS	NS	NS	8500	NS	NS	NS	1	mg/kg	<5.0	<5.0	5.9	<5.0	<5.0	6.3
Cadmium (Cd)	7440-43-9	0.01	10	20	30	1*	1*	NS	NS	10	4.5*	0.4	mg/kg	0.092	0.15	0.192	0.10	0.087	0.454
Chromium (Cr)	7440-47-3	1	64	100	200	60	60	NS	NS	150	60	70	mg/kg	25.8	25.3	33.7	22.1	21.7	42.6
Cobalt (Co)	7440-48-4	0.1	50	25	45	25	25	NS	NS	250	150	20	mg/kg	8.79	10.8	14.3	10.9	10.8	21
Copper (Cu)	7440-50-8	0.2	63	3500	150*	250*	75*	NS	NS	150	75*	75	mg/kg	54.4	52.1	57.3	28.8	27.6	81.1
Iron (Fe)	7439-89-6	10	NG	NS	NS	NS	NS	35000	NS	NS	NS	30000	mg/kg	30100	26900	32600	29400	27500	32400
Lead (Pb)	7439-92-1	0.1	140	120	550	120*	200*	NS	NS	350	150*	15	mg/kg	3.9	4.46	4.86	2.51	2.65	6.81
Lithium (Li)	7439-93-2	0.5	NG	NS	NS	NS	NS	30	NS	NS	NS	NS	mg/kg	6.7	5.7	8	7.5	7.5	9.7
Manganese (Mn)	7439-96-5	1	NG	6000	2000	2000	NS	NS	NS	NS	NS	1000	mg/kg	381	597	865	627	500	1040
Mercury (Hg)	7439-97-6	0.01	6.6	10	40	NS	NS	NS	NS	0.6	NS	0.075	mg/kg	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500
Molybdenum (Mo)	7439-98-7	0.2	10	200	80	15	650	NS	NS	NS	3.5	2	mg/kg	0.44	0.71	0.72	0.51	0.47	0.52
Nickel (Ni)	7440-02-0	0.5	45	450	150	70*	90*	NS	NS	250	70*	85	mg/kg	15.9	18.1	26.7	17.9	19.2	38.9
Selenium (Se)	7782-49-2	0.1	1	200	1.5	1	1	NS	NS	2	1	4	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Silver (Ag)	7440-22-4	0.5	20	NS	NS	NS	NS	200	20	NS	NS	1	mg/kg	0.12	<0.10	<0.10	<0.10	<0.10	0.16
Strontium (Sr)	7440-24-6	1	NG	NS	NS	NS	NS	9500	NS	NS	NS	250	mg/kg	41.5	71.6	60.3	62.1	64.4	80.5
Thallium (Tl)	7440-28-0	0.1	1	NS	NS	NS	NS	NS	9	NS	NS	NS	mg/kg	0.077	0.081	0.103	<0.050	<0.050	0.132
Tin (Sn)	7440-31-5	0.2	50	NS	NS	NS	NS	25000	50	NS	NS	4	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Tungsten (W)	7440-33-7	0.05	NG	NS	NS	NS	NS	15	NS	NS	NS	NS	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Uranium (U)	7440-61-1	0.2	23	100	500	30	150	NS	NS	35	300	NS	mg/kg	0.51	0.62	0.669	0.4	0.392	0.909
Vanadium (V)	7440-62-2	1	130	200	150	100	NS	NS	NS	NS	350	85	mg/kg	80.8	76.7	90.2	78.4	75.7	83.1
Zinc (Zn)	7440-66-6	1	250	10000	450	200*	150*	NS	NS	200	150*	100	mg/kg	46.1	53.6	65.5	45.9	45.1	82.8
Zirconium (Zr)	7440-67-7	0.1	NG	NS	NS	NS	NS	NS	NS	NS	NS	NS	mg/kg	8	7.6	9	6.4	7.2	16.2

CCME = Canadian Council of Ministers of the Environment
CEQG = Canadian Environmental Quality Guidelines
CSR = BC Contaminated Sites Regulation
AL = Agricultural Land Use
RL = Residential Land Use
RL_{LD} = Residential Land Use (Low Density)
PL = Park Land Use
NG = No Guideline
* pH-Dependent Standard (Lowest Shown)

HH = Site-specific factor for the protection of human health
E = Site-specific factor for the protection of the environment
HH-Soil Intake = Intake of contaminated soil
HH-DW = Groundwater used for drinking water
E-Toxicity = Toxicity to soil invertebrates and plants
E-AW Fresh = Groundwater flow to water used by aquatic life
E-Livestock I = Livestock ingesting soil and fodder
E-Livestock W = Groundwater used for livestockwatering
NS = No Standard

Protocol 4: CSR Protocol 4 Table 1 value: Regional estimates for background concentrations in soil for inorganic substances, Thompson/Nicola/Okanagan

100	Exceeds CCME CEQG
100	Exceeds CSR RL_{LD} Matrix Standard(s)
100	Exceeds CSR RL_{LD} Generic Standard(s)
100	Exceeds CSR AL Livestock Standard(s)

Table 3 Soil Metal Results -- Buried Dump 1 Mamit Lake Ranch Road South
Lower Nicola Indian Band Reserves #1 APEC 6

Reserve #														1		
APEC #														6		
APEC Name														Buried Dump 1 Mamit Lake Ranch Road South		
Applied Standards														CCME RL/PL & CSR RL_{LD} + livestock		
Sample Location														Test Pit 4	Test Pit 2	South of Test Pit 1
Client Sample ID														AEC 6 SS1	AEC 6 SS2	AEC 6 SS3
Date Sampled														16-Oct-20	16-Oct-20	16-Oct-20
Depth (m)														0.15	0.15	0.15
Lab Sample ID														VA20B8430-001	VA20B8430-002	VA20B8430-003
Parameter	CAS #	Detection Limit	CCME CEQG	CSR Sched. 3.1 Part 1 Matrix Numerical Standards (RL)				*CSR Sched. 3.1 Part 2 GHH (RL)*	*CSR Sched. 3.1 Part 3 GEH (RL)*	CSR Sched. 3.1 Part 1 Matrix Numerical Standards (AL)		CSR Protocol 4 Background	Units			
			RL/PL	**HH-Soil Intake**	**E-Toxicity**	**HH-DW**	**E-AW Fresh**			E-Livestock I	E-Livestock W					
Physical Tests																
pH (1:2 soil:water)	-	0.05	6 to 8	NS	NS	NS	NS	NS	NS	NS	NS	NS	pH	7.16	7.20	7.75
Metals (Soil)																
Aluminum (Al)	7429-90-5	10	NG	NS	NS	NS	NS	40000	NS	NS	NS	30000	mg/kg	9850	11300	12300
Antimony (Sb)	7440-36-0	0.1	20	NS	NS	NS	NS	250	20	NS	NS	4	mg/kg	0.51	0.58	5.81
Arsenic (As)	7440-38-2	0.1	12	20	25	10	10	NS	NS	25	10	15	mg/kg	3.51	3.95	12.3
Barium (Ba)	7440-39-3	0.5	500	8500	700	350	3500	NS	NS	400	NS	200	mg/kg	64.4	99.6	95.7
Beryllium (Be)	7440-41-7	0.1	4	85	150	1*	1*	NS	NS	NS	8.5*	0.5	mg/kg	0.27	0.37	0.3
Bismuth (Bi)	7440-69-9	0.5	NG	NS	NS	NS	NS	NS	NS	NS	NS	NS	mg/kg	<0.20	<0.20	<0.20
Boron (Bo)	7440-42-8	0.5	NG	NS	NS	NS	NS	8500	NS	NS	NS	1	mg/kg	<5.0	6.1	12.8
Cadmium (Cd)	7440-43-9	0.01	10	20	30	1*	1*	NS	NS	10	4.5*	0.4	mg/kg	0.157	0.224	0.522
Chromium (Cr)	7440-47-3	1	64	100	200	60	60	NS	NS	150	60	70	mg/kg	22.9	30.4	25.4
Cobalt (Co)	7440-48-4	0.1	50	25	45	25	25	NS	NS	250	150	20	mg/kg	8.52	9.85	9.35
Copper (Cu)	7440-50-8	0.2	63	3500	150*	250*	75*	NS	NS	150	75*	75	mg/kg	60.6	48.7	66.6
Iron (Fe)	7439-89-6	10	NG	NS	NS	NS	NS	35000	NS	NS	NS	30000	mg/kg	30600	34400	26600
Lead (Pb)	7439-92-1	0.1	140	120	550	120*	200*	NS	NS	350	150*	15	mg/kg	26.7	8.26	26.6
Lithium (Li)	7439-93-2	0.5	NG	NS	NS	NS	NS	30	NS	NS	NS	NS	mg/kg	5.6	5.9	6.3
Manganese (Mn)	7439-96-5	1	NG	6000	2000	2000	NS	NS	NS	NS	NS	1000	mg/kg	377	530	530
Mercury (Hg)	7439-97-6	0.01	6.6	10	40	NS	NS	NS	NS	0.6	NS	0.075	mg/kg	<0.0500	<0.0500	<0.0500
Molybdenum (Mo)	7439-98-7	0.2	10	200	80	15	650	NS	NS	NS	3.5	2	mg/kg	0.6	0.71	1.6
Nickel (Ni)	7440-02-0	0.5	45	450	150	70*	90*	NS	NS	250	70*	85	mg/kg	14.8	15.8	15.9
Selenium (Se)	7782-49-2	0.1	1	200	1.5	1	1	NS	NS	2	1	4	mg/kg	<0.20	<0.20	<0.20
Silver (Ag)	7440-22-4	0.5	20	NS	NS	NS	NS	200	20	NS	NS	1	mg/kg	<0.10	<0.10	0.12
Strontium (Sr)	7440-24-6	1	NG	NS	NS	NS	NS	9500	NS	NS	NS	250	mg/kg	36.3	48.4	59.8
Thallium (Tl)	7440-28-0	0.1	1	NS	NS	NS	NS	NS	9	NS	NS	NS	mg/kg	<0.05	<0.050	0.051
Tin (Sn)	7440-31-5	0.2	50	NS	NS	NS	NS	25000	50	NS	NS	4	mg/kg	<2.0	<2.0	3.8
Tungsten (W)	7440-33-7	0.05	NG	NS	NS	NS	NS	15	NS	NS	NS	NS	mg/kg	<0.50	<0.50	<0.50
Uranium (U)	7440-61-1	0.2	23	100	500	30	150	NS	NS	35	300	NS	mg/kg	0.63	0.667	0.472
Vanadium (V)	7440-62-2	1	130	200	150	100	NS	NS	NS	NS	350	85	mg/kg	**107**	**117**	76.1
Zinc (Zn)	7440-66-6	1	250	10000	450	200*	150*	NS	NS	200	150*	100	mg/kg	59.2	77.2	232
Zirconium (Zr)	7440-67-7	0.1	NG	NS	NS	NS	NS	NS	NS	NS	NS	NS	mg/kg	3.7	4.8	4.0

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100	Exceeds CCME CEQG
100	Exceeds CSR RL_{LD} Matrix Standard(s)
100	Exceeds CSR RL_{LD} Generic Standard(s)
100	Exceeds CSR AL Livestock Standard(s)

Protocol 4: CSR Protocol 4 Table 1 value: Regional estimates for background concentrations in soil for inorganic substances, Thompson/Nicola/Okanagan

Table 4 **Relative Percent Differences**

Lower Nicola Indian Band

December 3, 2020 Soil Samples

Sample Location	**4M7**	**4M7**	
Sample ID	4M7	4MX	
Date Sampled	2020-12-03	2020-12-03	
Depth (m)	0.3	0.3	
ALS Sample ID	VA20C2524-007	VA20C2524-009	
Analyte	**Soil**	**Soil**	**%RPD**
Aluminum (Al)	13400	13100	2%
Antimony (Sb)	0.28	0.29	4%
Arsenic (As)	4.87	4.12	17%
Barium (Ba)	52.6	64.7	21%
Beryllium (Be)	0.33	0.33	0%
Bismuth (Bi)	<0.20	<0.20	na
Boron (Bo)	<5.0	<5.0	na
Cadmium (Cd)	0.101	0.087	15%
Chromium (Cr)	22.1	21.7	2%
Cobalt (Co)	10.9	10.8	1%
Copper (Cu)	28.80	27.60	4%
Iron (Fe)	29400	27500	7%
Lead (Pb)	2.51	2.65	5%
Lithium (Li)	7.50	7.50	0%
Manganese (Mn)	627.00	500.00	23%
Mercury (Hg)	<0.0500	<0.0500	na
Molybdenum (Mo)	0.51	0.47	8%
Nickel (Ni)	17.9	19.2	7%
Selenium (Se)	<0.20	<0.20	na
Silver (Ag)	<0.10	<0.10	na
Strontium (Sr)	62.1	64.4	4%
Thallium (Tl)	<0.050	<0.050	na
Tin (Sn)	<2.0	<2.0	na
Tungsten (W)	<0.50	<0.50	na
Uranium (U)	0.384	0.392	2%
Vanadium (V)	78.4	75.7	4%
Zinc (Zn)	45.9	45.1	2%
Zirconium (Zr)	6.4	7.2	12%

APPENDIX III

DISPOSAL RECORDS

December 11, 2020
11:36:01AM

TNRD Custom

)20-11-01 12:00:00AM through 2020-11-30 11:59:59PM

Site	Date	Ticket #	Product	License No.	Price	Vol.	Total Cost	PriceBy	Cust	Hauler	Truck	I/O	Time Out
LN	11/18/20	160600 -1	31	CG 1231	$0.00	0.00	$0.00	t	SHULUS01	SHULUS01	999	In	09:37AM
LN	11/18/20	160609 -1	31	CG 1231	$0.00	0.00	$0.00	t	SHULUS01	SHULUS01	999	In	10:39AM
LN	11/18/20	160613 -1	31	CG 1231	$0.00	0.00	$0.00	t	SHULUS01	SHULUS01	999	In	11:34AM
LN	11/18/20	160616 -1	31	CG 1231	$0.00	0.00	$0.00	t	SHULUS01	SHULUS01	999	In	12:37PM
LN	11/18/20	160624 -1	31	CG 1231	$0.00	0.00	$0.00	t	SHULUS01	SHULUS01	999	In	01:42PM
LN	11/18/20	160631 -1	31	CG 1231	$0.00	0.00	$0.00	t	SHULUS01	SHULUS01	999	In	02:48PM
LN	11/18/20	160640 -1	31	CG 1231	$0.00	0.00	$0.00	t	SHULUS01	SHULUS01	999	In	03:39PM
LN	11/19/20	160645 -1	31	CG 1231	$0.00	0.00	$0.00	t	SHULUS01	SHULUS01	999	In	08:27AM
LN	11/19/20	160651 -1	31	CG 1231	$0.00	0.00	$0.00	t	SHULUS01	SHULUS01	999	In	09:22AM
LN	11/19/20	160659 -1	31	CG 1231	$0.00	0.00	$0.00	t	SHULUS01	SHULUS01	999	In	10:14AM
LN	11/19/20	160666 -1	31	CG 1231	$0.00	0.00	$0.00	t	SHULUS01	SHULUS01	999	In	11:06AM
LN	11/19/20	160674 -1	31	CG 1231	$0.00	0.00	$0.00	t	SHULUS01	SHULUS01	999	In	12:02PM
LN	11/19/20	160685 -1	31	CG 1231	$0.00	0.00	$0.00	t	SHULUS01	SHULUS01	999	In	12:57PM
LN	11/19/20	160695 -1	31	CG 1231	$0.00	0.00	$0.00	t	SHULUS01	SHULUS01	999	In	01:49PM
LN	11/19/20	160700 -1	31	CG 1231	$0.00	0.00	$0.00	t	SHULUS01	SHULUS01	999	In	02:38PM
LN	11/19/20	160712 -1	31	CG 1231	$0.00	0.00	$0.00	t	SHULUS01	SHULUS01	999	In	03:36PM
LN	11/20/20	160718 -1	31	CG 1231	$0.00	0.00	$0.00	t	SHULUS01	SHULUS01	999	In	08:06AM
LN	11/20/20	160720 -1	31	CG 1231	$0.00	0.00	$0.00	t	SHULUS01	SHULUS01	999	In	08:56AM
LN	11/20/20	160730 -1	31	CG 1231	$0.00	0.00	$0.00	t	SHULUS01	SHULUS01	999	In	09:45AM
LN	11/20/20	160739 -1	31	CG 1231	$0.00	0.00	$0.00	t	SHULUS01	SHULUS01	999	In	10:44AM
LN	11/20/20	160747 -1	31	CG 1231	$0.00	0.00	$0.00	t	SHULUS01	SHULUS01	999	In	11:22AM
LN	11/20/20	160756 -1	31	CG 1231	$0.00	0.00	$0.00	t	SHULUS01	SHULUS01	999	In	12:04PM
LN	11/20/20	160761 -1	31	CG 1231	$0.00	0.00	$0.00	t	SHULUS01	SHULUS01	999	In	12:41PM
LN	11/20/20	160771 -1	31	CG 1231	$0.00	0.00	$0.00	t	SHULUS01	SHULUS01	999	In	01:35PM
LN	11/20/20	160778 -1	31	CG 1231	$0.00	0.00	$0.00	t	SHULUS01	SHULUS01	999	In	02:24PM
LN	11/20/20	160791 -1	31	CG 1231	$0.00	0.00	$0.00	t	SHULUS01	SHULUS01	999	In	03:12PM
LN	11/29/20	161505 -1	01		$80.00	0.00	$34.40	t	SHULUS01	SHULUS01	NN 2394	In	03:39PM
Total:		**27**	**596.90**	**305.33**	**291.57**		**0.00**						**$34.40**

Start Date: 2020-11-01 - - - End Date: 2020-11-30 11:59:59 PM

Voided Tickets Excluded
Hauler Code = SHULUS01

APPENDIX IV

LABORATORY CERTIFICATES

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA20B5391**	Page	: 1 of 4
Client	: **Gandalf Consulting Ltd.**	Laboratory	: Vancouver - Environmental
Contact	: Paul Gardner	Account Manager	: Edward Ngai
Address	: 500 - 1190 Melville St. P.O. Box 48806 Vancouver BC Canada V6E 3W1	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: 604 633 2750	Telephone	: +1 604 253 4188
Project	: 6040 LN	Date Samples Received	: 16-Sep-2020 16:30
PO	: ----	Date Analysis Commenced	: 19-Sep-2020
C-O-C number	: 17-760473	Issue Date	: 22-Sep-2020 15:35
Sampler	: ----		
Site	: ----		
Quote number	: ----		
No. of samples received	: 6		
No. of samples analysed	: 3		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Brieanna Allen	Department Manager - Organics	Organics, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia
Shaneel Dayal	Analyst	Metals, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
mg/kg	milligrams per kilogram
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in reports identified as "Preliminary Report" are considered authorized for use.

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	4-mi-SS1	4-mi-SS2	4-mi-SS3	----	----
					Client sampling date / time	16-Sep-2020	16-Sep-2020	16-Sep-2020	----	----
						VA20B5391-001	VA20B5391-003	VA20B5391-005	--------	--------
						Result	Result	Result	----	----
Physical Tests										
pH (1:2 soil:water)	----	E108	0.10	pH units		7.39	8.37	7.23	----	----
Metals										
aluminum	7429-90-5	E440	50	mg/kg		19400	27200	17300	----	----
antimony	7440-36-0	E440	0.10	mg/kg		0.34	0.60	0.30	----	----
arsenic	7440-38-2	E440	0.10	mg/kg		3.80	6.58	2.54	----	----
barium	7440-39-3	E440	0.50	mg/kg		134	213	173	----	----
beryllium	7440-41-7	E440	0.10	mg/kg		0.47	0.60	0.44	----	----
bismuth	7440-69-9	E440	0.20	mg/kg		<0.20	<0.20	<0.20	----	----
boron	7440-42-8	E440	5.0	mg/kg		<5.0	5.2	7.0	----	----
cadmium	7440-43-9	E440	0.020	mg/kg		0.170	0.211	0.244	----	----
calcium	7440-70-2	E440	50	mg/kg		6360	18600	7290	----	----
chromium	7440-47-3	E440	0.50	mg/kg		29.4	43.9	25.0	----	----
cobalt	7440-48-4	E440	0.10	mg/kg		11.5	19.2	12.0	----	----
copper	7440-50-8	E440	0.50	mg/kg		47.3	89.8	41.5	----	----
iron	7439-89-6	E440	50	mg/kg		29000	38700	24800	----	----
lead	7439-92-1	E440	0.50	mg/kg		4.43	5.64	7.36	----	----
lithium	7439-93-2	E440	2.0	mg/kg		8.0	14.0	6.0	----	----
magnesium	7439-95-4	E440	20	mg/kg		5730	13900	4520	----	----
manganese	7439-96-5	E440	1.0	mg/kg		656	834	864	----	----
mercury	7439-97-6	E510	0.0500	mg/kg		<0.0500	0.0660	<0.0500	----	----
molybdenum	7439-98-7	E440	0.10	mg/kg		0.74	1.24	1.09	----	----
nickel	7440-02-0	E440	0.50	mg/kg		21.2	42.4	20.8	----	----
phosphorus	7723-14-0	E440	50	mg/kg		456	839	456	----	----
potassium	7440-09-7	E440	100	mg/kg		2780	2080	4030	----	----
selenium	7782-49-2	E440	0.20	mg/kg		<0.20	<0.20	<0.20	----	----
silver	7440-22-4	E440	0.10	mg/kg		<0.10	0.14	<0.10	----	----
sodium	7440-23-5	E440	50	mg/kg		354	794	212	----	----
strontium	7440-24-6	E440	0.50	mg/kg		55.3	114	54.8	----	----
sulfur	7704-34-9	E440	1000	mg/kg		<1000	<1000	<1000	----	----
thallium	7440-28-0	E440	0.050	mg/kg		0.087	0.108	0.088	----	----
tin	7440-31-5	E440	2.0	mg/kg		<2.0	<2.0	<2.0	----	----

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	4-mi-SS1	4-mi-SS2	4-mi-SS3	----	----
					Client sampling date / time	16-Sep-2020	16-Sep-2020	16-Sep-2020	----	----
						VA20B5391-001	VA20B5391-003	VA20B5391-005	--------	--------
						Result	Result	Result	----	----
Metals										
titanium	7440-32-6	E440	1.0	mg/kg		978	1300	889	----	----
tungsten	7440-33-7	E440	0.50	mg/kg		<0.50	<0.50	<0.50	----	----
uranium	7440-61-1	E440	0.050	mg/kg		0.678	0.892	0.511	----	----
vanadium	7440-62-2	E440	0.20	mg/kg		84.8	103	68.0	----	----
zinc	7440-66-6	E440	2.0	mg/kg		56.9	75.8	74.0	----	----
zirconium	7440-67-7	E440	1.0	mg/kg		9.3	11.7	8.4	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA20B5391**	Page	: 1 of 6
Client	: **Gandalf Consulting Ltd.**	Laboratory	: Vancouver - Environmental
Contact	: Paul Gardner	Account Manager	: Edward Ngai
Address	: 500 - 1190 Melville St. P.O. Box 48806 Vancouver BC Canada V6E 3W1	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 604 633 2750	Telephone	: +1 604 253 4188
Project	: 6040 LN	Date Samples Received	: 16-Sep-2020 16:30
PO	: ----	Issue Date	: 22-Sep-2020 15:35
C-O-C number	: 17-760473		
Sampler	: ----		
Site	: ----		
Quote number	: ----		
No. of samples received	: 6		
No. of samples analysed	: 3		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 15:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 15:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
4-mi-SS1	E510	16-Sep-2020	19-Sep-2020	28 days	2 days	✓	22-Sep-2020	25 days	2 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
4-mi-SS2	E510	16-Sep-2020	19-Sep-2020	28 days	2 days	✓	22-Sep-2020	25 days	2 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
4-mi-SS3	E510	16-Sep-2020	19-Sep-2020	28 days	2 days	✓	22-Sep-2020	25 days	2 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
4-mi-SS1	E440	16-Sep-2020	19-Sep-2020	180 days	2 days	✓	21-Sep-2020	177 days	2 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
4-mi-SS2	E440	16-Sep-2020	19-Sep-2020	180 days	2 days	✓	21-Sep-2020	177 days	2 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
4-mi-SS3	E440	16-Sep-2020	19-Sep-2020	180 days	2 days	✓	21-Sep-2020	177 days	2 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
4-mi-SS1	E108	16-Sep-2020	19-Sep-2020	30 days	2 days	✓	19-Sep-2020	27 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
4-mi-SS2	E108	16-Sep-2020	19-Sep-2020	30 days	2 days	✓	19-Sep-2020	27 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
4-mi-SS3	E108	16-Sep-2020	19-Sep-2020	30 days	2 days	✓	19-Sep-2020	27 days	0 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Mercury in Soil/Solid by CVAAS	E510	88113	1	3	33.3	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	88114	1	3	33.3	5.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	88112	1	5	20.0	5.0	✓
Laboratory Control Samples (LCS)							
Mercury in Soil/Solid by CVAAS	E510	88113	2	3	66.6	10.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	88114	2	3	66.6	10.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	88112	1	5	20.0	5.0	✓
Method Blanks (MB)							
Mercury in Soil/Solid by CVAAS	E510	88113	1	3	33.3	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	88114	1	3	33.3	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
pH by Meter (1:2 Soil:Water Extraction)	E108 Vancouver - Environmental	Soil/Solid	BC Lab Manual	pH is determined by potentiometric measurement with a pH electrode at ambient laboratory temperature (normally 20 ± 5°C), and is carried out in accordance with procedures described in the BC Lab Manual (prescriptive method). The procedure involves mixing the dried (at <60 ºC) and sieved (10mesh/2mm) sample with ultra pure water at a 1:2 ratio of sediment to water. The pH is then measured by a standard pH probe.
Metals in Soil/Solid by CRC ICPMS	E440 Vancouver - Environmental	Soil/Solid	EPA 6020B (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl. This method is intended to liberate metals that may be environmentally available. Silicate minerals are not solubilized. Dependent on sample matrix, some metals may be only partially recovered, including Al, Ba, Be, Cr, Sr, Ti, Tl, V, W, and Zr. Volatile forms of sulfur (including sulfide) may not be captured, as they may be lost during sampling, storage, or digestion. Analysis is by Collision/Reaction Cell ICPMS.
Mercury in Soil/Solid by CVAAS	E510 Vancouver - Environmental	Soil/Solid	EPA 200.2/1631 Appendix (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl, followed by CVAAS analysis.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Leach 1:2 Soil:Water for pH	EP108 Vancouver - Environmental	Soil/Solid	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL	The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water.
Digestion for Metals and Mercury	EP440 Vancouver - Environmental	Soil/Solid	EPA 200.2 (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl. This method is intended to liberate metals that may be environmentally available.

QUALITY CONTROL REPORT

Work Order	: **VA20B5391**	Page	: 1 of 10
Client	: Gandalf Consulting Ltd.	Laboratory	: Vancouver - Environmental
Contact	: Paul Gardner	Account Manager	: Edward Ngai
Address	: 500 - 1190 Melville St. P.O. Box 48806 Vancouver BC Canada V6E 3W1	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 604 633 2750	Telephone	: +1 604 253 4188
Project	: 6040 LN	Date Samples Received	: 16-Sep-2020 16:30
PO	: ----	Date Analysis Commenced	: 19-Sep-2020
C-O-C number	: 17-760473	Issue Date	: 22-Sep-2020 15:35
Sampler	: ----		
Site	: ----		
Quote number	: ----		
No. of samples received	: 6		
No. of samples analysed	: 3		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits
- Reference Material (RM) Report; Recovery and Acceptance Limits
- Method Blank (MB) Report; Recovery and Acceptance Limits
- Laboratory Control Sample (LCS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Brieanna Allen	Department Manager - Organics	Organics, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia
Shaneel Dayal	Analyst	Metals, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Services number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percentage Difference
# = Indicates a QC result that did not meet the ALS DQO.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test specific).

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Physical Tests (QC Lot: 88112)											
VA20B5391-001	4-mi-SS1	pH (1:2 soil:water)	----	E108	0.10	pH units	7.39	7.57	2.41%	5%	----
Metals (QC Lot: 88113)											
VA20B5391-001	4-mi-SS1	mercury	7439-97-6	E510	0.0500	mg/kg	<0.0500	<0.0500	0	Diff <2x LOR	----
Metals (QC Lot: 88114)											
VA20B5391-001	4-mi-SS1	aluminum	7429-90-5	E440	50	mg/kg	19400	19200	1.48%	40%	----
		antimony	7440-36-0	E440	0.10	mg/kg	0.34	0.36	0.02	Diff <2x LOR	----
		arsenic	7440-38-2	E440	0.10	mg/kg	3.80	3.70	2.62%	30%	----
		barium	7440-39-3	E440	0.50	mg/kg	134	145	7.48%	40%	----
		beryllium	7440-41-7	E440	0.10	mg/kg	0.47	0.47	0.004	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		boron	7440-42-8	E440	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		cadmium	7440-43-9	E440	0.020	mg/kg	0.170	0.161	5.21%	30%	----
		calcium	7440-70-2	E440	50	mg/kg	6360	6260	1.60%	30%	----
		chromium	7440-47-3	E440	0.50	mg/kg	29.4	29.0	1.22%	30%	----
		cobalt	7440-48-4	E440	0.10	mg/kg	11.5	11.0	5.02%	30%	----
		copper	7440-50-8	E440	0.50	mg/kg	47.3	46.8	1.19%	30%	----
		iron	7439-89-6	E440	50	mg/kg	29000	27700	4.49%	30%	----
		lead	7439-92-1	E440	0.50	mg/kg	4.43	4.56	2.94%	40%	----
		lithium	7439-93-2	E440	2.0	mg/kg	8.0	7.5	0.5	Diff <2x LOR	----
		magnesium	7439-95-4	E440	20	mg/kg	5730	5550	3.18%	30%	----
		manganese	7439-96-5	E440	1.0	mg/kg	656	638	2.87%	30%	----
		molybdenum	7439-98-7	E440	0.10	mg/kg	0.74	0.76	2.48%	40%	----
		nickel	7440-02-0	E440	0.50	mg/kg	21.2	21.4	0.798%	30%	----
		phosphorus	7723-14-0	E440	50	mg/kg	456	435	4.51%	30%	----
		potassium	7440-09-7	E440	100	mg/kg	2780	2770	0.396%	40%	----
		selenium	7782-49-2	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		silver	7440-22-4	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		sodium	7440-23-5	E440	50	mg/kg	354	356	0.324%	40%	----
		strontium	7440-24-6	E440	0.50	mg/kg	55.3	57.6	4.12%	40%	----
		sulfur	7704-34-9	E440	1000	mg/kg	<1000	<1000	0	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.050	mg/kg	0.087	0.097	0.010	Diff <2x LOR	----
		tin	7440-31-5	E440	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 88114) - continued											
VA20B5391-001	4-mi-SS1	titanium	7440-32-6	E440	1.0	mg/kg	978	954	2.48%	40%	----
		tungsten	7440-33-7	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.050	mg/kg	0.678	0.664	1.98%	30%	----
		vanadium	7440-62-2	E440	0.20	mg/kg	84.8	80.4	5.26%	30%	----
		zinc	7440-66-6	E440	2.0	mg/kg	56.9	56.2	1.15%	30%	----
		zirconium	7440-67-7	E440	1.0	mg/kg	9.3	9.7	4.59%	30%	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 88113)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 88114)						
aluminum	7429-90-5	E440	50	mg/kg	<50	----
antimony	7440-36-0	E440	0.1	mg/kg	<0.10	----
arsenic	7440-38-2	E440	0.1	mg/kg	<0.10	----
barium	7440-39-3	E440	0.5	mg/kg	<0.50	----
beryllium	7440-41-7	E440	0.1	mg/kg	<0.10	----
bismuth	7440-69-9	E440	0.2	mg/kg	<0.20	----
boron	7440-42-8	E440	5	mg/kg	<5.0	----
cadmium	7440-43-9	E440	0.02	mg/kg	<0.020	----
calcium	7440-70-2	E440	50	mg/kg	<50	----
chromium	7440-47-3	E440	0.5	mg/kg	<0.50	----
cobalt	7440-48-4	E440	0.1	mg/kg	<0.10	----
copper	7440-50-8	E440	0.5	mg/kg	<0.50	----
iron	7439-89-6	E440	50	mg/kg	<50	----
lead	7439-92-1	E440	0.5	mg/kg	<0.50	----
lithium	7439-93-2	E440	2	mg/kg	<2.0	----
magnesium	7439-95-4	E440	20	mg/kg	<20	----
manganese	7439-96-5	E440	1	mg/kg	<1.0	----
molybdenum	7439-98-7	E440	0.1	mg/kg	<0.10	----
nickel	7440-02-0	E440	0.5	mg/kg	<0.50	----
phosphorus	7723-14-0	E440	50	mg/kg	<50	----
potassium	7440-09-7	E440	100	mg/kg	<100	----
selenium	7782-49-2	E440	0.2	mg/kg	<0.20	----
silver	7440-22-4	E440	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E440	50	mg/kg	<50	----
strontium	7440-24-6	E440	0.5	mg/kg	<0.50	----
sulfur	7704-34-9	E440	1000	mg/kg	<1000	----
thallium	7440-28-0	E440	0.05	mg/kg	<0.050	----
tin	7440-31-5	E440	2	mg/kg	<2.0	----
titanium	7440-32-6	E440	1	mg/kg	<1.0	----
tungsten	7440-33-7	E440	0.5	mg/kg	<0.50	----
uranium	7440-61-1	E440	0.05	mg/kg	<0.050	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 88114) - continued						
vanadium	7440-62-2	E440	0.2	mg/kg	<0.20	----
zinc	7440-66-6	E440	2	mg/kg	<2.0	----
zirconium	7440-67-7	E440	1	mg/kg	<1.0	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 88112)									
pH (1:2 soil:water)	----	E108	----	pH units	6 pH units	100	95.0	105	----
Metals (QCLot: 88113)									
mercury	7439-97-6	E510	0.005	mg/kg	0.1 mg/kg	104	80.0	120	----
Metals (QCLot: 88114)									
aluminum	7429-90-5	E440	50	mg/kg	200 mg/kg	104	80.0	120	----
antimony	7440-36-0	E440	0.1	mg/kg	100 mg/kg	105	80.0	120	----
arsenic	7440-38-2	E440	0.1	mg/kg	100 mg/kg	102	80.0	120	----
barium	7440-39-3	E440	0.5	mg/kg	25 mg/kg	102	80.0	120	----
beryllium	7440-41-7	E440	0.1	mg/kg	10 mg/kg	97.8	80.0	120	----
bismuth	7440-69-9	E440	0.2	mg/kg	100 mg/kg	95.6	80.0	120	----
boron	7440-42-8	E440	5	mg/kg	100 mg/kg	96.7	80.0	120	----
cadmium	7440-43-9	E440	0.02	mg/kg	10 mg/kg	106	80.0	120	----
calcium	7440-70-2	E440	50	mg/kg	5000 mg/kg	101	80.0	120	----
chromium	7440-47-3	E440	0.5	mg/kg	25 mg/kg	103	80.0	120	----
cobalt	7440-48-4	E440	0.1	mg/kg	25 mg/kg	102	80.0	120	----
copper	7440-50-8	E440	0.5	mg/kg	25 mg/kg	100	80.0	120	----
iron	7439-89-6	E440	50	mg/kg	100 mg/kg	103	80.0	120	----
lead	7439-92-1	E440	0.5	mg/kg	50 mg/kg	100	80.0	120	----
lithium	7439-93-2	E440	2	mg/kg	25 mg/kg	96.8	80.0	120	----
magnesium	7439-95-4	E440	20	mg/kg	5000 mg/kg	105	80.0	120	----
manganese	7439-96-5	E440	1	mg/kg	25 mg/kg	104	80.0	120	----
molybdenum	7439-98-7	E440	0.1	mg/kg	25 mg/kg	109	80.0	120	----
nickel	7440-02-0	E440	0.5	mg/kg	50 mg/kg	100	80.0	120	----
phosphorus	7723-14-0	E440	50	mg/kg	1000 mg/kg	105	80.0	120	----
potassium	7440-09-7	E440	100	mg/kg	5000 mg/kg	101	80.0	120	----
selenium	7782-49-2	E440	0.2	mg/kg	100 mg/kg	101	80.0	120	----
silver	7440-22-4	E440	0.1	mg/kg	10 mg/kg	103	80.0	120	----
sodium	7440-23-5	E440	50	mg/kg	5000 mg/kg	104	80.0	120	----
strontium	7440-24-6	E440	0.5	mg/kg	25 mg/kg	103	80.0	120	----
sulfur	7704-34-9	E440	1000	mg/kg	5000 mg/kg	89.9	80.0	120	----
thallium	7440-28-0	E440	0.05	mg/kg	100 mg/kg	96.2	80.0	120	----
tin	7440-31-5	E440	2	mg/kg	50 mg/kg	107	80.0	120	----
titanium	7440-32-6	E440	1	mg/kg	25 mg/kg	98.3	80.0	120	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 88114) - continued									
tungsten	7440-33-7	E440	0.5	mg/kg	10 mg/kg	106	80.0	120	----
uranium	7440-61-1	E440	0.05	mg/kg	0.5 mg/kg	106	80.0	120	----
vanadium	7440-62-2	E440	0.2	mg/kg	50 mg/kg	106	80.0	120	----
zinc	7440-66-6	E440	2	mg/kg	50 mg/kg	99.0	80.0	120	----
zirconium	7440-67-7	E440	1	mg/kg	10 mg/kg	92.7	80.0	120	----

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix: **Soil/Solid**

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 88113)									
QC-88113-003	SCP SS-2	mercury	7439-97-6	E510	0.059 mg/kg	109	70.0	130	----
Metals (QCLot: 88114)									
QC-88114-003	SCP SS-2	aluminum	7429-90-5	E440	9817 mg/kg	108	70.0	130	----
QC-88114-003	SCP SS-2	antimony	7440-36-0	E440	3.99 mg/kg	102	70.0	130	----
QC-88114-003	SCP SS-2	arsenic	7440-38-2	E440	3.73 mg/kg	101	70.0	130	----
QC-88114-003	SCP SS-2	barium	7440-39-3	E440	105 mg/kg	99.8	70.0	130	----
QC-88114-003	SCP SS-2	beryllium	7440-41-7	E440	0.349 mg/kg	100.0	70.0	130	----
QC-88114-003	SCP SS-2	boron	7440-42-8	E440	8.5 mg/kg	111	40.0	160	----
QC-88114-003	SCP SS-2	cadmium	7440-43-9	E440	0.91 mg/kg	103	70.0	130	----
QC-88114-003	SCP SS-2	calcium	7440-70-2	E440	31082 mg/kg	93.0	70.0	130	----
QC-88114-003	SCP SS-2	chromium	7440-47-3	E440	101 mg/kg	108	70.0	130	----
QC-88114-003	SCP SS-2	cobalt	7440-48-4	E440	6.9 mg/kg	104	70.0	130	----
QC-88114-003	SCP SS-2	copper	7440-50-8	E440	123 mg/kg	100	70.0	130	----
QC-88114-003	SCP SS-2	iron	7439-89-6	E440	23558 mg/kg	99.9	70.0	130	----
QC-88114-003	SCP SS-2	lead	7439-92-1	E440	267 mg/kg	93.7	70.0	130	----
QC-88114-003	SCP SS-2	lithium	7439-93-2	E440	9.5 mg/kg	97.0	70.0	130	----
QC-88114-003	SCP SS-2	magnesium	7439-95-4	E440	5509 mg/kg	100	70.0	130	----
QC-88114-003	SCP SS-2	manganese	7439-96-5	E440	269 mg/kg	105	70.0	130	----
QC-88114-003	SCP SS-2	molybdenum	7439-98-7	E440	1.03 mg/kg	108	70.0	130	----
QC-88114-003	SCP SS-2	nickel	7440-02-0	E440	26.7 mg/kg	99.4	70.0	130	----
QC-88114-003	SCP SS-2	phosphorus	7723-14-0	E440	752 mg/kg	95.0	70.0	130	----
QC-88114-003	SCP SS-2	potassium	7440-09-7	E440	1587 mg/kg	111	70.0	130	----
QC-88114-003	SCP SS-2	sodium	7440-23-5	E440	797 mg/kg	105	70.0	130	----
QC-88114-003	SCP SS-2	strontium	7440-24-6	E440	86.1 mg/kg	98.2	70.0	130	----
QC-88114-003	SCP SS-2	thallium	7440-28-0	E440	0.0786 mg/kg	103	40.0	160	----
QC-88114-003	SCP SS-2	tin	7440-31-5	E440	10.6 mg/kg	93.7	70.0	130	----
QC-88114-003	SCP SS-2	titanium	7440-32-6	E440	839 mg/kg	113	70.0	130	----
QC-88114-003	SCP SS-2	uranium	7440-61-1	E440	0.52 mg/kg	103	70.0	130	----
QC-88114-003	SCP SS-2	vanadium	7440-62-2	E440	32.7 mg/kg	107	70.0	130	----

Sub-Matrix: **Soil/Solid**

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 88114) - continued									
QC-88114-003	SCP SS-2	zinc	7440-66-6	E440	297 mg/kg	95.4	70.0	130	----
QC-88114-003	SCP SS-2	zirconium	7440-67-7	E440	5.73 mg/kg	89.0	70.0	130	----

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 760473

Page 1 of 1

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)
Company:	Sample Consult Ltd.	Select Report Format: [X] PDF [X] EXCEL [ ] EDD (DIGITAL)	Regular [R] [ ] Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Paul Gardner	Quality Control (QC) Report with Report [ ] YES [ ] NO	PRIORITY (Business Days): 4 day [P4-20%] [X] / 3 day [P3-25%] [ ] / 2 day [P2-50%] [ ]
Phone:	604-633-2750	[ ] Compare Results to Criteria on Report - provide details below if box checked	EMERGENCY: 1 Business day [E - 100%] [ ] / Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)] [ ]
Company address below will appear on the final report		Select Distribution: [X] EMAIL [ ] MAIL [ ] FAX	Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm
Street:	Melville St	Email 1 or Fax: Gardner@gardolf-consulting.bc.ca	For tests that can not be performed according to the service level selected, you will be contacted.
City/Province:	Vancouver	Email 2	
Postal Code:		Email 3	

Invoice To		Invoice Distribution	
	Same as Report To [X] YES [ ] NO	Select Invoice Distribution: [X] EMAIL [ ] MAIL [ ] FAX	
	Copy of Invoice with Report [X] YES [ ] NO	Email 1 or Fax: As Above	
Company:		Email 2	
Contact:			

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:	6090 LN	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	

ALS Lab Work Order # (lab use only):	ALS Contact:	Sampler:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

NUMBER OF CONTAINERS: Metals

Environmental Division
Vancouver
Work Order Reference
VA20B5391

Telephone : +1 604 253 4188

SAMPLES ON HOLD

SUSPECTED HAZARD (see Special Instructions)

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	Metals
	4-mi-SS1	20-09-16		SOIL	1	X
	4-mi-SS1	20-09-16		SOIL	1	
	4-mi-SS2	20-09-16		SOIL	1	X
	4-mi-SS2	20-09-16		SOIL	1	
	4-mi-SS3	20-09-16		SOIL	1	X
	4-mi-SS3	20-09-16		SOIL	1	

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? [ ] YES [ ] NO	
Are samples for human consumption/ use? [ ] YES [ ] NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen [ ] SIF Observations Yes [ ] No [ ]
Ice Packs [✓] Ice Cubes [ ] Custody seal intact Yes [ ] No [ ]
Cooling Initiated [ ]

INITIAL COOLER TEMPERATURES °C	FINAL COOLER TEMPERATURES °C
	22

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
							20 Sep 16	9:30

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

JUNE 2018 FRONT

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form.**

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA20B8430**	Page	: 1 of 4
Client	: **Gandalf Consulting Ltd.**	Laboratory	: Vancouver - Environmental
Contact	: Bob Symington	Account Manager	: Edward Ngai
Address	: 500 - 1190 Melville St. P.O. Box 48806 Vancouver BC Canada V6E 3W1	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: 604 633 2750	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 17-Oct-2020 18:10
PO	: ----	Date Analysis Commenced	: 21-Oct-2020
C-O-C number	: 17-864036	Issue Date	: 28-Oct-2020 17:38
Sampler	: ----		
Site	: ----		
Quote number	: ----		
No. of samples received	: 3		
No. of samples analysed	: 3		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Brieanna Allen	Department Manager - Organics	Organics, Burnaby, British Columbia
Dee Lee	Analyst	Metals, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Metals, Burnaby, British Columbia
Ophelia Chiu	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
mg/kg	milligrams per kilogram
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in reports identified as "Preliminary Report" are considered authorized for use.

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	AEC 6 SS1	AEC 6 SS2	AEC 6 SS3	----	----
					Client sampling date / time	16-Oct-2020	16-Oct-2020	16-Oct-2020	----	----
						VA20B8430-001	VA20B8430-002	VA20B8430-003	--------	--------
						Result	Result	Result	----	----
Physical Tests										
pH (1:2 soil:water)	----	E108	0.10	pH units		7.16	7.20	7.75	----	----
Metals										
aluminum	7429-90-5	E440	50	mg/kg		9850	11300	12300	----	----
antimony	7440-36-0	E440	0.10	mg/kg		0.51	0.58	5.81	----	----
arsenic	7440-38-2	E440	0.10	mg/kg		3.51	3.95	12.3	----	----
barium	7440-39-3	E440	0.50	mg/kg		64.4	99.6	95.7	----	----
beryllium	7440-41-7	E440	0.10	mg/kg		0.27	0.37	0.30	----	----
bismuth	7440-69-9	E440	0.20	mg/kg		<0.20	<0.20	<0.20	----	----
boron	7440-42-8	E440	5.0	mg/kg		<5.0	6.1	12.8	----	----
cadmium	7440-43-9	E440	0.020	mg/kg		0.157	0.224	0.522	----	----
calcium	7440-70-2	E440	50	mg/kg		6960	8110	13900	----	----
chromium	7440-47-3	E440	0.50	mg/kg		22.9	30.4	25.4	----	----
cobalt	7440-48-4	E440	0.10	mg/kg		8.52	9.85	9.35	----	----
copper	7440-50-8	E440	0.50	mg/kg		60.6	48.7	66.6	----	----
iron	7439-89-6	E440	50	mg/kg		30600	34400	26600	----	----
lead	7439-92-1	E440	0.50	mg/kg		26.7	8.26	26.6	----	----
lithium	7439-93-2	E440	2.0	mg/kg		5.6	5.9	6.3	----	----
magnesium	7439-95-4	E440	20	mg/kg		5590	5780	6110	----	----
manganese	7439-96-5	E440	1.0	mg/kg		377	530	530	----	----
mercury	7439-97-6	E510	0.0500	mg/kg		<0.0500	<0.0500	<0.0500	----	----
molybdenum	7439-98-7	E440	0.10	mg/kg		0.60	0.71	1.60	----	----
nickel	7440-02-0	E440	0.50	mg/kg		14.8	15.8	15.9	----	----
phosphorus	7723-14-0	E440	50	mg/kg		612	697	828	----	----
potassium	7440-09-7	E440	100	mg/kg		810	1240	1530	----	----
selenium	7782-49-2	E440	0.20	mg/kg		<0.20	<0.20	<0.20	----	----
silver	7440-22-4	E440	0.10	mg/kg		<0.10	<0.10	0.12	----	----
sodium	7440-23-5	E440	50	mg/kg		195	248	377	----	----
strontium	7440-24-6	E440	0.50	mg/kg		36.3	48.4	59.8	----	----
sulfur	7704-34-9	E440	1000	mg/kg		<1000	<1000	1300	----	----
thallium	7440-28-0	E440	0.050	mg/kg		<0.050	<0.050	0.051	----	----
tin	7440-31-5	E440	2.0	mg/kg		<2.0	<2.0	3.8	----	----

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	AEC 6 SS1	AEC 6 SS2	AEC 6 SS3	----	----
					Client sampling date / time	16-Oct-2020	16-Oct-2020	16-Oct-2020	----	----
						VA20B8430-001	VA20B8430-002	VA20B8430-003	--------	--------
						Result	Result	Result	----	----
Metals										
titanium	7440-32-6	E440	1.0	mg/kg		820	854	848	----	----
tungsten	7440-33-7	E440	0.50	mg/kg		<0.50	<0.50	<0.50	----	----
uranium	7440-61-1	E440	0.050	mg/kg		0.630	0.667	0.472	----	----
vanadium	7440-62-2	E440	0.20	mg/kg		107	117	76.1	----	----
zinc	7440-66-6	E440	2.0	mg/kg		59.2	77.2	232	----	----
zirconium	7440-67-7	E440	1.0	mg/kg		3.7	4.8	4.0	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA20B8430**	Page	: 1 of 7
Client	: **Gandalf Consulting Ltd.**	Laboratory	: Vancouver - Environmental
Contact	: Bob Symington	Account Manager	: Edward Ngai
Address	: 500 - 1190 Melville St. P.O. Box 48806 Vancouver BC Canada V6E 3W1	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 604 633 2750	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 17-Oct-2020 18:10
PO	: ----	Issue Date	: 28-Oct-2020 17:38
C-O-C number	: 17-864036		
Sampler	: ----		
Site	: ----		
Quote number	: ----		
No. of samples received	: 3		
No. of samples analysed	: 3		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- Duplicate outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Soil/Solid**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Duplicate (DUP) RPDs								
Metals	VA20B8430-001	AEC 6 SS1	cadmium	7440-43-9	E440	42.4 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.
Metals	VA20B8430-001	AEC 6 SS1	copper	7440-50-8	E440	30.1 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.
Metals	VA20B8430-001	AEC 6 SS1	lead	7439-92-1	E440	85.6 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.

Result Qualifiers

Qualifier	*Description*
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 15:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 15:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
AEC 6 SS1	E510	16-Oct-2020	21-Oct-2020	28 days	4 days	✓	23-Oct-2020	23 days	2 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
AEC 6 SS2	E510	16-Oct-2020	21-Oct-2020	28 days	4 days	✓	23-Oct-2020	23 days	2 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
AEC 6 SS3	E510	16-Oct-2020	21-Oct-2020	28 days	4 days	✓	23-Oct-2020	23 days	2 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
AEC 6 SS1	E440	16-Oct-2020	21-Oct-2020	180 days	4 days	✓	23-Oct-2020	175 days	2 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
AEC 6 SS2	E440	16-Oct-2020	21-Oct-2020	180 days	4 days	✓	23-Oct-2020	175 days	2 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
AEC 6 SS3	E440	16-Oct-2020	21-Oct-2020	180 days	4 days	✓	23-Oct-2020	175 days	2 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
AEC 6 SS1	E108	16-Oct-2020	21-Oct-2020	30 days	4 days	✓	21-Oct-2020	25 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
AEC 6 SS2	E108	16-Oct-2020	21-Oct-2020	30 days	4 days	✓	21-Oct-2020	25 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
AEC 6 SS3	E108	16-Oct-2020	21-Oct-2020	30 days	4 days	✓	21-Oct-2020	25 days	0 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Mercury in Soil/Solid by CVAAS	E510	105362	1	13	7.6	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	105363	1	13	7.6	5.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	105364	1	13	7.6	5.0	✓
Laboratory Control Samples (LCS)							
Mercury in Soil/Solid by CVAAS	E510	105362	2	13	15.3	10.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	105363	2	13	15.3	10.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	105364	1	13	7.6	5.0	✓
Method Blanks (MB)							
Mercury in Soil/Solid by CVAAS	E510	105362	1	13	7.6	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	105363	1	13	7.6	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
pH by Meter (1:2 Soil:Water Extraction)	E108 Vancouver - Environmental	Soil/Solid	BC Lab Manual	pH is determined by potentiometric measurement with a pH electrode at ambient laboratory temperature (normally 20 ± 5°C), and is carried out in accordance with procedures described in the BC Lab Manual (prescriptive method). The procedure involves mixing the dried (at <60 ºC) and sieved (10mesh/2mm) sample with ultra pure water at a 1:2 ratio of sediment to water. The pH is then measured by a standard pH probe.
Metals in Soil/Solid by CRC ICPMS	E440 Vancouver - Environmental	Soil/Solid	EPA 6020B (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl. This method is intended to liberate metals that may be environmentally available. Silicate minerals are not solubilized. Dependent on sample matrix, some metals may be only partially recovered, including Al, Ba, Be, Cr, Sr, Ti, Tl, V, W, and Zr. Volatile forms of sulfur (including sulfide) may not be captured, as they may be lost during sampling, storage, or digestion. Analysis is by Collision/Reaction Cell ICPMS.
Mercury in Soil/Solid by CVAAS	E510 Vancouver - Environmental	Soil/Solid	EPA 200.2/1631 Appendix (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl, followed by CVAAS analysis.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Leach 1:2 Soil:Water for pH	EP108 Vancouver - Environmental	Soil/Solid	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL	The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water.
Digestion for Metals and Mercury	EP440 Vancouver - Environmental	Soil/Solid	EPA 200.2 (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl. This method is intended to liberate metals that may be environmentally available.

QUALITY CONTROL REPORT

Work Order	: **VA20B8430**	Page	: 1 of 10
Client	: Gandalf Consulting Ltd.	Laboratory	: Vancouver - Environmental
Contact	: Bob Symington	Account Manager	: Edward Ngai
Address	: 500 - 1190 Melville St. P.O. Box 48806 Vancouver BC Canada V6E 3W1	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 604 633 2750	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 17-Oct-2020 18:10
PO	: ----	Date Analysis Commenced	: 21-Oct-2020
C-O-C number	: 17-864036	Issue Date	: 28-Oct-2020 17:38
Sampler	: ----		
Site	: ----		
Quote number	: ----		
No. of samples received	: 3		
No. of samples analysed	: 3		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits
- Reference Material (RM) Report; Recovery and Acceptance Limits
- Method Blank (MB) Report; Recovery and Acceptance Limits
- Laboratory Control Sample (LCS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Brieanna Allen	Department Manager - Organics	Organics, Burnaby, British Columbia
Dee Lee	Analyst	Metals, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Metals, Burnaby, British Columbia
Ophelia Chiu	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Services number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percentage Difference
# = Indicates a QC result that did not meet the ALS DQO.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test specific).

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Physical Tests (QC Lot: 105364)											
VA20B8430-001	AEC 6 SS1	pH (1:2 soil:water)	----	E108	0.10	pH units	7.16	7.09	0.982%	5%	----
Metals (QC Lot: 105362)											
VA20B8430-001	AEC 6 SS1	mercury	7439-97-6	E510	0.0500	mg/kg	<0.0500	<0.0500	0	Diff <2x LOR	----
Metals (QC Lot: 105363)											
VA20B8430-001	AEC 6 SS1	aluminum	7429-90-5	E440	50	mg/kg	9850	11400	14.1%	40%	----
		antimony	7440-36-0	E440	0.10	mg/kg	0.51	0.40	0.11	Diff <2x LOR	----
		arsenic	7440-38-2	E440	0.10	mg/kg	3.51	3.69	5.04%	30%	----
		barium	7440-39-3	E440	0.50	mg/kg	64.4	78.6	19.8%	40%	----
		beryllium	7440-41-7	E440	0.10	mg/kg	0.27	0.29	0.02	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		boron	7440-42-8	E440	5.0	mg/kg	<5.0	5.2	0.2	Diff <2x LOR	----
		cadmium	7440-43-9	E440	0.020	mg/kg	0.157	0.242	42.4%	30%	DUP-H
		calcium	7440-70-2	E440	50	mg/kg	6960	7720	10.4%	30%	----
		chromium	7440-47-3	E440	0.50	mg/kg	22.9	29.4	24.8%	30%	----
		cobalt	7440-48-4	E440	0.10	mg/kg	8.52	9.56	11.5%	30%	----
		copper	7440-50-8	E440	0.50	mg/kg	60.6	44.7	30.1%	30%	DUP-H
		iron	7439-89-6	E440	50	mg/kg	30600	35900	15.9%	30%	----
		lead	7439-92-1	E440	0.50	mg/kg	26.7	10.7	85.6%	40%	DUP-H
		lithium	7439-93-2	E440	2.0	mg/kg	5.6	7.0	1.3	Diff <2x LOR	----
		magnesium	7439-95-4	E440	20	mg/kg	5590	6060	8.00%	30%	----
		manganese	7439-96-5	E440	1.0	mg/kg	377	445	16.5%	30%	----
		molybdenum	7439-98-7	E440	0.10	mg/kg	0.60	0.69	14.8%	40%	----
		nickel	7440-02-0	E440	0.50	mg/kg	14.8	14.5	1.85%	30%	----
		phosphorus	7723-14-0	E440	50	mg/kg	612	624	2.00%	30%	----
		potassium	7440-09-7	E440	100	mg/kg	810	920	12.5%	40%	----
		selenium	7782-49-2	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		silver	7440-22-4	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		sodium	7440-23-5	E440	50	mg/kg	195	281	86	Diff <2x LOR	----
		strontium	7440-24-6	E440	0.50	mg/kg	36.3	38.5	5.88%	40%	----
		sulfur	7704-34-9	E440	1000	mg/kg	<1000	<1000	0	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		tin	7440-31-5	E440	2.0	mg/kg	<2.0	2.4	0.4	Diff <2x LOR	----

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 105363) - continued											
VA20B8430-001	AEC 6 SS1	titanium	7440-32-6	E440	1.0	mg/kg	820	901	9.35%	40%	----
		tungsten	7440-33-7	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.050	mg/kg	0.630	0.554	13.0%	30%	----
		vanadium	7440-62-2	E440	0.20	mg/kg	107	126	16.1%	30%	----
		zinc	7440-66-6	E440	2.0	mg/kg	59.2	67.4	12.9%	30%	----
		zirconium	7440-67-7	E440	1.0	mg/kg	3.7	4.5	0.8	Diff <2x LOR	----

Qualifiers

Qualifier	*Description*
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 105362)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 105363)						
aluminum	7429-90-5	E440	50	mg/kg	<50	----
antimony	7440-36-0	E440	0.1	mg/kg	<0.10	----
arsenic	7440-38-2	E440	0.1	mg/kg	<0.10	----
barium	7440-39-3	E440	0.5	mg/kg	<0.50	----
beryllium	7440-41-7	E440	0.1	mg/kg	<0.10	----
bismuth	7440-69-9	E440	0.2	mg/kg	<0.20	----
boron	7440-42-8	E440	5	mg/kg	<5.0	----
cadmium	7440-43-9	E440	0.02	mg/kg	<0.020	----
calcium	7440-70-2	E440	50	mg/kg	<50	----
chromium	7440-47-3	E440	0.5	mg/kg	<0.50	----
cobalt	7440-48-4	E440	0.1	mg/kg	<0.10	----
copper	7440-50-8	E440	0.5	mg/kg	<0.50	----
iron	7439-89-6	E440	50	mg/kg	<50	----
lead	7439-92-1	E440	0.5	mg/kg	<0.50	----
lithium	7439-93-2	E440	2	mg/kg	<2.0	----
magnesium	7439-95-4	E440	20	mg/kg	<20	----
manganese	7439-96-5	E440	1	mg/kg	<1.0	----
molybdenum	7439-98-7	E440	0.1	mg/kg	<0.10	----
nickel	7440-02-0	E440	0.5	mg/kg	<0.50	----
phosphorus	7723-14-0	E440	50	mg/kg	<50	----
potassium	7440-09-7	E440	100	mg/kg	<100	----
selenium	7782-49-2	E440	0.2	mg/kg	<0.20	----
silver	7440-22-4	E440	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E440	50	mg/kg	<50	----
strontium	7440-24-6	E440	0.5	mg/kg	<0.50	----
sulfur	7704-34-9	E440	1000	mg/kg	<1000	----
thallium	7440-28-0	E440	0.05	mg/kg	<0.050	----
tin	7440-31-5	E440	2	mg/kg	<2.0	----
titanium	7440-32-6	E440	1	mg/kg	<1.0	----
tungsten	7440-33-7	E440	0.5	mg/kg	<0.50	----
uranium	7440-61-1	E440	0.05	mg/kg	<0.050	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 105363) - continued						
vanadium	7440-62-2	E440	0.2	mg/kg	<0.20	----
zinc	7440-66-6	E440	2	mg/kg	<2.0	----
zirconium	7440-67-7	E440	1	mg/kg	<1.0	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 105364)									
pH (1:2 soil:water)	----	E108	----	pH units	6 pH units	100	95.0	105	----
Metals (QCLot: 105362)									
mercury	7439-97-6	E510	0.005	mg/kg	0.1 mg/kg	100	80.0	120	----
Metals (QCLot: 105363)									
aluminum	7429-90-5	E440	50	mg/kg	200 mg/kg	98.2	80.0	120	----
antimony	7440-36-0	E440	0.1	mg/kg	100 mg/kg	105	80.0	120	----
arsenic	7440-38-2	E440	0.1	mg/kg	100 mg/kg	99.8	80.0	120	----
barium	7440-39-3	E440	0.5	mg/kg	25 mg/kg	104	80.0	120	----
beryllium	7440-41-7	E440	0.1	mg/kg	10 mg/kg	101	80.0	120	----
bismuth	7440-69-9	E440	0.2	mg/kg	100 mg/kg	105	80.0	120	----
boron	7440-42-8	E440	5	mg/kg	100 mg/kg	102	80.0	120	----
cadmium	7440-43-9	E440	0.02	mg/kg	10 mg/kg	101	80.0	120	----
calcium	7440-70-2	E440	50	mg/kg	5000 mg/kg	103	80.0	120	----
chromium	7440-47-3	E440	0.5	mg/kg	25 mg/kg	102	80.0	120	----
cobalt	7440-48-4	E440	0.1	mg/kg	25 mg/kg	100	80.0	120	----
copper	7440-50-8	E440	0.5	mg/kg	25 mg/kg	99.3	80.0	120	----
iron	7439-89-6	E440	50	mg/kg	100 mg/kg	103	80.0	120	----
lead	7439-92-1	E440	0.5	mg/kg	50 mg/kg	103	80.0	120	----
lithium	7439-93-2	E440	2	mg/kg	25 mg/kg	97.6	80.0	120	----
magnesium	7439-95-4	E440	20	mg/kg	5000 mg/kg	99.6	80.0	120	----
manganese	7439-96-5	E440	1	mg/kg	25 mg/kg	97.6	80.0	120	----
molybdenum	7439-98-7	E440	0.1	mg/kg	25 mg/kg	105	80.0	120	----
nickel	7440-02-0	E440	0.5	mg/kg	50 mg/kg	99.9	80.0	120	----
phosphorus	7723-14-0	E440	50	mg/kg	1000 mg/kg	100.0	80.0	120	----
potassium	7440-09-7	E440	100	mg/kg	5000 mg/kg	101	80.0	120	----
selenium	7782-49-2	E440	0.2	mg/kg	100 mg/kg	100	80.0	120	----
silver	7440-22-4	E440	0.1	mg/kg	10 mg/kg	108	80.0	120	----
sodium	7440-23-5	E440	50	mg/kg	5000 mg/kg	98.0	80.0	120	----
strontium	7440-24-6	E440	0.5	mg/kg	25 mg/kg	104	80.0	120	----
sulfur	7704-34-9	E440	1000	mg/kg	5000 mg/kg	102	80.0	120	----
thallium	7440-28-0	E440	0.05	mg/kg	100 mg/kg	103	80.0	120	----
tin	7440-31-5	E440	2	mg/kg	50 mg/kg	106	80.0	120	----
titanium	7440-32-6	E440	1	mg/kg	25 mg/kg	96.9	80.0	120	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 105363) - continued									
tungsten	7440-33-7	E440	0.5	mg/kg	10 mg/kg	107	80.0	120	----
uranium	7440-61-1	E440	0.05	mg/kg	0.5 mg/kg	111	80.0	120	----
vanadium	7440-62-2	E440	0.2	mg/kg	50 mg/kg	102	80.0	120	----
zinc	7440-66-6	E440	2	mg/kg	50 mg/kg	104	80.0	120	----
zirconium	7440-67-7	E440	1	mg/kg	10 mg/kg	97.7	80.0	120	----

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix: **Soil/Solid**

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 105362)									
QC-105362-003	SCP SS-2	mercury	7439-97-6	E510	0.059 mg/kg	104	70.0	130	----
Metals (QCLot: 105363)									
QC-105363-003	SCP SS-2	aluminum	7429-90-5	E440	9817 mg/kg	105	70.0	130	----
QC-105363-003	SCP SS-2	antimony	7440-36-0	E440	3.99 mg/kg	96.1	70.0	130	----
QC-105363-003	SCP SS-2	arsenic	7440-38-2	E440	3.73 mg/kg	105	70.0	130	----
QC-105363-003	SCP SS-2	barium	7440-39-3	E440	105 mg/kg	106	70.0	130	----
QC-105363-003	SCP SS-2	beryllium	7440-41-7	E440	0.349 mg/kg	96.4	70.0	130	----
QC-105363-003	SCP SS-2	boron	7440-42-8	E440	8.5 mg/kg	112	40.0	160	----
QC-105363-003	SCP SS-2	cadmium	7440-43-9	E440	0.91 mg/kg	102	70.0	130	----
QC-105363-003	SCP SS-2	calcium	7440-70-2	E440	31082 mg/kg	98.6	70.0	130	----
QC-105363-003	SCP SS-2	chromium	7440-47-3	E440	101 mg/kg	108	70.0	130	----
QC-105363-003	SCP SS-2	cobalt	7440-48-4	E440	6.9 mg/kg	102	70.0	130	----
QC-105363-003	SCP SS-2	copper	7440-50-8	E440	123 mg/kg	102	70.0	130	----
QC-105363-003	SCP SS-2	iron	7439-89-6	E440	23558 mg/kg	107	70.0	130	----
QC-105363-003	SCP SS-2	lead	7439-92-1	E440	267 mg/kg	103	70.0	130	----
QC-105363-003	SCP SS-2	lithium	7439-93-2	E440	9.5 mg/kg	96.6	70.0	130	----
QC-105363-003	SCP SS-2	magnesium	7439-95-4	E440	5509 mg/kg	106	70.0	130	----
QC-105363-003	SCP SS-2	manganese	7439-96-5	E440	269 mg/kg	108	70.0	130	----
QC-105363-003	SCP SS-2	molybdenum	7439-98-7	E440	1.03 mg/kg	106	70.0	130	----
QC-105363-003	SCP SS-2	nickel	7440-02-0	E440	26.7 mg/kg	106	70.0	130	----
QC-105363-003	SCP SS-2	phosphorus	7723-14-0	E440	752 mg/kg	95.8	70.0	130	----
QC-105363-003	SCP SS-2	potassium	7440-09-7	E440	1587 mg/kg	111	70.0	130	----
QC-105363-003	SCP SS-2	sodium	7440-23-5	E440	797 mg/kg	105	70.0	130	----
QC-105363-003	SCP SS-2	strontium	7440-24-6	E440	86.1 mg/kg	99.7	70.0	130	----
QC-105363-003	SCP SS-2	thallium	7440-28-0	E440	0.0786 mg/kg	89.5	40.0	160	----
QC-105363-003	SCP SS-2	tin	7440-31-5	E440	10.6 mg/kg	130	70.0	130	----
QC-105363-003	SCP SS-2	titanium	7440-32-6	E440	839 mg/kg	115	70.0	130	----
QC-105363-003	SCP SS-2	uranium	7440-61-1	E440	0.52 mg/kg	106	70.0	130	----
QC-105363-003	SCP SS-2	vanadium	7440-62-2	E440	32.7 mg/kg	108	70.0	130	----

Sub-Matrix: **Soil/Solid**

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 105363) - continued									
QC-105363-003	SCP SS-2	zinc	7440-66-6	E440	297 mg/kg	100	70.0	130	----
QC-105363-003	SCP SS-2	zirconium	7440-67-7	E440	5.73 mg/kg	102	70.0	130	----

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 864036

Page of

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)
Company:	GANDALF CONSULTING	Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	BOB SYMINGTON	Quality Control (QC) Report with Report ☐ YES ☐ NO	PRIORITY (Business Days): 4 day [P4-20%] ☐ / 3 day [P3-25%] ☐ / 2 day [P2-50%] ☐
Phone:	604 633 2750	☐ Compare Results to Criteria on Report - provide details below if box checked	EMERGENCY: 1 Business day [E - 100%] ☐ / Same Day, Weekend or Statutory holiday [E2 -200%] (Laboratory opening fees may apply)] ☐
	Company address below will appear on the final report	Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	
Street:		Email 1 or Fax	Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm
City/Province:		Email 2	For tests that can not be performed according to the service level selected, you will be contacted.
Postal Code:		Email 3	

Invoice To		Invoice Distribution
	Same as Report To ☑ YES ☐ NO	Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
	Copy of Invoice with Report ☑ YES ☐ NO	
Company:		Email 1 or Fax
Contact:		Email 2

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):		ALS Contact:	Sampler:

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	METALS	SAMPLES ON HOLD	SUSPECTED HAZARD (see Special Instructions)
	AEC 6 SS 1	20 1016		SOIL	1	✓		
	AEC 6 SS 2	↓		↓	1	✓		
	AEC 6 SS 3				1	✓		

Environmental Division
Vancouver
Work Order Reference
VA20B8430

Telephone : +1 604 253 4188

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☐ NO	CSR – RP STANDARD.
Are samples for human consumption/ use? ☐ YES ☐ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐
Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
				5°C			

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by: AM / JG	Date: 17 Sep	Time: 6:10 PM

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION — WHITE - LABORATORY COPY — YELLOW - CLIENT COPY — JUNE 2018 FRONT

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA20C2524**	Page	: 1 of 6
Client	: **Gandalf Consulting Ltd.**	Laboratory	: Vancouver - Environmental
Contact	: Bob Symington	Account Manager	: Edward Ngai
Address	: 500 - 1190 Melville St. P.O. Box 48806 Vancouver BC Canada V6E 3W1	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: 604 633 2750	Telephone	: +1 604 253 4188
Project	: 6040 LN	Date Samples Received	: 03-Dec-2020 17:24
PO	: ----	Date Analysis Commenced	: 08-Dec-2020
C-O-C number	: 17-858032	Issue Date	: 09-Dec-2020 16:44
Sampler	: XS		
Site	: ----		
Quote number	: ----		
No. of samples received	: 9		
No. of samples analysed	: 9		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Angela Ren	Team Leader - Metals	Metals, Burnaby, British Columbia
Dee Lee	Analyst	Metals, Burnaby, British Columbia
Ophelia Chiu	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
mg/kg	milligrams per kilogram
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in reports identified as "Preliminary Report" are considered authorized for use.

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	4M1	4M2	4M3	4M4	4M5
					Client sampling date / time	03-Dec-2020	03-Dec-2020	03-Dec-2020	03-Dec-2020	03-Dec-2020
						VA20C2524-001	VA20C2524-002	VA20C2524-003	VA20C2524-004	VA20C2524-005
						Result	Result	Result	Result	Result
Physical Tests										
pH (1:2 soil:water)	----	E108	0.10	pH units		6.70	9.02	7.16	7.35	7.05
Metals										
aluminum	7429-90-5	E440	50	mg/kg		19100	30200	12400	15200	15000
antimony	7440-36-0	E440	0.10	mg/kg		0.28	0.43	0.28	0.32	0.32
arsenic	7440-38-2	E440	0.10	mg/kg		2.70	2.36	4.24	4.28	3.14
barium	7440-39-3	E440	0.50	mg/kg		176	239	56.8	98.9	150
beryllium	7440-41-7	E440	0.10	mg/kg		0.48	0.75	0.30	0.49	0.46
bismuth	7440-69-9	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
boron	7440-42-8	E440	5.0	mg/kg		5.9	7.9	<5.0	<5.0	<5.0
cadmium	7440-43-9	E440	0.020	mg/kg		0.218	0.281	0.082	0.092	0.154
calcium	7440-70-2	E440	50	mg/kg		6820	8400	15200	6690	6510
chromium	7440-47-3	E440	0.50	mg/kg		29.9	43.6	22.6	25.8	25.3
cobalt	7440-48-4	E440	0.10	mg/kg		12.8	18.1	11.2	8.79	10.8
copper	7440-50-8	E440	0.50	mg/kg		47.0	78.5	27.2	54.4	52.1
iron	7439-89-6	E440	50	mg/kg		27400	36200	29000	30100	26900
lead	7439-92-1	E440	0.50	mg/kg		4.92	8.52	2.65	3.90	4.46
lithium	7439-93-2	E440	2.0	mg/kg		6.3	10.1	7.2	6.7	5.7
magnesium	7439-95-4	E440	20	mg/kg		5130	8120	9520	5030	4800
manganese	7439-96-5	E440	1.0	mg/kg		740	905	511	381	597
mercury	7439-97-6	E510	0.0500	mg/kg		<0.0500	<0.0500	<0.0500	<0.0500	<0.0500
molybdenum	7439-98-7	E440	0.10	mg/kg		1.01	1.11	0.61	0.44	0.71
nickel	7440-02-0	E440	0.50	mg/kg		22.5	37.7	20.2	15.9	18.1
phosphorus	7723-14-0	E440	50	mg/kg		455	599	775	571	466
potassium	7440-09-7	E440	100	mg/kg		3410	5860	600	2160	2470
selenium	7782-49-2	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
silver	7440-22-4	E440	0.10	mg/kg		<0.10	0.16	<0.10	0.12	<0.10
sodium	7440-23-5	E440	50	mg/kg		316	323	371	166	221
strontium	7440-24-6	E440	0.50	mg/kg		57.9	70.2	57.1	41.5	71.6
sulfur	7704-34-9	E440	1000	mg/kg		<1000	<1000	<1000	<1000	<1000
thallium	7440-28-0	E440	0.050	mg/kg		0.098	0.156	<0.050	0.077	0.081
tin	7440-31-5	E440	2.0	mg/kg		<2.0	<2.0	<2.0	<2.0	<2.0

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	4M1	4M2	4M3	4M4	4M5
					Client sampling date / time	03-Dec-2020	03-Dec-2020	03-Dec-2020	03-Dec-2020	03-Dec-2020
						VA20C2524-001	VA20C2524-002	VA20C2524-003	VA20C2524-004	VA20C2524-005
						Result	Result	Result	Result	Result
Metals										
titanium	7440-32-6	E440	1.0	mg/kg		995	1320	1030	553	674
tungsten	7440-33-7	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
uranium	7440-61-1	E440	0.050	mg/kg		0.648	0.988	0.354	0.510	0.620
vanadium	7440-62-2	E440	0.20	mg/kg		71.4	71.1	72.5	80.8	76.7
zinc	7440-66-6	E440	2.0	mg/kg		76.8	101	48.9	46.1	53.6
zirconium	7440-67-7	E440	1.0	mg/kg		8.0	21.3	6.8	8.0	7.6

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	4M6	4M7	4M8	4MX	----
					Client sampling date / time	03-Dec-2020	03-Dec-2020	03-Dec-2020	03-Dec-2020	----
						VA20C2524-006	VA20C2524-007	VA20C2524-008	VA20C2524-009	--------
						Result	Result	Result	Result	----
Physical Tests										
pH (1:2 soil:water)	----	E108	0.10	pH units		7.36	8.99	7.14	8.97	----
Metals										
aluminum	7429-90-5	E440	50	mg/kg		21000	13400	25200	13100	----
antimony	7440-36-0	E440	0.10	mg/kg		0.38	0.28	0.43	0.29	----
arsenic	7440-38-2	E440	0.10	mg/kg		3.49	4.87	3.19	4.12	----
barium	7440-39-3	E440	0.50	mg/kg		179	52.6	221	64.7	----
beryllium	7440-41-7	E440	0.10	mg/kg		0.54	0.33	0.63	0.33	----
bismuth	7440-69-9	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	----
boron	7440-42-8	E440	5.0	mg/kg		5.9	<5.0	6.3	<5.0	----
cadmium	7440-43-9	E440	0.020	mg/kg		0.192	0.101	0.454	0.087	----
calcium	7440-70-2	E440	50	mg/kg		8260	19500	9430	15000	----
chromium	7440-47-3	E440	0.50	mg/kg		33.7	22.1	42.6	21.7	----
cobalt	7440-48-4	E440	0.10	mg/kg		14.3	10.9	21.0	10.8	----
copper	7440-50-8	E440	0.50	mg/kg		57.3	28.8	81.1	27.6	----
iron	7439-89-6	E440	50	mg/kg		32600	29400	32400	27500	----
lead	7439-92-1	E440	0.50	mg/kg		4.86	2.51	6.81	2.65	----
lithium	7439-93-2	E440	2.0	mg/kg		8.0	7.5	9.7	7.5	----
magnesium	7439-95-4	E440	20	mg/kg		6250	9670	8280	9070	----
manganese	7439-96-5	E440	1.0	mg/kg		865	627	1040	500	----
mercury	7439-97-6	E510	0.0500	mg/kg		<0.0500	<0.0500	<0.0500	<0.0500	----
molybdenum	7439-98-7	E440	0.10	mg/kg		0.72	0.51	0.52	0.47	----
nickel	7440-02-0	E440	0.50	mg/kg		26.7	17.9	38.9	19.2	----
phosphorus	7723-14-0	E440	50	mg/kg		418	922	620	752	----
potassium	7440-09-7	E440	100	mg/kg		3640	660	4220	710	----
selenium	7782-49-2	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	----
silver	7440-22-4	E440	0.10	mg/kg		<0.10	<0.10	0.16	<0.10	----
sodium	7440-23-5	E440	50	mg/kg		257	382	657	399	----
strontium	7440-24-6	E440	0.50	mg/kg		60.3	62.1	80.5	64.4	----
sulfur	7704-34-9	E440	1000	mg/kg		<1000	<1000	<1000	<1000	----
thallium	7440-28-0	E440	0.050	mg/kg		0.103	<0.050	0.132	<0.050	----
tin	7440-31-5	E440	2.0	mg/kg		<2.0	<2.0	<2.0	<2.0	----
titanium	7440-32-6	E440	1.0	mg/kg		990	1100	1670	1160	----

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	4M6	4M7	4M8	4MX	----
					Client sampling date / time	03-Dec-2020	03-Dec-2020	03-Dec-2020	03-Dec-2020	----
						VA20C2524-006	VA20C2524-007	VA20C2524-008	VA20C2524-009	--------
						Result	Result	Result	Result	----
Metals										
tungsten	7440-33-7	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	----
uranium	7440-61-1	E440	0.050	mg/kg		0.669	0.384	0.909	0.392	----
vanadium	7440-62-2	E440	0.20	mg/kg		90.2	78.4	83.1	75.7	----
zinc	7440-66-6	E440	2.0	mg/kg		65.5	45.9	82.8	45.1	----
zirconium	7440-67-7	E440	1.0	mg/kg		9.0	6.4	16.2	7.2	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA20C2524**	Page	: 1 of 9
Client	: **Gandalf Consulting Ltd.**	Laboratory	: Vancouver - Environmental
Contact	: Bob Symington	Account Manager	: Edward Ngai
Address	: 500 - 1190 Melville St. P.O. Box 48806 Vancouver BC Canada V6E 3W1	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 604 633 2750	Telephone	: +1 604 253 4188
Project	: 6040 LN	Date Samples Received	: 03-Dec-2020 17:24
PO	: ----	Issue Date	: 09-Dec-2020 16:44
C-O-C number	: 17-858032		
Sampler	: XS		
Site	: ----		
Quote number	: ----		
No. of samples received	: 9		
No. of samples analysed	: 9		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- Duplicate outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Soil/Solid**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Duplicate (DUP) RPDs								
Metals	Anonymous	Anonymous	antimony	7440-36-0	E440	86.4 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.
Metals	Anonymous	Anonymous	arsenic	7440-38-2	E440	33.2 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.
Metals	Anonymous	Anonymous	copper	7440-50-8	E440	33.6 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.

Result Qualifiers

Qualifier	Description
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 15:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 15:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
4M1	E510	03-Dec-2020	08-Dec-2020	28 days	5 days	✓	09-Dec-2020	22 days	0 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
4M2	E510	03-Dec-2020	08-Dec-2020	28 days	5 days	✓	09-Dec-2020	22 days	0 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
4M3	E510	03-Dec-2020	08-Dec-2020	28 days	5 days	✓	09-Dec-2020	22 days	0 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
4M4	E510	03-Dec-2020	08-Dec-2020	28 days	5 days	✓	09-Dec-2020	22 days	0 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
4M5	E510	03-Dec-2020	08-Dec-2020	28 days	5 days	✓	09-Dec-2020	22 days	0 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
4M6	E510	03-Dec-2020	08-Dec-2020	28 days	5 days	✓	09-Dec-2020	22 days	0 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
4M7	E510	03-Dec-2020	08-Dec-2020	28 days	5 days	✓	09-Dec-2020	22 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap 4M8	E510	03-Dec-2020	08-Dec-2020	28 days	5 days	✓	09-Dec-2020	22 days	0 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap 4MX	E510	03-Dec-2020	08-Dec-2020	28 days	5 days	✓	09-Dec-2020	22 days	0 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap 4M1	E440	03-Dec-2020	08-Dec-2020	180 days	5 days	✓	08-Dec-2020	174 days	0 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap 4M2	E440	03-Dec-2020	08-Dec-2020	180 days	5 days	✓	08-Dec-2020	174 days	0 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap 4M3	E440	03-Dec-2020	08-Dec-2020	180 days	5 days	✓	08-Dec-2020	174 days	0 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap 4M4	E440	03-Dec-2020	08-Dec-2020	180 days	5 days	✓	08-Dec-2020	174 days	0 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap 4M5	E440	03-Dec-2020	08-Dec-2020	180 days	5 days	✓	08-Dec-2020	174 days	0 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap 4M6	E440	03-Dec-2020	08-Dec-2020	180 days	5 days	✓	08-Dec-2020	174 days	0 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap 4M7	E440	03-Dec-2020	08-Dec-2020	180 days	5 days	✓	08-Dec-2020	174 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
4M8	E440	03-Dec-2020	08-Dec-2020	180 days	5 days	✓	08-Dec-2020	174 days	0 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
4MX	E440	03-Dec-2020	08-Dec-2020	180 days	5 days	✓	08-Dec-2020	174 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
4M1	E108	03-Dec-2020	08-Dec-2020	30 days	5 days	✓	09-Dec-2020	24 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
4M2	E108	03-Dec-2020	08-Dec-2020	30 days	5 days	✓	09-Dec-2020	24 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
4M3	E108	03-Dec-2020	08-Dec-2020	30 days	5 days	✓	09-Dec-2020	24 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
4M4	E108	03-Dec-2020	08-Dec-2020	30 days	5 days	✓	09-Dec-2020	24 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
4M5	E108	03-Dec-2020	08-Dec-2020	30 days	5 days	✓	09-Dec-2020	24 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
4M6	E108	03-Dec-2020	08-Dec-2020	30 days	5 days	✓	09-Dec-2020	24 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
4M7	E108	03-Dec-2020	08-Dec-2020	30 days	5 days	✓	09-Dec-2020	24 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
4M8	E108	03-Dec-2020	08-Dec-2020	30 days	5 days	✓	09-Dec-2020	24 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
4MX	E108	03-Dec-2020	08-Dec-2020	30 days	5 days	✓	09-Dec-2020	24 days	0 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Mercury in Soil/Solid by CVAAS	E510	126720	1	16	6.2	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	126719	1	16	6.2	5.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	126721	1	16	6.2	5.0	✓
Laboratory Control Samples (LCS)							
Mercury in Soil/Solid by CVAAS	E510	126720	2	16	12.5	10.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	126719	2	16	12.5	10.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	126721	1	16	6.2	5.0	✓
Method Blanks (MB)							
Mercury in Soil/Solid by CVAAS	E510	126720	1	16	6.2	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	126719	1	16	6.2	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
pH by Meter (1:2 Soil:Water Extraction)	E108 Vancouver - Environmental	Soil/Solid	BC Lab Manual	pH is determined by potentiometric measurement with a pH electrode at ambient laboratory temperature (normally 20 ± 5°C), and is carried out in accordance with procedures described in the BC Lab Manual (prescriptive method). The procedure involves mixing the dried (at <60 ºC) and sieved (10mesh/2mm) sample with ultra pure water at a 1:2 ratio of sediment to water. The pH is then measured by a standard pH probe.
Metals in Soil/Solid by CRC ICPMS	E440 Vancouver - Environmental	Soil/Solid	EPA 6020B (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl. This method is intended to liberate metals that may be environmentally available. Silicate minerals are not solubilized. Dependent on sample matrix, some metals may be only partially recovered, including Al, Ba, Be, Cr, Sr, Ti, Tl, V, W, and Zr. Volatile forms of sulfur (including sulfide) may not be captured, as they may be lost during sampling, storage, or digestion. Analysis is by Collision/Reaction Cell ICPMS.
Mercury in Soil/Solid by CVAAS	E510 Vancouver - Environmental	Soil/Solid	EPA 200.2/1631 Appendix (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl, followed by CVAAS analysis.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Leach 1:2 Soil:Water for pH/EC	EP108 Vancouver - Environmental	Soil/Solid	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL	The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water.
Digestion for Metals and Mercury	EP440 Vancouver - Environmental	Soil/Solid	EPA 200.2 (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl. This method is intended to liberate metals that may be environmentally available.

QUALITY CONTROL REPORT

Work Order	: **VA20C2524**	Page	: 1 of 10
Client	: Gandalf Consulting Ltd.	Laboratory	: Vancouver - Environmental
Contact	: Bob Symington	Account Manager	: Edward Ngai
Address	: 500 - 1190 Melville St. P.O. Box 48806 Vancouver BC Canada V6E 3W1	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 604 633 2750	Telephone	: +1 604 253 4188
Project	: 6040 LN	Date Samples Received	: 03-Dec-2020 17:24
PO	: ----	Date Analysis Commenced	: 08-Dec-2020
C-O-C number	: 17-858032	Issue Date	: 09-Dec-2020 16:44
Sampler	: XS		
Site	: ----		
Quote number	: ----		
No. of samples received	: 9		
No. of samples analysed	: 9		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits
- Reference Material (RM) Report; Recovery and Acceptance Limits
- Method Blank (MB) Report; Recovery and Acceptance Limits
- Laboratory Control Sample (LCS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Angela Ren	Team Leader - Metals	Metals, Burnaby, British Columbia
Dee Lee	Analyst	Metals, Burnaby, British Columbia
Ophelia Chiu	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Services number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percentage Difference
# = Indicates a QC result that did not meet the ALS DQO.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test specific).

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Physical Tests (QC Lot: 126721)											
VA20C2429-001	Anonymous	pH (1:2 soil:water)	----	E108	0.10	pH units	6.52	6.68	2.42%	5%	----
Metals (QC Lot: 126719)											
VA20C2429-001	Anonymous	aluminum	7429-90-5	E440	50	mg/kg	27300	27800	1.81%	40%	----
		antimony	7440-36-0	E440	0.10	mg/kg	1.45	3.65	86.4%	30%	DUP-H
		arsenic	7440-38-2	E440	0.10	mg/kg	8.15	11.4	33.2%	30%	DUP-H
		barium	7440-39-3	E440	0.50	mg/kg	130	141	8.32%	40%	----
		beryllium	7440-41-7	E440	0.10	mg/kg	0.40	0.40	0.007	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		boron	7440-42-8	E440	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		cadmium	7440-43-9	E440	0.020	mg/kg	0.249	0.232	6.85%	30%	----
		calcium	7440-70-2	E440	50	mg/kg	5790	6440	10.5%	30%	----
		chromium	7440-47-3	E440	0.50	mg/kg	41.2	38.7	6.24%	30%	----
		cobalt	7440-48-4	E440	0.10	mg/kg	10.7	11.3	4.90%	30%	----
		copper	7440-50-8	E440	0.50	mg/kg	103	73.4	33.6%	30%	DUP-H
		iron	7439-89-6	E440	50	mg/kg	28100	31300	11.0%	30%	----
		lead	7439-92-1	E440	0.50	mg/kg	23.2	22.4	3.29%	40%	----
		lithium	7439-93-2	E440	2.0	mg/kg	14.8	15.8	6.37%	30%	----
		magnesium	7439-95-4	E440	20	mg/kg	6410	6750	5.23%	30%	----
		manganese	7439-96-5	E440	1.0	mg/kg	485	499	2.74%	30%	----
		molybdenum	7439-98-7	E440	0.10	mg/kg	0.93	0.89	5.10%	40%	----
		nickel	7440-02-0	E440	0.50	mg/kg	32.6	32.1	1.78%	30%	----
		phosphorus	7723-14-0	E440	50	mg/kg	750	832	10.4%	30%	----
		potassium	7440-09-7	E440	100	mg/kg	920	980	7.14%	40%	----
		selenium	7782-49-2	E440	0.20	mg/kg	0.31	0.29	0.02	Diff <2x LOR	----
		silver	7440-22-4	E440	0.10	mg/kg	0.47	0.45	0.02	Diff <2x LOR	----
		sodium	7440-23-5	E440	50	mg/kg	160	179	19	Diff <2x LOR	----
		strontium	7440-24-6	E440	0.50	mg/kg	33.1	33.0	0.426%	40%	----
		sulfur	7704-34-9	E440	1000	mg/kg	<1000	<1000	0	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.050	mg/kg	0.094	0.098	0.004	Diff <2x LOR	----
		tin	7440-31-5	E440	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		titanium	7440-32-6	E440	1.0	mg/kg	1190	1300	8.80%	40%	----
		tungsten	7440-33-7	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 126719) - continued											
VA20C2429-001	Anonymous	uranium	7440-61-1	E440	0.050	mg/kg	0.464	0.493	6.10%	30%	----
		vanadium	7440-62-2	E440	0.20	mg/kg	66.1	75.1	12.8%	30%	----
		zinc	7440-66-6	E440	2.0	mg/kg	142	155	8.70%	30%	----
		zirconium	7440-67-7	E440	1.0	mg/kg	1.7	1.9	0.2	Diff <2x LOR	----
Metals (QC Lot: 126720)											
VA20C2429-001	Anonymous	mercury	7439-97-6	E510	0.0500	mg/kg	0.118	0.0993	0.0186	Diff <2x LOR	----

Qualifiers

Qualifier	*Description*
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 126719)						
aluminum	7429-90-5	E440	50	mg/kg	<50	----
antimony	7440-36-0	E440	0.1	mg/kg	<0.10	----
arsenic	7440-38-2	E440	0.1	mg/kg	<0.10	----
barium	7440-39-3	E440	0.5	mg/kg	<0.50	----
beryllium	7440-41-7	E440	0.1	mg/kg	<0.10	----
bismuth	7440-69-9	E440	0.2	mg/kg	<0.20	----
boron	7440-42-8	E440	5	mg/kg	<5.0	----
cadmium	7440-43-9	E440	0.02	mg/kg	<0.020	----
calcium	7440-70-2	E440	50	mg/kg	<50	----
chromium	7440-47-3	E440	0.5	mg/kg	<0.50	----
cobalt	7440-48-4	E440	0.1	mg/kg	<0.10	----
copper	7440-50-8	E440	0.5	mg/kg	<0.50	----
iron	7439-89-6	E440	50	mg/kg	<50	----
lead	7439-92-1	E440	0.5	mg/kg	<0.50	----
lithium	7439-93-2	E440	2	mg/kg	<2.0	----
magnesium	7439-95-4	E440	20	mg/kg	<20	----
manganese	7439-96-5	E440	1	mg/kg	<1.0	----
molybdenum	7439-98-7	E440	0.1	mg/kg	<0.10	----
nickel	7440-02-0	E440	0.5	mg/kg	<0.50	----
phosphorus	7723-14-0	E440	50	mg/kg	<50	----
potassium	7440-09-7	E440	100	mg/kg	<100	----
selenium	7782-49-2	E440	0.2	mg/kg	<0.20	----
silver	7440-22-4	E440	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E440	50	mg/kg	<50	----
strontium	7440-24-6	E440	0.5	mg/kg	<0.50	----
sulfur	7704-34-9	E440	1000	mg/kg	<1000	----
thallium	7440-28-0	E440	0.05	mg/kg	<0.050	----
tin	7440-31-5	E440	2	mg/kg	<2.0	----
titanium	7440-32-6	E440	1	mg/kg	<1.0	----
tungsten	7440-33-7	E440	0.5	mg/kg	<0.50	----
uranium	7440-61-1	E440	0.05	mg/kg	<0.050	----
vanadium	7440-62-2	E440	0.2	mg/kg	<0.20	----
zinc	7440-66-6	E440	2	mg/kg	<2.0	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 126719) - continued						
zirconium	7440-67-7	E440	1	mg/kg	<1.0	----
Metals (QCLot: 126720)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 126721)									
pH (1:2 soil:water)	----	E108	----	pH units	6 pH units	100	95.0	105	----
Metals (QCLot: 126719)									
aluminum	7429-90-5	E440	50	mg/kg	200 mg/kg	99.3	80.0	120	----
antimony	7440-36-0	E440	0.1	mg/kg	100 mg/kg	95.0	80.0	120	----
arsenic	7440-38-2	E440	0.1	mg/kg	100 mg/kg	96.2	80.0	120	----
barium	7440-39-3	E440	0.5	mg/kg	25 mg/kg	101	80.0	120	----
beryllium	7440-41-7	E440	0.1	mg/kg	10 mg/kg	100	80.0	120	----
bismuth	7440-69-9	E440	0.2	mg/kg	100 mg/kg	95.8	80.0	120	----
boron	7440-42-8	E440	5	mg/kg	100 mg/kg	99.6	80.0	120	----
cadmium	7440-43-9	E440	0.02	mg/kg	10 mg/kg	100	80.0	120	----
calcium	7440-70-2	E440	50	mg/kg	5000 mg/kg	105	80.0	120	----
chromium	7440-47-3	E440	0.5	mg/kg	25 mg/kg	97.8	80.0	120	----
cobalt	7440-48-4	E440	0.1	mg/kg	25 mg/kg	99.0	80.0	120	----
copper	7440-50-8	E440	0.5	mg/kg	25 mg/kg	96.7	80.0	120	----
iron	7439-89-6	E440	50	mg/kg	100 mg/kg	97.8	80.0	120	----
lead	7439-92-1	E440	0.5	mg/kg	50 mg/kg	97.4	80.0	120	----
lithium	7439-93-2	E440	2	mg/kg	25 mg/kg	102	80.0	120	----
magnesium	7439-95-4	E440	20	mg/kg	5000 mg/kg	102	80.0	120	----
manganese	7439-96-5	E440	1	mg/kg	25 mg/kg	101	80.0	120	----
molybdenum	7439-98-7	E440	0.1	mg/kg	25 mg/kg	93.4	80.0	120	----
nickel	7440-02-0	E440	0.5	mg/kg	50 mg/kg	97.0	80.0	120	----
phosphorus	7723-14-0	E440	50	mg/kg	1000 mg/kg	99.9	80.0	120	----
potassium	7440-09-7	E440	100	mg/kg	5000 mg/kg	96.7	80.0	120	----
selenium	7782-49-2	E440	0.2	mg/kg	100 mg/kg	90.7	80.0	120	----
silver	7440-22-4	E440	0.1	mg/kg	10 mg/kg	90.2	80.0	120	----
sodium	7440-23-5	E440	50	mg/kg	5000 mg/kg	101	80.0	120	----
strontium	7440-24-6	E440	0.5	mg/kg	25 mg/kg	97.7	80.0	120	----
sulfur	7704-34-9	E440	1000	mg/kg	5000 mg/kg	98.4	80.0	120	----
thallium	7440-28-0	E440	0.05	mg/kg	100 mg/kg	93.8	80.0	120	----
tin	7440-31-5	E440	2	mg/kg	50 mg/kg	91.5	80.0	120	----
titanium	7440-32-6	E440	1	mg/kg	25 mg/kg	92.6	80.0	120	----
tungsten	7440-33-7	E440	0.5	mg/kg	10 mg/kg	96.3	80.0	120	----
uranium	7440-61-1	E440	0.05	mg/kg	0.5 mg/kg	104	80.0	120	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 126719) - continued									
vanadium	7440-62-2	E440	0.2	mg/kg	50 mg/kg	99.6	80.0	120	----
zinc	7440-66-6	E440	2	mg/kg	50 mg/kg	95.9	80.0	120	----
zirconium	7440-67-7	E440	1	mg/kg	10 mg/kg	87.6	80.0	120	----
Metals (QCLot: 126720)									
mercury	7439-97-6	E510	0.005	mg/kg	0.1 mg/kg	102	80.0	120	----

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix: **Soil/Solid**

Reference Material (RM) Report									
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method					
Metals (QCLot: 126719)									
QC-126719-003	SCP SS-2	aluminum	7429-90-5	E440	9817 mg/kg	101	70.0	130	----
QC-126719-003	SCP SS-2	antimony	7440-36-0	E440	3.99 mg/kg	95.1	70.0	130	----
QC-126719-003	SCP SS-2	arsenic	7440-38-2	E440	3.73 mg/kg	103	70.0	130	----
QC-126719-003	SCP SS-2	barium	7440-39-3	E440	105 mg/kg	102	70.0	130	----
QC-126719-003	SCP SS-2	beryllium	7440-41-7	E440	0.349 mg/kg	102	70.0	130	----
QC-126719-003	SCP SS-2	boron	7440-42-8	E440	8.5 mg/kg	110	40.0	160	----
QC-126719-003	SCP SS-2	cadmium	7440-43-9	E440	0.91 mg/kg	101	70.0	130	----
QC-126719-003	SCP SS-2	calcium	7440-70-2	E440	31082 mg/kg	104	70.0	130	----
QC-126719-003	SCP SS-2	chromium	7440-47-3	E440	101 mg/kg	103	70.0	130	----
QC-126719-003	SCP SS-2	cobalt	7440-48-4	E440	6.9 mg/kg	100	70.0	130	----
QC-126719-003	SCP SS-2	copper	7440-50-8	E440	123 mg/kg	99.8	70.0	130	----
QC-126719-003	SCP SS-2	iron	7439-89-6	E440	23558 mg/kg	101	70.0	130	----
QC-126719-003	SCP SS-2	lead	7439-92-1	E440	267 mg/kg	91.6	70.0	130	----
QC-126719-003	SCP SS-2	lithium	7439-93-2	E440	9.5 mg/kg	99.7	70.0	130	----
QC-126719-003	SCP SS-2	magnesium	7439-95-4	E440	5509 mg/kg	98.7	70.0	130	----
QC-126719-003	SCP SS-2	manganese	7439-96-5	E440	269 mg/kg	104	70.0	130	----
QC-126719-003	SCP SS-2	molybdenum	7439-98-7	E440	1.03 mg/kg	93.0	70.0	130	----
QC-126719-003	SCP SS-2	nickel	7440-02-0	E440	26.7 mg/kg	98.2	70.0	130	----
QC-126719-003	SCP SS-2	phosphorus	7723-14-0	E440	752 mg/kg	93.3	70.0	130	----
QC-126719-003	SCP SS-2	potassium	7440-09-7	E440	1587 mg/kg	102	70.0	130	----
QC-126719-003	SCP SS-2	sodium	7440-23-5	E440	797 mg/kg	101	70.0	130	----
QC-126719-003	SCP SS-2	strontium	7440-24-6	E440	86.1 mg/kg	92.9	70.0	130	----
QC-126719-003	SCP SS-2	thallium	7440-28-0	E440	0.0786 mg/kg	92.4	40.0	160	----
QC-126719-003	SCP SS-2	tin	7440-31-5	E440	10.6 mg/kg	92.5	70.0	130	----
QC-126719-003	SCP SS-2	titanium	7440-32-6	E440	839 mg/kg	109	70.0	130	----
QC-126719-003	SCP SS-2	uranium	7440-61-1	E440	0.52 mg/kg	105	70.0	130	----
QC-126719-003	SCP SS-2	vanadium	7440-62-2	E440	32.7 mg/kg	103	70.0	130	----
QC-126719-003	SCP SS-2	zinc	7440-66-6	E440	297 mg/kg	97.0	70.0	130	----
QC-126719-003	SCP SS-2	zirconium	7440-67-7	E440	5.73 mg/kg	89.4	70.0	130	----

Sub-Matrix: **Soil/Solid**

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 126720)									
QC-126720-003	SCP SS-2	mercury	7439-97-6	E510	0.059 mg/kg	103	70.0	130	----

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 858032

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	Gandalf
Contact:	Bob Symington
Phone:	
	Company address below will appear on the final report
Street:	
City/Province:	
Postal Code:	
Invoice To	Same as Report To [X] YES [ ] NO
	Copy of Invoice with Report [X] YES [ ] NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	[ ] PDF [X] EXCEL [ ] EDD (DIGITAL)
Quality Control (QC) Report with Report	[X] YES [ ] NO
[ ] Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	[X] EMAIL [ ] MAIL [ ] FAX
Email 1 or Fax	Bob
Email 2	Paul
Email 3	Xavier
Invoice Distribution	
Select Invoice Distribution:	[X] EMAIL [ ] MAIL [ ] FAX
Email 1 or Fax	
Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:	6040LN	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):		ALS Contact:	Sampler: XS

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] [X] Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] [ ] | 3 day [P3-25%] [ ] | 2 day [P2-50%] [ ]

EMERGENCY: 1 Business day [E - 100%] [ ] | Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)] [ ]

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	metals	SAMPLES ON HOLD	SUSPECTED HAZARD (see Special Instructions)
	4m 1	Dec 3/20		Soil	1	X		
	4m 2				1	X		
	4m 3				1	X		
	4m 4				1	X		
	4m 5				1	X		
	4m 6				1	X		
	4m 7				1	X		
	4m 8				1	X		
	4m X				1	X		

Environmental Division
Vancouver
Work Order Reference
VA20C2524

Telephone : +1 604 253 4188

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? [ ] YES [ ] NO

Are samples for human consumption/ use? [ ] YES [ ] NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen [ ] | SIF Observations Yes [ ] No [ ]

Ice Packs [ ] Ice Cubes [ ] | Custody seal intact Yes [ ] No [ ]

Cooling Initiated [ ]

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
				13.9			

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Xavier	Date: Dec 3	Time: 5:15pm	Received by:	Date:	Time:	Received by: MB	Date: Dec 3	Time: 5:24PM

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

JUNE 2018 FRONT

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.