Appendix F

Edie Lake Geotechnical Assessment Report

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Memo

To: Joe Acorn, Manager – Mackenzie Valley Highway Environmental Affairs

From: Blake Brodland, P.Eng. **Reviewer:** Kevin Spencer, P.Eng., M.Eng.

cc: Patricia Coyne, Senior Environmental Analysist **Project No.:** CG14367

Date: 31 March 2020

Re: Edie Lake Quarry Investigation

1 Introduction

Wood Environment & Infrastructure Solutions (Wood), a Division of Wood Canada, is pleased to submit this memorandum to the Government of the Northwest Territories (GNWT) for materials testing at the existing Edie Lake Quarry. The Edie Lake Quarry is located approximately 12 km east of Norman Wells, NT. This work was done in response to discussion and email with Joe Acorn. The work was undertaken under contract SC-458837, issued 17 January 2020.

2 Background

It is understood that testing of the rock at the prospective quarry was intended to have been conducted on rock core recovered from the 2016 borehole investigation completed by others between 26 and 29 March 2016, however poor borehole recovery resulted in limited samples being recovered for testing. During the drilling program at the quarry the rock was identified as limestone, described as grey-brown, fine grained, crystalline and moderately strong. The samples which were recovered are understood to have been discarded. Subsequently, the quarry was developed, and the recovered rock was used to build the Canyon Creek All-Season Access Road, which was completed by 2018.

The Edie Lake Quarry was visited on 30 May 2019 by Wood representatives B. Brodland, P.Eng. and N. Khan, GIT and the GNWT representative B. An, P.Eng..

The number of samples which should be collected and tested for a quarry depends on the geology, however some rules of thumb are presented in Table 1, which is based on British Columbia Acid Rock Drainage Guidelines. The guidelines are to be used in conjunction with the understanding of the site conditions and geology to refine the testing requirements further.

Table 1: SAMPLES PER QUARRY SIZE (PRICE AND ERRINGTON 1997)

Metric Tonnes (1,000 kg)	Recommended Number of Samples
<10,000	3
<100,000	8
<1,000,000	26
<100,000,000	80

In addition to the number of samples, there are specific sampling techniques outlined by the American Society for Testing and Materials (ASTM) in document D75/D75M-14 for use when sampling from quarry stockpiles. The proper ASTM sampling procedures for the sample collected by Wood in May 2019 were not followed, since the sample was collected ad hoc and not under a specific scope or purpose. The collection methodology and number of samples do not meet standard practices.

3 Scope of Work

The analysis completed as part of the scope of work for this project included:

- Acid-Base Accounting (ABA) Analysis;
- Whole Rock Metals (ICP-MS) Analysis;
- Shake Flask Extraction (SFE) Analysis;
- Petrographic Analysis;
- Flakiness Index (ATT 49/94); and
- Los Angeles Abrasion (CSA A23.2-16A or 17A).

The GNWT requested to proceed with completing as many tests listed above as were practical based on the single bucket of rock sample (approximately 35kg) collected by Wood in May 2019.

Upon completion, this short summary memorandum was be prepared to present the results of the laboratory testing.

4 Site Visit

A sample was collected under the direction of the GNWT from what appeared to be a safety berm near the toe of the blasted cut as shown in Photograph 1. A single 5-gallon bucket of rock sample was collected (approximately 35 kg) as shown in Photograph 2 and was shipped to the Wood laboratory.

The sample was collected from what appeared to be a safety berm near the toe of the blasted cut. This sample may or may not be representative of the quarry. The sample was likely exposed to weathering, which may skew physical results to be less favourable and may influence chemical results to be more representative of weathered material instead of fresh material. Weathering can potentially result in some leaching of sulphide minerals, which in turn can alter the metal leaching behaviour of the material.

Photograph 1: Edie Lake Quarry, sample collected from berm in foreground

Photograph 2: Sample Collected from Edie Lake Quarry

5 Laboratory Results and Discussion

The following sections discuss the test purpose and the corresponding results.

5.1 Acid-Base Accounting (ABA) Analysis

Assessment of the potential for a sample to generate acidity is known as acid base accounting (ABA) and is primarily defined by the neutralization potential ratio (NPR), which is the ratio of the neutralization potential (NP) to acid potential (AP) (NPR=NP/AP). For sample screening purposes, the British Columbia MOTI circular T-04/13 identifies three different scenarios:

Scenario 1: NPR>2
Samples with NPR>2 indicate that the sample is non-potentially acid generating (non-PAG) with a low potential to generate ARD.

Scenario 2: NPR between 1 and 2
Samples with NPR between 1 and 2 indicate that the potential of the sample to produce ARD is uncertain (uncertain PAG). Further alternate testing and other methods of evaluation must be conducted to resolve the uncertainty in the evaluation.

Scenario 3: NPR<1
Samples with NPR<1 have a high potential to produce ARD and are potentially acid generating (PAG). These rocks are generally deemed unsuitable for aggregate sources, and the rock should not be further disturbed or exposed.

5.1.1 Results

The results of this testing are summarized below in Table 2. The full laboratory results are available in Appendix A.

Table 2: ACID-BASE ACCOUNTING ANALYSIS SUMMARY

Fizz Rating	Paste pH	Total Sulphur (wt%)	Sulphate Sulphur (wt%)	Sulphide Sulphur (wt%)	Maximum Potential Acidity (kg CaCO3 /tonne)	Neutralization Potential (kg CaCO3 /tonne)	Net Neutralization Potential (kg CaCO3 /tonne)	Neutralization Potential Ratio (kg CaCO3 /tonne)
Strong	10.0	0.05	<0.01	0.05	1.6	738.5	736.9	472.6

5.1.2 Discussion

The results of the testing indicate that this rock is non-potentially acid generating (non-PAG) with a low sulphide content and a low potential to generate ARD. The very high neutralization potential is consistent with carbonate rock.

5.2 Whole Rock Metals (ICP-MS) Analysis

Total solid phase elemental analysis quantifies the concentration of a range of elements of environmental interest in a sample. These results cannot be directly related to the potential for metal leaching for a given element, rather they support other characterization techniques and can be used as a screening tool to identify possible metal enrichment by comparison to average crustal abundance values (Price, 1997). For screening purposes, samples with more than ten-times the average crustal abundance for a given element are considered enriched.

5.2.1 Results

The results of this testing are summarized in Table 3, possible exceedances are highlighted yellow. The full laboratory results are available in Appendix A.

Table 3: WHOLE ROCK METAL (ICP-MS) ANALYSIS SUMMARY

Parameter	Screening Concentration[1] (ppm)	Sample Result (ppm)		Parameter	Screening Concentration[1] (ppm)	Sample Result (ppm)
Silver Ag	0.75	0.05		**Molybdenum Mo**	12	0.62
Aluminum Al	823,000	200[2]		**Sodium Na**	235,500	<100[2]
Arsenic As	18	0.3		**Columbium Nb**	200	0.06
Gold Au	0.04	0.008		**Nickle Ni**	840	1.7
Boron B	100	<5		**Phosphorus P**	10,500	30[2]
Barium Ba	4,250	46		**Lead Pb**	140	2.7
Beryllium Be	30	0.14		**Rubidium Rb**	900	0.8
Bismuth Bi	0.085	0.04		**Rhenium Re**	0.007	0.002
Calcium Ca	415,000	>250,000[2]		**Sulfur S**	3,500	600[2]
Cadmium Cd	30	0.09		**Antimony Sb**	2	0.16
Cerium Ce	665	1.24		**Scandium Sc**	220	<0.1
Cobalt Co	250	1.4		**Selenium Se**	0.5	0.7
Chromium Cr	1,020	0.8		**Tin Sn**	23	<0.2
Caesium Cs	96	0.06		**Strontium Sr**	3,700	323
Copper Cu	600	4.2		**Tantalum Ta**	20	<0.01
Iron Fe	563,000	700[2]		**Tellurium Te**	-	<0.01
Gallium Ga	190	0.5		**Thorium Th**	12	0.2
Germanium Ge	15	<0.05		**Titanium Ti**	56,500	<50[2]
Hafnium Hf	30	<0.02		**Thallium Tl**	8.5	<0.01
Mercury Hg	0.85	<0.01		**Uranium U**	27	0.61
Indium In	2.5	<0.005		**Vanadium V**	1,200	1.8
Potassium K	208,500	100[2]		**Tungsten W**	12.5	<0.5
Lanthanum La	390	0.5		**Yttrium Y**	330	0.67
Lithium Li	200	5.2		**Zinc Zn**	700	6
Magnesium Mg	233,000	2,100[2]		**Zirconium Zr**	1650	<0.5
Manganese Mn	9,500	<1		**-**	-	-

Notes

1. Screening Concentrations are from Appendix 3 Norman Trace Element Concentrations in Selected Rock Types of DRAFT Guidelines and Recommended Methods for the Prediction of Metal Leaching and Acid Rock Drainage at Mine sites in British Columbia., published by Reclamation Section Energy and Mineral Division, authored by Dr. Willian A. Price, April 1997, using ten-times the continental crust concentrations
2. Values were reported in percentage (parts per hundred) and converted to parts per million (ppm)
3. Yellow colour indicates a possible exceedance

5.2.2 Discussion

With the exception of one parameter, all of the reported values fall below the ten-times continental crust concentration values identified in DRAFT Guidelines and Recommended Methods for the Prediction of Metal Leaching and Acid Rock Drainage at Mine sites in British Columbia.

The Calcium content in the sample exceeded the test detection maximum of >250,000 ppm. The calcium content may or may not exceed the ten-times continental crust concentration value which is 415,000 ppm. Given that the rock is carbonate, this result is unsurprising and is likely not a concern. For comparison, the ten-times sedimentary carbonate rock concentration is 3,023,000 ppm.

5.3 Shake Flask Extraction (SFE) Analysis

Leachable metal tests are used to assess the presence of potentially soluble elements and their release during initial stages of weathering. The results of leachable metal testing are used as a geochemical screening tool to assess whether short-term metal leaching could potentially occur from a sample. They are not direct measures of the expected drainage chemistry but are used as a screening tool to identify potential metal/elements of concern for leaching.

For comparison purposes only, the leachable metal results were also reviewed in relation to the *Guidelines for Designing and Implementing Aquatic Effects Monitoring Programs for Development Project in the Northwest Territories, AEMP Technical Guidance Document Volume 3* (June 2009). These values are not directly comparable to leachate from source materials. This comparison is strictly for reference purposes and implies neither compliance nor non-compliance with specific guidelines but provides reference to potential impact related to metal leaching. The leachable metal results are considered elevated when concentrations are greater than the guideline values.

5.3.1 Results

The results of this testing are summarized below in Table 4. The full laboratory results are available in Appendix A.

Table 4: SHAKE FLASK EXTRACTION (SFE) ANALYSIS SUMMARY

Parameter (dissolved)	AEMP Screening Threshold[1] (mg/L)	CCME Long-Term Screening Threshold (mg/L)	Waste Discharge Screening Threshold (mg/L)	Sample Result (mg/L)
Silver	0.000098	0.00025	0.1	<0.00008
Aluminum	0.0884	-	1	0.084
Arsenic	0.154	0.005	1	<0.0002
Boron	-	1.5	-	<0.01
Barium	-	-	1	0.0398
Beryllium	-	-	-	<0.0001
Bismuth	-	-	-	<0.0001
Calcium	-	-	-	5.80
Cadmium	0.00039	-	0.1	<0.00001
Cobalt	-	-	-	<0.0001
Chromium	0.0108[2]	-	0.1	<0.0005
Copper	0.00417	-	1	<0.0005
Iron	0.887	0.3	1	<0.02
Mercury	0.000182	0.000026	0.0006	<0.000003[3]
Potassium	-	-	-	0.44
Lithium	-	-	-	0.0011
Magnesium	-	-	-	0.59
Manganese	-	-	-	<0.0002
Molybdenum	0.395	0.073	-	0.0014
Sodium	-	-	-	0.53
Nickel	0.0605	-	1	<0.0005
Phosphorus	-	-	1	<0.05
Lead	-	-	0.05	<0.0005
Sulphur	-	-	-	1.2
Antimony	-	-	-	<0.0001
Selenium	0.00496	0.001	-	<0.0005

Parameter (dissolved)	AEMP Screening Threshold[1] (mg/L)	CCME Long-Term Screening Threshold (mg/L)	Waste Discharge Screening Threshold (mg/L)	Sample Result (mg/L)
Silicon	-	-	-	0.25
Tin	0.0848	-	1	<0.0005
Strontium	-	-	-	0.0340
Tellurium	-	-	-	<0.0002
Thorium	-	-	-	<0.0001
Titanium	-	-	-	<0.0005
Thallium	0.00985	0.0008	-	<0.00005
Uranium	0.0026	0.015	-	0.00011
Vanadium	0.0177	-	-	<0.001
Tungsten	-	-	-	<0.0001
Zinc	0.0608	-	0.5	<0.001
Zirconium	-	-	-	<0.0001

Notes

1. AEMP Screening Thresholds are from Appendix A, Table A.1.2: Toxicity thresholds for surface water and pore water (freshwater) of Guidelines for Designing and Implementing Aquatic Effects Monitoring Programs for Development Projects in the Northwest Territories, Recommended Procedures for Developing Data Quality Objectives and a Conceptual Study Design, AEMP Technical Guidance Document Volume 3, published by Indian and Northern Affairs Canada, June 2009
2. Values for Chromium III and Chromium IV given in reference, the low (i.e. more conservative value is presented herein)
3. The original value reported was <0.0005, which was above the toxicity threshold. The result of a more detailed re-test is provided.
4. Where no screening threshold is presented, a specific threshold was not given in the reference document.
5. CCME Long-Term Screening Thresholds are from Canadian Council of Ministers of the Environment, Chapter Water Quality Guidelines for the Protection of Aquatic Life
6. Waste Discharge Screening Thresholds are from Guideline for Industrial Waste Discharged in the NWT, Schedule II: Standard for Non-Point Sources Discharges, Concentrations not to be Exceeded, April 2004

5.3.2 Discussion

All of the reported values fall below the three screening thresholds.

5.4 Petrographic Analysis

Petrographic analysis was conducted to determine the physical and chemical characteristics of the aggregate, classify and determine relative amounts of the constituents, and to determine the presence of any deleterious substances in the aggregate. Petrographic analysis was also used to provide a petrographic number (PN) which is an appraisal of the physical-mechanical quality of the coarse aggregate. The petrographic number may be used for different purposes including providing a preliminary assessment for the quality of aggregate and monitoring the quality of aggregate produced.

5.4.1 Results

The constituents that made up more than 5% of the sample are summarized below in Table 5. The full laboratory results are available in Appendix A.

Table 5: PETROGRAPHIC ANALYSIS SUMMARY

Constituent	Constituent Percentage in Entire Sample (%)	Petrographic Number
Carbonate - grey; micritic to fine grained; calcite content less than 1%; angular - irregular; hard to medium hard	29.3	110
Carbonate - grey; micritic to fine grained; calcite content less than 5%; angular - irregular; hard to medium hard	16.7	
Carbonate - grey; micritic to fine grained; calcite content less than 1%; occasional stylolites; angular - irregular; hard to medium hard	14.0	
Carbonate - grey; micritic to fine grained; calcite content less than 5%; occasional stylolites; angular - irregular; hard to medium hard	9.5	
Carbonate - grey; micritic to fine grained; calcite content less than 1%; with sphalerite; angular - irregular; hard to medium hard	9.3	

5.4.2 Discussion

The petrographic analysis and PN indicate that the rock is of good quality for use as aggregate. The closer the PN is to 100, the better the quality of the rock. Table 6 below shows the suggested PN limits for aggregate quality classifications as indicated on Table A3.1 from Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for concrete, published by Canadian Standards Association Group in June 2019.

Table 6: SUGGESTED PN LIMITS FOR AGGREGATE QUALITY CLASSIFICATIONS[1]

Product type	Maximum PN Limit
Concrete class C1, C2, F1, C-XL, A-XL, A-1, A-2	125
Other concrete classes	140
Shotcrete	125
Railroad ballast	125
Granular base	150
Select granular sub-base	160

Note

1. Table taken from Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete published by Canadian Standards Association Group in June 2019; Table A3.1.

5.5 Flakiness Index (ATT 49/94)

The flakiness index is determined using a series of sieves with rectangular slots instead of square mesh. The weights of aggregate passing and retained on various sieves is measured in an effort to determine the flakiness of a particular aggregate. A flaky particle generally has a thickness less than 0.6 of their nominal size. A lower flakiness index corresponds to higher aggregate sphericity.

5.5.1 Results

The results of this testing are summarized below in Table 7. The full laboratory results are available in Appendix A.

Table 7: FLAKINESS INDEX SUMMARY

Sieve Fraction (mm)	Flakiness Index (%)
14-20	15.6
10-14	18.3
6.3-10	24.9
Total Flakiness Index	18.1

5.5.2 Discussion

The result of the test indicated a total flakiness index of 18.1%, which is considered acceptable. The finer aggregates seem to have a higher degree of flakiness. A flakiness index of 30% or higher is generally considered undesirable.

5.6 Los Angeles Abrasion

The Los Angeles Abrasion test is a test used to estimate the durability of a sample. The test is performed by turning a steel drum containing the rock sample and 12 steel balls, each weighing approximately 0.415 kg. The steel balls impact and abrade the rock giving an indication of how durable the rock might be over a long period of time under in-situ conditions. After 500 revolutions the test is ended and the loss (i.e. fines) are screened and weighed.

5.6.1 Results

The results of this testing are summarized below in Table 8. The full laboratory results are available in Appendix A.

Table 8: LOS ANGELES ABRASION SUMMARY

Maximum Aggregate Size Used (mm)	Percent Loss (%)
14	27

5.6.2 Discussion

The result of this test indicates that the rock is resistant to abrasion and falls within the typical range for limestone or dolostone of between 18 and 30% loss.

6 Recommendations

Wood has the following recommendations for the Edie Quarry Site:

- Additional samples should be collected from the quarry stockpile(s) in order to have samples from multiple locations in the quarry. Table 1 of this memorandum provided rules of thumb for testing based on volume. Additional testing would allow for more representative testing from the entire quarry, instead on just one location (which may or may not be representative). Care should be given to collecting unbiased samples from stockpiles following appropriate methodology.
- If additional testing is completed and the entire rock quarry is carbonate rock, further ARD and ML testing should focus on risks from neutral metal leaching (ICP metals analysis and Shake Flask Extraction).

7 Closure

This document was prepared for the exclusive use of the Government of the Northwest Territories for the specific application described within. It was prepared in accordance with generally accepted engineering practices in the geotechnical consulting industry. No other warranty, express or implied is made. Please also refer to the limitations in Section 9 of this memorandum.

Sincerely,

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a Division of Wood Canada Limited
Signature
Date March 31, 2020
PERMIT NUMBER: P 047
NT/NU Association of Professional Engineers and Geoscientists

BB/rm

Attachment:
Appendix A Laboratory Testing

8 References

American Society for Testing and Materials. Standard Practice for Sampling Aggregates, Designation: D75/D75M-14

British Columbia Ministry of Transportation and Infrastructure (MOTI)., Technical Circular: Evaluating the Potential for Acid Rock Drainage and Metal Leaching at Quarries, Rock Cuts Sites and from Stockpiled Rock or Talus Materials used by the MOTI. September 15, 2013

Canadian Council of Ministers of the Environment (CCME) Long-Term Screening Thresholds, Chapter: Water Quality Guidelines for the Protection of Aquatic Life, accessed online at http://st-ts.ccme.ca/en/index.html, March 2020

Canadian Standards Association Group. Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete. June 2019.

Guideline for Industrial Waste Discharged in the NWT, Schedule II: Standard for Non-Point Sources Discharges, Concentrations not to be Exceeded, April 2004

Indian and Northern Affairs Canada. Guidelines for Designing and Implementing Aquatic Effects Monitoring Programs for Development Project in the Northwest Territories, Recommended Procedures for Developing Data Quality Objectives and a Conceptual Study Design, AEMP Technical Guidance Document Volume 3. June 2009

Price, Dr. William A., Errington, J.C., The B.C. MEMPR Acid Rock Drainage Guidelines. 1997

Price, Dr. William A., DRAFT Guidelines and Recommended Methods for the Prediction of Metal Leaching and Acid Rock Drainage at Mine sites in British Columbia., published by Reclamation Section Energy and Mineral Division, April 1997

9 Limitations to Geotechnical Reports

1. The work performed in the preparation of this report and the conclusions presented herein are subject to the following:

    a) The contract between Wood and the Client, including any subsequent written amendment or Change Order dully signed by the parties (hereinafter together referred as the "Contract");

    b) Any and all time, budgetary, access and/or site disturbance, risk management preferences, constraints or restrictions as described in the contract, in this report, or in any subsequent communication sent by Wood to the Client in connection to the Contract; and

    c) The limitations stated herein.

2. **Standard of care:** Wood has prepared this report in a manner consistent with the level of skill and are ordinarily exercised by reputable members of Wood's profession, practicing in the same or similar locality at the time of performance, and subject to the time limits and physical constraints applicable to the scope of work, and terms and conditions for this assignment. No other warranty, guarantee, or representation, expressed or implied, is made or intended in this report, or in any other communication (oral or written) related to this project. The same are specifically disclaimed, including the implied warranties of merchantability and fitness for a particular purpose.

3. **Limited locations:** The information contained in this report is restricted to the site and structures evaluated by Wood and to the topics specifically discussed in it, and is not applicable to any other aspects, areas or locations.

4. **Information utilized:** The information, conclusions and estimates contained in this report are based exclusively on: i) information available at the time of preparation, ii) the accuracy and completeness of data supplied by the Client or by third parties as instructed by the Client, and iii) the assumptions, conditions and qualifications/limitations set forth in this report.

5. **Accuracy of information:** No attempt has been made to verify the accuracy of any information provided by the Client or third parties, except as specifically stated in this report (hereinafter "Supplied Data"). Wood cannot be held responsible for any loss or damage, of either contractual or extra-contractual nature, resulting from conclusions that are based upon reliance on the Supplied Data.

6. **Report interpretation:** This report must be read and interpreted in its entirety, as some sections could be inaccurately interpreted when taken individually or out-of-context. The contents of this report are based upon the conditions known and information provided as of the date of preparation. The text of the final version of this report supersedes any other previous versions produced by Wood.

7. **No legal representations:** Wood makes no representations whatsoever concerning the legal significance of its findings, or as to other legal matters touched on in this report, including but not limited to, ownership of any property, or the application of any law to the facts set forth herein. With respect to regulatory compliance issues, regulatory statutes are subject to interpretation and change. Such interpretations and regulatory changes should be reviewed with legal counsel.

8. **Decrease in property value:** Wood shall not be responsible for any decrease, real or perceived, of the property or site's value or failure to complete a transaction, as a consequence of the information contained in this report.

9. **No third-party reliance:** This report is for the sole use of the party to whom it is addressed unless expressly stated otherwise in the report or Contract. Any use or reproduction which any third party makes of the report, in whole or in part, or any reliance thereon or decisions made based on any information or conclusions in the report is the sole responsibility of such third party. Wood does not represent or warrant the accuracy, completeness, merchantability, fitness for purpose or usefulness of this document, or any information contained in this document, for use or consideration by any third party. Wood accepts no responsibility whatsoever for damages or loss of any nature or kind suffered by any such third party as a result of actions taken or not taken or decisions made in reliance on this report or anything set out therein. including without limitation, any indirect, special, incidental, punitive or consequential loss, liability or damage of any kind.

10. **Assumptions:** Where design recommendations are given in this report, they apply only if the project contemplated by the Client is constructed substantially in accordance with the details stated in this report. It is the sole responsibility of the Client to provide to Wood changes made in the project, including but not limited to, details in

the design, conditions, engineering or construction that could in any manner whatsoever impact the validity of the recommendations made in the report. Wood shall be entitled to additional compensation from Client to review and assess the effect of such changes to the project.

11. **Time dependence:** If the project contemplated by the Client is not undertaken within a period of 18 months following the submission of this report, or within the time frame understood by Wood to be contemplated by the Client at the commencement of Wood's assignment, and/or, if any changes are made, for example, to the elevation, design or nature of any development on the site, its size and configuration, the location of any development on the site and its orientation, the use of the site, performance criteria and the location of any physical infrastructure, the conclusions and recommendations presented herein should not be considered valid unless the impact of the said changes is evaluated by Wood, and the conclusions of the report are amended or are validated in writing accordingly.

    Advancements in the practice of geotechnical engineering, engineering geology and hydrogeology and changes in applicable regulations, standards, codes or criteria could impact the contents of the report, in which case, a supplementary report may be required. The requirements for such a review remain the sole responsibility of the Client or their agents.

    Wood will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

12. **Limitations of visual inspections:** Where conclusions and recommendations are given based on a visual inspection conducted by Wood, they relate only to the natural or man-made structures, slopes, etc. inspected at the time the site visit was performed. These conclusions cannot and are not extended to include those portions of the site or structures, which were not reasonably available, in Wood's opinion, for direct observation.

13. **Limitations of site investigations:** Site exploration identifies specific subsurface conditions only at those points from which samples have been taken and only at the time of the site investigation. Site investigation programs are a professional estimate of the scope of investigation required to provide a general profile of subsurface conditions.

    The data derived from the site investigation program and subsequent laboratory testing are interpreted by trained personnel and extrapolated across the site to form an inferred geological representation and an engineering opinion is rendered about overall subsurface conditions and their likely behaviour with regard to the proposed development. Despite this investigation, conditions between and beyond the borehole/test hole locations may differ from those encountered at the borehole/test hole locations and the actual conditions at the site might differ from those inferred to exist, since no subsurface exploration program, no matter how comprehensive, can reveal all subsurface details and anomalies.

    Final sub-surface/bore/profile logs are developed by geotechnical engineers based upon their interpretation of field logs and laboratory evaluation of field samples. Customarily, only the final bore/profile logs are included in geotechnical engineering reports.

    Bedrock, soil properties and groundwater conditions can be significantly altered by environmental remediation and/or construction activities such as the use of heavy equipment or machinery, excavation, blasting, pile-driving or draining or other activities conducted either directly on site or on adjacent terrain. These properties can also be indirectly affected by exposure to unfavorable natural events or weather conditions, including freezing, drought, precipitation and snowmelt.

    During construction, excavation is frequently undertaken which exposes the actual subsurface and groundwater conditions between and beyond the test locations, which may differ from those encountered at the test locations. It is recommended practice that Wood be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered at the test locations, that construction work has no negative impact on the geotechnical aspects of the design, to adjust recommendations in accordance with conditions as additional site information is gained and to deal quickly with geotechnical considerations if they arise.

    Interpretations and recommendations presented herein may not be valid if an adequate level of review or inspection by Wood is not provided during construction.

14. **Factors that may affect construction methods, costs and scheduling:** The performance of rock and soil materials during construction is greatly influenced by the means and methods of construction. Where comments are made relating to possible methods of construction, construction costs, construction techniques, sequencing, equipment or

scheduling, they are intended only for the guidance of the project design professionals, and those responsible for construction monitoring. The number of test holes may not be sufficient to determine the local underground conditions between test locations that may affect construction costs, construction techniques, sequencing, equipment, scheduling, operational planning, etc.

Any contractors bidding on or undertaking the works should draw their own conclusions as to how the subsurface and groundwater conditions may affect their work, based on their own investigations and interpretations of the factual soil data, groundwater observations, and other factual information.

15. **Groundwater and Dewatering:** Wood will accept no responsibility for the effects of drainage and/or dewatering measures if Wood has not been specifically consulted and involved in the design and monitoring of the drainage and/or dewatering system.
16. **Environmental and Hazardous Materials Aspects:** Unless otherwise stated, the information contained in this report in no way reflects on the environmental aspects of this project, since this aspect is beyond the Scope of Work and the Contract. Unless expressly included in the Scope of Work, this report specifically excludes the identification or interpretation of environmental conditions such as contamination, hazardous materials, wildlife conditions, rare plants or archeology conditions that may affect use or design at the site. This report specifically excludes the investigation, detection, prevention or assessment of conditions that can contribute to moisture, mold or other microbial contaminant growth and/or other moisture related deterioration, such as corrosion, decay, rot in buildings or their surroundings. Any statements in this report or on the boring logs regarding odours, colours, and unusual or suspicious items or conditions are strictly for informational purposes
17. **Sample Disposal:** Wood will dispose of all uncontaminated soil and rock samples after 30 days following the release of the final geotechnical report. Should the Client request that the samples be retained for a longer time, the Client will be billed for such storage at an agreed upon rate. Contaminated samples of soil, rock or groundwater are the property of the Client, and the Client will be responsible for the proper disposal of these samples, unless previously arranged for with Wood or a third party.

Appendix A

Laboratory Testing

AGAT Laboratories

Unit 120 • 8600 Glenlyon Parkway
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CERTIFICATE OF ANALYSIS • COVER PAGE

Client:	WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS
Mailing Address:	3450 Harvester Road Suite 100
	Burlington, ON L7N 3W5
Attention To:	Corina Aldea
E-mail Address:	corina.aldea@woodplc.com
Contact No:	(905) 741-5710
Fax No:	

Client Project Name:	
Client Project Number:	CG14367

Results:		
Reported To:	**1**	Corina Aldea
	2	
	3	
	4	

Invoice:	Corina Aldea
Submitted To:	

AGAT Work Order:	20V571389
Report Version:	1
Pages (Including Cover):	4

Analysis Reviewed By:	Vivian Ferrera Leon, MSc., PGeo.Acid Rock Drainage Lab Coordinator
Report Certified By:	Vivian Ferrera Leon, MSc., PGeo.Acid Rock Drainage Lab Coordinator
Signature:	

Should you require any further information regarding this analysis please contact your client services representative at (778) 452 4000

Notes:

Note: All samples are stored at no charge for 90 days. Please contact the lab if you require additional sample storage time.

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CERTIFICATE OF ANALYSIS ▪ SAMPLE DETAILS

AGAT WORK ORDER: 20V571389
REPORT VERSION: 1

CLIENT NAME: WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS
PROJECT NO: CG14367

S. No.	AGAT Sample ID	Client Sample ID	Sample Type	Condition	Received Sample Wt (kg)	Dry Sample Wt. (kg)
1	918551	S019-20	Crushed rock and pulp	Dry		
				Total Sample Weight Received (kg):	**0**	

Sample Receipt Info:	
Date Samples Received:	3-Feb-20
No. of Samples Received:	1
Samples Received By:	R. Littke

Analytical Instructions:	
From:	Corina Aldea
Date:	3-Feb-20

Date of Analysis:	
Paste pH:	13-Feb-20
Fizz Rating:	13-Feb-20
Rinse pH:	NA
Carbonate Carbon (CO2):	NA
Total Carbon:	NA
Total Inorganic Carbon:	NA
Total Sulphur:	21-Feb-20
Sulphate Sulphur:	21-Feb-20
Neutralization Potential (NP):	19-Feb-20

Results relate only to the items tested and all the items tested

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CERTIFICATE OF ANALYSIS ▪ ABA RESULTS

AGAT WORK ORDER: 20V571389
REPORT VERSION: 1

CLIENT NAME: WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS
PROJECT NO: CG14367

S. No.	AGAT Sample ID	Client Sample ID	Paste pH	Fizz Rating	Total Sulphur	Sulphate Sulphur	Sulphide Sulphur	Maximum Potential Acidity (MPA)	Mod. ABA NP Neutralization Potential (NP)	Net Neutralization Potential (NNP)	Neutralization Potential Ratio (NPR)
Units:			pH Units		(wt %)	(wt %)	(wt %)	(kg CaCO3/tonne)	(kg CaCO3/tonne)	(kg CaCO3/tonne)	
Reported Detection Limit (RDL):			*0.1*		*0.01*	*0.01*	*0.02*	*0.6*			
1	918551	S019-20	10.0	Strong	0.05	<0.01	0.05	1.6	738.5	736.9	472.6

QUALITY ASSURANCE											
Replicate Analysis:											
1	**918551**	**S019-20**	**10.0**	**Strong**	**0.05**	**<0.01**	**0.05**	**1.6**	**738.5**	**736.9**	**472.6**
1 R	**918551**	**S019-20**	**10.0**	**Strong**	**-**	**<0.01**	**-**	**-**	**750.7**	**-**	**-**
10	**933556**	**-**	**-**	**-**	**0.4**	**-**	**-**	**-**	**-**	**-**	**-**
10 R	**933556**	**-**	**-**	**-**	**0.4**	**-**	**-**	**-**	**-**	**-**	**-**
Reference Material Analysis:											
Reference Material			IN-HOUSE REF 1		KZK-1	Ref.2016-2			KZK-1		
Ref. Material Certified/Informational Value			8.8		0.80	0.10			58.9		
Reference Material Results			8.8		0.72	0.10			48.9		
Method Blank Analysis:											
Method Blank Results						<0.01					
Method Blank Spike Recovery (%)						104%					

Notes:
pH of DI water used: 6.38
EC of DI water used: <2
R = Replicate; D = Duplicate
NA = A result is not calculated when the MPA is <0.6

Results relate only to the items tested and all the items tested

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CERTIFICATE OF ANALYSIS • METHOD SUMMARY

AGAT WORK ORDER: 20V571389
REPORT VERSION: 1

CLIENT NAME: WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS
PROJECT NO: CG14367

Parameter	AGAT S.O.P	Literature Reference	Analytical Technique
Sample Preparation	ARD-181-18007	ASTM E877-08; MEND Report 1.20.1, Version 0 (2009)	Crusher/Pulverizer
Paste pH (Near Saturation)	ARD-181-18003	Sobek, A.A., Schuller, W.A., Freeman, J.R. and Smith, R.M.; EPA-600/2-78-054 (1978)	pH Meter
Fizz Rating	ARD-181-18000	Lawrence, R. W., Poling, G.P. and Marchant, P.B., MEND Project 1.16.1a (1989); MEND Acid Rock Drainage Prediction Manual, MEND Project 1.16.1b, Section 6.2.3 (March 1991)	Observation
Total Sulphur	INOR-181-6027	modified from ASTM E1915-11	Combustion TC
Sulphate Sulphur	ARD-181-18009;	modified from MEND Report 1.20.1, Version 0 (2009);	HCl Extraction
	INOR-181-6028	modified from SM 4500-SO_4^{2-} E	UV-Vis Spectrophotometer
Sulphide Sulphur			Calculation
Maximum Potential Acidity			Calculation
Neutralization Potential **(Modified ABA NP)**	ARD-181-18000	Lawrence, R. W., Poling, G.P. and Marchant, P.B., MEND Project 1.16.1a (1989); MEND Acid Rock Drainage Prediction Manual, MEND Project 1.16.1b, Section 6.2.3 (March 1991)	Titration
Net Neutralization Potential			Calculation
Neutralization Potential Ratio			Calculation

CALCULATIONS:

Sulphide Sulphur: difference between total sulphur and sulphate sulphur

Maximum Potential Acidity (MPA): is based on sulphide sulphur

Net Neutralization Potential (NNP): difference between NP and MPA

Neutralization Potential Ratio (NPR): NP/MPA

METHOD DESCRIPTIONS:

Sample Preparation

ABA: Air-dried or oven dried at 55 ± 5 °C (if samples arrive wet), crushed (if necessary), split by riffling, and pulverized to 85% passing 200 mesh (75 µm).

Analytical

Paste pH: DDI water is added to the prepared sample to form a paste at near saturation. The volume of water added varies depending on the sample's tendency to absorb water. A pH probe is placed in the paste slurry and the pH is read directly from the meter.

Fizz Rating: One to two drops of 25% HCl is added to a sample aliquot and the degree of reaction observed and rated. The presence of $CaCO_3$ is indicated by a bubbling or audible "fizz" sound.

Total Sulphur: The sample is combusted in an induction furnace in the presence of oxygen. The sulfur in the sample is converted to sulfur dioxide (SO2) and subsequently measured by an TC detector.

Sulphate Sulphur: Pulp samples are treated with dilute HCl and boiled for 30 minutes at ~80 °C. The digested sample is then re-constituted with DI water and filtered. Filtered extracts are then analyzed by the turbidimetric method using a UV-Vis spectrophotometer. The analytical results are back-calculated to the initial pulp sample weight and expressed in weight % Sulphate Sulphur.

Modified ABA NP: A pulp sample is digested with a known excess of standardized HCl at room temperature for a period of 24 hours in order to determine the amount of neutralizing bases present in the sample. The residual acid solution is titrated to pH 8.3 with standardized NaOH in order to determine the amount of acid consumed by the original sample.

Results relate only to the items tested and all the items tested

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CLIENT NAME: WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS
3450 HARVESTER ROAD, SUITE 100
BURLINGTON, ON L7N 3W5
(905) 335-2353

ATTENTION TO: Corina Aldea

PROJECT: CG14367*V

AGAT WORK ORDER: 20T567177

SOLID ANALYSIS REVIEWED BY: Kevin Motomura, Data Review Supervisor

DATE REPORTED: Feb 28, 2020

PAGES (INCLUDING COVER): 10

Should you require any information regarding this analysis please contact your client services representative at (905) 501-9998

*NOTES
VERSION 1:Revised Report Issued with additional analysis 201074 on February 28, 2020

All samples are stored at no charge for 90 days. Please contact the lab if you require additional sample storage time.

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Certificate of Analysis

AGAT WORK ORDER: 20T567177

PROJECT: CG14367*V

CLIENT NAME: WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS

ATTENTION TO: Corina Aldea

(201-043) LECO (Combustion IR) - Total C, Total S

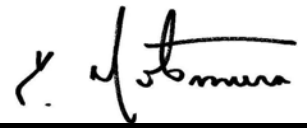
DATE SAMPLED: Jan 23, 2020 | DATE RECEIVED: Jan 24, 2020 | DATE REPORTED: Feb 28, 2020 | SAMPLE TYPE: Other

Analyte:	C	S
Unit:	%	%
Sample ID (AGAT ID) RDL:	0.01	0.005
5019-20 (886790)	12.1	0.016

Comments: RDL - Reported Detection Limit

Analysis performed at AGAT 5623 McAdam Rd., Mississauga, ON (unless marked by *)

Certified By:



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Certificate of Analysis

AGAT WORK ORDER: 20T567177

PROJECT: CG14367*V

CLIENT NAME: WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS

ATTENTION TO: Corina Aldea

(201-074) Aqua Regia Digest - Metals Package, ICP/ICP-MS finish

DATE SAMPLED: Jan 23, 2020 | DATE RECEIVED: Jan 24, 2020 | DATE REPORTED: Feb 28, 2020 | SAMPLE TYPE: Other

Analyte:	Ag	Al	As	Au	B	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs
Unit:	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm
Sample ID (AGAT ID) RDL:	0.01	0.01	0.1	0.005	5	1	0.05	0.01	0.01	0.01	0.01	0.1	0.5	0.05
5019-20 (886790)	0.05	0.02	0.3	0.008	<5	46	0.14	0.04	>25	0.09	1.24	1.4	0.8	0.06

Analyte:	Cu	Fe	Ga	Ge	Hf	Hg	In	K	La	Li	Mg	Mn	Mo	Na
Unit:	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	ppm	%
Sample ID (AGAT ID) RDL:	0.5	0.01	0.05	0.05	0.02	0.01	0.005	0.01	0.1	0.1	0.01	1	0.05	0.01
5019-20 (886790)	4.2	0.07	0.50	<0.05	<0.02	<0.01	<0.005	0.01	0.5	5.2	0.21	<1	0.62	<0.01

Analyte:	Nb	Ni	P	Pb	Rb	Re	S	Sb	Sc	Se	Sn	Sr	Ta	Te
Unit:	ppm	ppm	%	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Sample ID (AGAT ID) RDL:	0.05	0.5	0.001	0.1	0.1	0.001	0.01	0.05	0.1	0.2	0.2	0.2	0.01	0.01
5019-20 (886790)	0.06	1.7	0.003	2.7	0.8	0.002	0.06	0.16	<0.1	0.7	<0.2	323	<0.01	<0.01

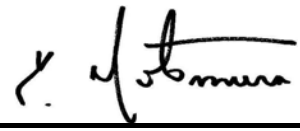
Analyte:	Th	Ti	Tl	U	V	W	Y	Zn	Zr
Unit:	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Sample ID (AGAT ID) RDL:	0.1	0.005	0.01	0.05	0.5	0.05	0.05	0.5	0.5
5019-20 (886790)	0.2	<0.005	<0.01	0.61	1.8	<0.05	0.67	6.0	<0.5

Comments: RDL - Reported Detection Limit

886790 Au determination by this method is semi-quantitative due to small sample size.

Analysis performed at AGAT 5623 McAdam Rd., Mississauga, ON (unless marked by *)

Certified By:



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Certificate of Analysis

AGAT WORK ORDER: 20T567177

PROJECT: CG14367*V

CLIENT NAME: WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS

ATTENTION TO: Corina Aldea

(201-676) Lithium Borate Fusion - Summation of Oxides, XRF finish

DATE SAMPLED: Jan 23, 2020 | DATE RECEIVED: Jan 24, 2020 | DATE REPORTED: Feb 28, 2020 | SAMPLE TYPE: Other

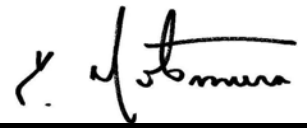
Analyte:	Al2O3	BaO	CaO	Cr2O3	Fe2O3	K2O	MgO	MnO	Na2O	P2O5	SiO2	TiO2	SrO	V2O5
Unit:	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Sample ID (AGAT ID) RDL:	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
5019-20 (886790)	0.33	<0.01	55.3	<0.01	0.13	0.07	0.40	0.01	<0.01	<0.01	0.68	0.01	0.05	<0.01

Analyte:	LOI	Total Oxides
Unit:	%	%
Sample ID (AGAT ID) RDL:	0.01	0.01
5019-20 (886790)	43.0	100

Comments: RDL - Reported Detection Limit

Analysis performed at AGAT 5623 McAdam Rd., Mississauga, ON (unless marked by *)

Certified By:



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Quality Assurance - Replicate

AGAT WORK ORDER: 20T567177

PROJECT: CG14367*V

CLIENT NAME: WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS

ATTENTION TO: Corina AIdea

(201-043) LECO (Combustion IR) - Total C, Total S

	REPLICATE #1															
Parameter	Sample ID	Original	Replicate	RPD												
C	886790	12.1	12.2	0.8%												
S	886790	0.016	0.0132	19.2%												

(201-074) Aqua Regia Digest - Metals Package, ICP/ICP-MS finish

	REPLICATE #1															
Parameter	Sample ID	Original	Replicate	RPD												
Ag	886790	0.053	0.066	21.8%												
Al	886790	0.02	0.02	0.0%												
As	886790	0.3	0.5													
Au	886790	0.008	0.010													
B	886790	< 5	< 5	0.0%												
Ba	886790	46	44	4.4%												
Be	886790	0.14	0.14	0.0%												
Bi	886790	0.040	0.036	10.5%												
Ca	886790	38.9	39.8	2.3%												
Cd	886790	0.09	0.09	0.0%												
Ce	886790	1.24	1.28	3.2%												
Co	886790	1.43	1.57	9.3%												
Cr	886790	0.8	< 0.5													
Cs	886790	0.06	0.06	0.0%												
Cu	886790	4.2	4.4	4.7%												
Fe	886790	0.074	0.075	1.3%												
Ga	886790	0.50	0.55	9.5%												
Ge	886790	< 0.05	< 0.05	0.0%												
Hf	886790	< 0.02	< 0.02	0.0%												
Hg	886790	< 0.01	< 0.01	0.0%												
In	886790	< 0.005	< 0.005	0.0%												
K	886790	0.01	0.01	0.0%												
La	886790	0.55	0.56	1.8%												
Li	886790	5.2	4.5	14.4%												
Mg	886790	0.210	0.217	3.3%												
Mn	886790	< 1	< 1	0.0%												

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CLIENT NAME: WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS

ATTENTION TO: Corina AIdea

Mo	886790	0.62	0.55	12.0%												
Na	886790	< 0.01	< 0.01	0.0%												
Nb	886790	0.06	< 0.05													
Ni	886790	1.7	1.7	0.0%												
P	886790	0.003	0.002													
Pb	886790	2.7	2.0													
Rb	886790	0.8	0.8	0.0%												
Re	886790	0.002	< 0.001													
S	886790	0.063	0.068	7.6%												
Sb	886790	0.16	0.14	13.3%												
Sc	886790	< 0.1	< 0.1	0.0%												
Se	886790	0.7	0.7	0.0%												
Sn	886790	< 0.2	< 0.2	0.0%												
Sr	886790	323	328	1.5%												
Ta	886790	< 0.01	< 0.01	0.0%												
Te	886790	< 0.01	< 0.01	0.0%												
Th	886790	0.2	0.2	0.0%												
Ti	886790	< 0.005	< 0.005	0.0%												
Tl	886790	< 0.01	< 0.01	0.0%												
U	886790	0.61	0.60	1.7%												
V	886790	1.75	1.73	1.1%												
W	886790	< 0.05	< 0.05	0.0%												
Y	886790	0.67	0.59	12.7%												
Zn	886790	6.04	6.10	1.0%												
Zr	886790	< 0.5	< 0.5	0.0%												

(201-676) Lithium Borate Fusion - Summation of Oxides, XRF finish

	REPLICATE #1															
Parameter	Sample ID	Original	Replicate	RPD												
Al2O3	886790	0.330	0.338	2.4%												
BaO	886790	< 0.01	< 0.01	0.0%												
CaO	886790	55.3	55.3	0.0%												
Cr2O3	886790	< 0.01	< 0.01	0.0%												
Fe2O3	886790	0.126	0.135	6.9%												
K2O	886790	0.068	0.064	6.1%												

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ATTENTION TO: Corina AIdea

MgO	886790	0.40	0.40	0.0%												
MnO	886790	0.01	< 0.01													
Na2O	886790	< 0.01	< 0.01	0.0%												
P2O5	886790	< 0.01	< 0.01	0.0%												
SiO2	886790	0.68	0.67	1.5%												
TiO2	886790	0.01	< 0.01													
SrO	886790	0.045	0.042	6.9%												
V2O5	886790	< 0.01	< 0.01	0.0%												
LOI	886790	43.0	42.9	0.2%												

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Quality Assurance - Certified Reference materials

AGAT WORK ORDER: 20T567177

PROJECT: CG14367*V

CLIENT NAME: WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS

ATTENTION TO: Corina Aldea

(201-043) LECO (Combustion IR) - Total C, Total S

	CRM #1				CRM #2											
Parameter	Expect	Actual	Recovery	Limits	Expect	Actual	Recovery	Limits								
C	0.95	0.95	100%	90% - 110%												
S	0.8	0.8	100%	90% - 110%												

(201-074) Aqua Regia Digest - Metals Package, ICP/ICP-MS finish

	CRM #1 (ref.ME-1303)				CRM #2											
Parameter	Expect	Actual	Recovery	Limits	Expect	Actual	Recovery	Limits								
Ag	152	157	103%	90% - 110%												
Cu	3440	3454	100%	90% - 110%												
Pb	12200	12000	99%	90% - 110%												
Zn	9310	9590	103%	90% - 110%												

(201-676) Lithium Borate Fusion - Summation of Oxides, XRF finish

	CRM #1 (ref.SY-4)				CRM #2											
Parameter	Expect	Actual	Recovery	Limits	Expect	Actual	Recovery	Limits								
Al2O3	20.7	20.8	101%	90% - 110%												
BaO	0.038	0.042	111%	90% - 110%												
CaO	8.05	7.99	99%	90% - 110%												
Fe2O3	6.21	6.21	100%	90% - 110%												
K2O	1.66	1.65	99%	90% - 110%												
MgO	0.54	0.54	99%	90% - 110%												
MnO	0.108	0.11	102%	90% - 110%												
Na2O	7.1	7.4	105%	90% - 110%												
P2O5	0.131	0.121	92%	90% - 110%												
SiO2	49.9	50.1	100%	90% - 110%												
TiO2	0.287	0.299	104%	90% - 110%												
SrO	0.141	0.136	96%	90% - 110%												
LOI					4.56	4.36	95%	90% - 110%								

AGAT Laboratories

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Method Summary

CLIENT NAME: WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS

AGAT WORK ORDER: 20T567177

PROJECT: CG14367*V

ATTENTION TO: Corina Aldea

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Solid Analysis			
C	MIN-200-12000	ASTM E1915-07a	LECO
S	MIN-200-12000	ASTM E1915-07a	LECO
Ag	MIN-200-12018		ICP-MS
Al	MIN-200-12020		ICP/OES
As	MIN-200-12018		ICP-MS
Au	MIN-200-12018		ICP-MS
B	MIN-200-12020		ICP/OES
Ba	MIN-200-12018		ICP-MS
Be	MIN-200-12018		ICP-MS
Bi	MIN-200-12018		ICP-MS
Ca	MIN-200-12020		ICP/OES
Cd	MIN-200-12018		ICP-MS
Ce	MIN-200-12018		ICP-MS
Co	MIN-200-12018		ICP-MS
Cr	MIN-200-12020		ICP/OES
Cs	MIN-200-12018		ICP-MS
Cu	MIN-200-12018		ICP-MS
Fe	MIN-200-12020		ICP/OES
Ga	MIN-200-12018		ICP-MS
Ge	MIN-200-12018		ICP-MS
Hf	MIN-200-12018		ICP-MS
Hg	MIN-200-12018		ICP-MS
In	MIN-200-12018		ICP-MS
K	MIN-200-12020		ICP/OES
La	MIN-200-12018		ICP-MS
Li	MIN-200-12018		ICP-MS
Mg	MIN-200-12020		ICP/OES
Mn	MIN-200-12020		ICP/OES
Mo	MIN-200-12018		ICP-MS
Na	MIN-200-12020		ICP/OES
Nb	MIN-200-12018		ICP-MS
Ni	MIN-200-12018		ICP-MS
P	MIN-200-12020		ICP/OES
Pb	MIN-200-12018		ICP-MS
Rb	MIN-200-12018		ICP-MS
Re	MIN-200-12018		ICP-MS
S	MIN-200-12020		ICP/OES
Sb	MIN-200-12018		ICP-MS
Sc	MIN-200-12018		ICP-MS
Se	MIN-200-12018		ICP-MS
Sn	MIN-200-12018		ICP-MS
Sr	MIN-200-12018		ICP-MS
Ta	MIN-200-12018		ICP-MS
Te	MIN-200-12018		ICP-MS
Th	MIN-200-12018		ICP-MS
Ti	MIN-200-12020		ICP/OES
Tl	MIN-200-12018		ICP-MS
U	MIN-200-12018		ICP-MS
V	MIN-200-12020		ICP/OES

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Method Summary

CLIENT NAME: WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS

AGAT WORK ORDER: 20T567177

PROJECT: CG14367*V

ATTENTION TO: Corina Aldea

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
W	MIN-200-12018		ICP-MS
Y	MIN-200-12018		ICP-MS
Zn	MIN-200-12018		ICP-MS
Zr	MIN-200-12018		ICP-MS
Al2O3	MIN-200-12027	Sulcek Z. Methods of Decomposition & ASTM-D7343	XRF
BaO	MIN-200-12027	Sulcek Z. Methods of Decomposition & ASTM-D7343	XRF
CaO	MIN-200-12027	Sulcek Z. Methods of Decomposition & ASTM-D7343	XRF
Cr2O3	MIN-200-12027	Sulcek Z. Methods of Decomposition & ASTM-D7343	XRF
Fe2O3	MIN-200-12027	Sulcek Z. Methods of Decomposition & ASTM-D7343	XRF
K2O	MIN-200-12027	Sulcek Z. Methods of Decomposition & ASTM-D7343	XRF
MgO	MIN-200-12027	Sulcek Z. Methods of Decomposition & ASTM-D7343	XRF
MnO	MIN-200-12027	Sulcek Z. Methods of Decomposition & ASTM-D7343	XRF
Na2O	MIN-200-12027	Sulcek Z. Methods of Decomposition & ASTM-D7343	XRF
P2O5	MIN-200-12027	Sulcek Z. Methods of Decomposition & ASTM-D7343	XRF
SiO2	MIN-200-12027	Sulcek Z. Methods of Decomposition & ASTM-D7343	XRF
TiO2	MIN-200-12027	Sulcek Z. Methods of Decomposition & ASTM-D7343	XRF
SrO	MIN-200-12027	Sulcek Z. Methods of Decomposition & ASTM-D7343	XRF
V2O5	MIN-200-12027	Sulcek Z. Methods of Decomposition & ASTM-D7343	XRF
LOI	MIN-200-12021	Sulcek Z. Methods of Decomposition in Inorganic	FURNACE
Total Oxides	MIN-200-12015		CALCULATION

AGAT Laboratories

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CLIENT NAME: MISC AGAT CLIENT BC, BC V5J0B6
ATTENTION TO: Corina Aldea
PROJECT: CG14367
AGAT WORK ORDER: 20V571389
WATER ANALYSIS REVIEWED BY: Jacky Takeuchi, BScH(Chem Eng), BSc (Biology), P.Chem Organics Technical Manager
DATE REPORTED: Mar 05, 2020
PAGES (INCLUDING COVER): 12
VERSION*: 2

Should you require any information regarding this analysis please contact your client services representative at (778) 452-4000

*Notes
VERSION 2:As per clients request low level Mercury analysis was done.

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Certificate of Analysis

AGAT WORK ORDER: 20V571389

PROJECT: CG14367

CLIENT NAME: MISC AGAT CLIENT BC

ATTENTION TO: Corina Aldea

SAMPLING SITE:

SAMPLED BY:

Shake Flask Extraction - Dissolved Metals

DATE RECEIVED: 2020-02-03

DATE REPORTED: 2020-03-05

				Method Blank		S019-20
SAMPLE DESCRIPTION:				-SFE		SFE
SAMPLE TYPE:				SFE		SFE
DATE SAMPLED:						
Parameter	Unit	G / S	RDL	919171	RDL	919174
Weight of Dry Sample	g			0		250
Volume of DI Water	mL			750		750
Silver Dissolved	mg/L		0.00008	<0.00008	0.00008	<0.00008
Aluminum Dissolved	mg/L		0.001	<0.001	0.001	0.084
Arsenic Dissolved	mg/L		0.0002	<0.0002	0.0002	<0.0002
Boron Dissolved	mg/L		0.01	0.01	0.01	<0.01
Barium Dissolved	mg/L		0.0002	<0.0002	0.0002	0.0398
Beryllium Dissolved	mg/L		0.0001	<0.0001	0.0001	<0.0001
Bismuth Dissolved	mg/L		0.0001	<0.0001	0.0001	<0.0001
Calcium Dissolved	mg/L		0.05	<0.05	0.05	5.80
Cadmium Dissolved	mg/L		0.00001	<0.00001	0.00001	<0.00001
Cobalt Dissolved	mg/L		0.0001	<0.0001	0.0001	<0.0001
Chromium Dissolved	mg/L		0.0005	<0.0005	0.0005	<0.0005
Copper Dissolved	mg/L		0.0005	<0.0005	0.0005	<0.0005
Iron Dissolved	mg/L		0.02	<0.02	0.02	<0.02
Potassium Dissolved	mg/L		0.05	<0.05	0.05	0.44
Lithium Dissolved	mg/L		0.0005	<0.0005	0.0005	0.0011
Magnesium Dissolved	mg/L		0.005	<0.005	0.05	0.59
Manganese Dissolved	mg/L		0.0002	<0.0002	0.0002	<0.0002
Molybdenum Dissolved	mg/L		0.0001	<0.0001	0.0001	0.0014
Sodium Dissolved	mg/L		0.02	<0.02	0.02	0.53
Nickel Dissolved	mg/L		0.0005	<0.0005	0.0005	<0.0005
Phosphorus Dissolved	mg/L		0.05	<0.05	0.05	<0.05
Lead Dissolved	mg/L		0.0005	<0.0005	0.0005	<0.0005
Sulphur Dissolved	mg/L		0.5	<0.5	0.5	1.2
Antimony Dissolved	mg/L		0.0001	<0.0001	0.0001	<0.0001
Selenium Dissolved	mg/L		0.0005	<0.0005	0.0005	<0.0005
Silicon Dissolved	mg/L		0.05	<0.05	0.05	0.25
Tin Dissolved	mg/L		0.0005	<0.0005	0.0005	<0.0005

Certified By:

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Certificate of Analysis

AGAT WORK ORDER: 20V571389

PROJECT: CG14367

CLIENT NAME: MISC AGAT CLIENT BC

ATTENTION TO: Corina Aldea

SAMPLING SITE:

SAMPLED BY:

Shake Flask Extraction - Dissolved Metals

DATE RECEIVED: 2020-02-03

DATE REPORTED: 2020-03-05

				Method Blank		S019-20
		SAMPLE DESCRIPTION:		-SFE		SFE
		SAMPLE TYPE:		SFE		SFE
		DATE SAMPLED:				
Parameter	Unit	G / S	RDL	919171	RDL	919174
Strontium Dissolved	mg/L		0.0002	0.0003	0.0002	0.0340
Tellurium Dissolved	mg/L		0.0002	<0.0002	0.0002	<0.0002
Thorium Dissolved	mg/L		0.0001	<0.0001	0.0001	<0.0001
Titanium Dissolved	mg/L		0.0005	<0.0005	0.0005	<0.0005
Thallium Dissolved	mg/L		0.00005	<0.00005	0.00005	<0.00005
Uranium Dissolved	mg/L		0.00005	<0.00005	0.00005	0.00011
Vanadium Dissolved	mg/L		0.001	<0.001	0.001	<0.001
Tungsten Dissolved	mg/L		0.0001	<0.0001	0.0001	<0.0001
Zinc Dissolved	mg/L		0.001	<0.001	0.001	<0.001
Zirconium Dissolved	mg/L		0.0001	<0.0001	0.0001	<0.0001
Mercury Dissolved	mg/L		0.000003	<0.000003	0.000003	<0.000003

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Analysis performed at AGAT Vancouver (unless marked by *)

Certified By:

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Quality Assurance

CLIENT NAME: MISC AGAT CLIENT BC

AGAT WORK ORDER: 20V571389

PROJECT: CG14367

ATTENTION TO: Corina Aldea

SAMPLING SITE:

SAMPLED BY:

Soil Analysis

RPT Date:			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
ABA Package															
Sulphur - Total	933556		0.38	0.39	2.6%	< 0.01	89%	80%	120%						
Sulphate Sulphur	918551		<0.01	<0.01	NA	< 0.01	96%	80%	120%	104%	85%	115%			

Comments: RPDs are calculated using raw analytical data and not the rounded duplicate values reported.

Certified By:

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Quality Assurance

CLIENT NAME: MISC AGAT CLIENT BC

AGAT WORK ORDER: 20V571389

PROJECT: CG14367

ATTENTION TO: Corina Aldea

SAMPLING SITE:

SAMPLED BY:

Water Analysis

RPT Date:			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Shake Flask Extraction - Dissolved Metals															
Silver Dissolved	931555		<0.00008	<0.00008	NA	< 0.00008				100%	90%	110%			
Aluminum Dissolved	931555		0.093	0.079	16.1%	< 0.001				98%	90%	110%			
Arsenic Dissolved	931555		0.0005	0.0005	NA	< 0.0002				100%	90%	110%			
Boron Dissolved	931555		<0.01	<0.01	NA	< 0.01				97%	90%	110%			
Barium Dissolved	931555		0.0278	0.0278	0.1%	< 0.0002				99%	90%	110%			
Beryllium Dissolved	931555		<0.0001	<0.0001	NA	< 0.0001				99%	90%	110%			
Bismuth Dissolved	931555		<0.0001	<0.0001	NA	< 0.0001				109%	90%	110%			
Calcium Dissolved	931555		11.2	11.8	5.2%	< 0.05				95%	90%	110%			
Cadmium Dissolved	931555		<0.00001	<0.00001	NA	< 0.00001				100%	90%	110%			
Cobalt Dissolved	931555		<0.0001	<0.0001	NA	< 0.0001				107%	90%	110%			
Chromium Dissolved	931555		<0.0005	<0.0005	NA	< 0.0005				99%	90%	110%			
Copper Dissolved	931555		0.0008	<0.0005	NA	< 0.0005				106%	90%	110%			
Iron Dissolved	931555		0.02	0.02	NA	< 0.02				94%	90%	110%			
Potassium Dissolved	931555		1.26	1.27	0.8%	< 0.05				96%	90%	110%			
Lithium Dissolved	931555		0.0012	0.0016	NA	< 0.0005				103%	90%	110%			
Magnesium Dissolved	931555		1.41	1.40	0.7%	< 0.005				94%	90%	110%			
Manganese Dissolved	931555		0.0019	0.0019	0.0%	< 0.0002				95%	90%	110%			
Molybdenum Dissolved	931555		0.0034	0.0032	6.1%	< 0.0001				105%	90%	110%			
Sodium Dissolved	931555		0.46	0.47	2.2%	< 0.02				98%	90%	110%			
Nickel Dissolved	931555		<0.0005	<0.0005	NA	< 0.0005				103%	90%	110%			
Phosphorus Dissolved	931555		<0.05	<0.05	NA	< 0.05				99%	90%	110%			
Lead Dissolved	931555		<0.0005	<0.0005	NA	< 0.0005				106%	90%	110%			
Sulphur Dissolved	931555		4.3	4.0	7.2%	< 0.5				98%	90%	110%			
Antimony Dissolved	931555		0.0004	0.0003	NA	< 0.0001				104%	90%	110%			
Selenium Dissolved	931555		<0.0005	<0.0005	NA	<0.0005				97%	90%	110%			
Silicon Dissolved	931555		0.64	0.67	4.6%	< 0.05				90%	90%	110%			
Tin Dissolved	931555		<0.0005	<0.0005	NA	< 0.0005				101%	90%	110%			
Strontium Dissolved	931555		0.0486	0.0519	6.6%	< 0.0002				93%	90%	110%			
Tellurium Dissolved	931555		<0.0002	<0.0002	NA	< 0.0002				104%	90%	110%			
Thorium Dissolved	931555		<0.0001	<0.0001	NA	< 0.0001				104%	90%	110%			
Titanium Dissolved	931555		0.0009	0.0011	NA	< 0.0005				93%	90%	110%			
Thallium Dissolved	931555		<0.00005	<0.00005	NA	< 0.00005				106%	90%	110%			
Uranium Dissolved	931555		0.00053	0.00054	1.0%	< 0.00005				107%	90%	110%			
Vanadium Dissolved	931555		<0.001	<0.001	NA	< 0.001				106%	90%	110%			
Tungsten Dissolved	931555		0.0002	0.0001	NA	< 0.0001				104%	90%	110%			
Zinc Dissolved	931555		0.001	<0.001	NA	< 0.001				108%	90%	110%			
Zirconium Dissolved	931555		<0.0001	<0.0001	NA	< 0.0001				106%	90%	110%			
Mercury Dissolved	919174		<0.	<0.	NA	< 0.000003	111%	70%	130%	99%	90%	110%			

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Quality Assurance

CLIENT NAME: MISC AGAT CLIENT BC

AGAT WORK ORDER: 20V571389

PROJECT: CG14367

ATTENTION TO: Corina Aldea

SAMPLING SITE:

SAMPLED BY:

Water Analysis (Continued)

RPT Date:			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Comments: RPDs are calculated using raw analytical data and not the rounded duplicate values reported.

Certified By:

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Method Summary

CLIENT NAME: MISC AGAT CLIENT BC

AGAT WORK ORDER: 20V571389

PROJECT: CG14367

ATTENTION TO: Corina Aldea

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Paste pH	ARD-181-18003	Sobek A.A. et al; Report EPA-600/2-78-054 (1978)	PH METER
Fizz Rating	ARD-181-18000	MEND Project 1.16.1b (Sect. 6.2.3) (March 1991)	
Sulphur - Total	INOR-181-6027	Modified from ASTM E1915-11	COMBUSTION
Sulphate Sulphur	ARD-181-18009; INOR-181-6028	MEND Report 1.20.1 (09); mod from SM 4500-SO4 E	SPECTROPHOTOMETER
Modified ABA NP	ARD-181-18000	MEND Project 1.16.1b (Sect. 6.2.3) (March 1991)	TITRATION

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Method Summary

CLIENT NAME: MISC AGAT CLIENT BC

AGAT WORK ORDER: 20V571389

PROJECT: CG14367

ATTENTION TO: Corina Aldea

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Weight of Dry Sample			ICP-MS
Volume of DI Water			PH METER
Silver Dissolved	ARD-181-18006, MET-181-6107	MEND Report 1.20.1 (2009), Modified from SM 3125 B	ICP-MS
Aluminum Dissolved	ARD-181-18006, MET-181-6107	MEND Report 1.20.1 (2009), Modified from SM 3125 B	ICP-MS
Arsenic Dissolved	ARD-181-18006, MET-181-6107	MEND Report 1.20.1 (2009), Modified from SM 3125 B	ICP-MS
Boron Dissolved	ARD-181-18006, MET-181-6107	MEND Report 1.20.1 (2009), Modified from SM 3125 B	ICP-MS
Barium Dissolved	ARD-181-18006, MET-181-6107	MEND Report 1.20.1 (2009), Modified from SM 3125 B	ICP-MS
Beryllium Dissolved	ARD-181-18006, MET-181-6107	MEND Report 1.20.1 (2009), Modified from SM 3125 B	ICP-MS
Bismuth Dissolved	ARD-181-18006, MET-181-6107	MEND Report 1.20.1 (2009), Modified from SM 3125 B	ICP-MS
Calcium Dissolved	ARD-181-18006, MET-181-6108	MEND Report 1.20.1 (2009), Modified from SM 3120 B	ICP/OES
Cadmium Dissolved	ARD-181-18006, MET-181-6107	MEND Report 1.20.1 (2009), Modified from SM 3125 B	ICP-MS
Cobalt Dissolved	ARD-181-18006, MET-181-6107	MEND Report 1.20.1 (2009), Modified from SM 3125 B	ICP-MS
Chromium Dissolved	ARD-181-18006, MET-181-6107	MEND Report 1.20.1 (2009), Modified from SM 3125 B	ICP-MS
Copper Dissolved	ARD-181-18006, MET-181-6107	MEND Report 1.20.1 (2009), Modified from SM 3125 B	ICP-MS
Iron Dissolved	ARD-181-18006, MET-181-6108	MEND Report 1.20.1 (2009), Modified from SM 3120 B	ICP/OES
Potassium Dissolved	ARD-181-18006, MET-181-6108	MEND Report 1.20.1 (2009), Modified from SM 3120 B	ICP/OES
Lithium Dissolved	ARD-181-18006, MET-181-6107	MEND Report 1.20.1 (2009), Modified from SM 3125 B	ICP-MS
Magnesium Dissolved	ARD-181-18006, MET-181-6107	MEND Report 1.20.1 (2009), Modified from SM 3125 B	ICP-MS
Manganese Dissolved	ARD-181-18006, MET-181-6107	MEND Report 1.20.1 (2009), Modified from SM 3125 B	ICP-MS
Molybdenum Dissolved	ARD-181-18006, MET-181-6107	MEND Report 1.20.1 (2009), Modified from SM 3125 B	ICP-MS
Sodium Dissolved	ARD-181-18006, MET-181-6108	MEND Report 1.20.1 (2009), Modified from SM 3120 B	ICP/OES
Nickel Dissolved	ARD-181-18006, MET-181-6107	MEND Report 1.20.1 (2009), Modified from SM 3125 B	ICP-MS
Phosphorus Dissolved	ARD-181-18006, MET-181-6108	MEND Report 1.20.1 (2009), Modified from SM 3120 B	ICP/OES
Lead Dissolved	ARD-181-18006, MET-181-6107	MEND Report 1.20.1 (2009), Modified from SM 3125 B	ICP-MS
Sulphur Dissolved	ARD-181-18006, MET-181-6108	MEND Report 1.20.1 (2009), Modified from SM 3120 B	ICP/OES
Antimony Dissolved	ARD-181-18006, MET-181-6107	MEND Report 1.20.1 (2009), Modified from SM 3125 B	ICP-MS
Selenium Dissolved	ARD-181-18006, MET-181-6107	MEND Report 1.20.1 (2009), Modified from SM 3125 B	ICP-MS
Silicon Dissolved	ARD-181-18006, MET-181-6108	MEND Report 1.20.1 (2009), Modified from SM 3120 B	ICP/OES

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Method Summary

CLIENT NAME: MISC AGAT CLIENT BC

AGAT WORK ORDER: 20V571389

PROJECT: CG14367

ATTENTION TO: Corina Aldea

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Tin Dissolved	ARD-181-18006, MET-181-6107	MEND Report 1.20.1 (2009), Modified from SM 3125 B	ICP-MS
Strontium Dissolved	ARD-181-18006, MET-181-6107	MEND Report 1.20.1 (2009), Modified from SM 3125 B	ICP-MS
Tellurium Dissolved	ARD-181-18006, MET-181-6107	MEND Report 1.20.1 (2009), Modified from SM 3125 B	ICP-MS
Thorium Dissolved	ARD-181-18006, MET-181-6107	MEND Report 1.20.1 (2009), Modified from SM 3125 B	ICP-MS
Titanium Dissolved	ARD-181-18006, MET-181-6107	MEND Report 1.20.1 (2009), Modified from SM 3125 B	ICP-MS
Thallium Dissolved	ARD-181-18006, MET-181-6107	MEND Report 1.20.1 (2009), Modified from SM 3125 B	ICP-MS
Uranium Dissolved	ARD-181-18006, MET-181-6107	MEND Report 1.20.1 (2009), Modified from SM 3125 B	ICP-MS
Vanadium Dissolved	ARD-181-18006, MET-181-6107	MEND Report 1.20.1 (2009), Modified from SM 3125 B	ICP-MS
Tungsten Dissolved	ARD-181-18006, MET-181-6107	MEND Report 1.20.1 (2009), Modified from SM 3125 B	ICP-MS
Zinc Dissolved	ARD-181-18006, MET-181-6107	MEND Report 1.20.1 (2009), Modified from SM 3125 B	ICP-MS
Zirconium Dissolved	ARD-181-18006, MET-181-6107	MEND Report 1.20.1 (2009), Modified from SM 3125 B	ICP-MS
Mercury Dissolved	MET-181-6103, LAB-181-4015	Modified from EPA 245.7	CV/AA

AGAT Laboratories

Acid Rock Drainage Chain Of Custody Form (for solid samples, extracts & leachates)

Address: 120 - 8500 Glenlyon Parkway, Burnaby, BC V5J 0B6, Web E-Mail: webearth.agatlabs.com

Phone: 778.452.4000; Fax: 778.452.4074

Contact Person: Andrew Garrard; E-Mail: garrard@agatlabs.com

Laboratory Use Only

Arrival Condition:	X	Good		Poor
AGAT Work Order #:	20V571329			
Date Samples Rec'd:	February 3, 2020			

Company:	Wood E & IS	1	Corina Aldea
Contact Person:	Corina Aldea	2	
Address:	3450 Harvester Road Suite 100	3	
	Burlington, ON L7N 3W5	4	
Telephone:	(905) 741-5710 Fax:	E-Mail:	
Client Project Name:		1	corina.aldea@woodplc.com
Client Project #:	CG14367	2	
AGAT ARD Project #:		3	
AGAT ARD Quote #:		4	

Report Format Request: [ ] Excel Format [ ] PDF Format [X] Both

TAT Request: [ ] Regular TAT [X] Rush TAT

Client Notes:

COC No.: 1 of

DUE DATE: **February 17, 2020**

Notes:
Two weeks TAT, No preparation required
One sample at AGAT Mining rec'd Jan 24
W.O 20T567177

Courier information(if available):
Print Name: Purolator
Date:

Storage Policy: All solid samples will be stored free for 90 days and all extracts in cold room for 60 days and then discarded or returned. Clients must inform AGAT if longer storage is required. A storage fee will apply.

Analysis Request

S. No.	Client Sample ID (Solids Matrix)	AGAT Sample ID	Sample Prep [Dry <1kg, crush to 80% passing ¼ inch, split 120g and pulverize to 85% passing 200 mesh (75 um)]	Modified ABA Package (96-97 Method) (Paste pH, Fizz test, NP & Total S)	Standard Sobek ABA Package (Paste pH, Fizz test, NP & Total S)	Siderite Corrected NP	Sulphate Sulphur- HCl Leach (sulphide sulphur by difference)	Sulphate Sulphur- Na2CO3 Leach	Sulphate Sulphur- Gravimetric Method	Sulphur Spec. (Sulphate-S, Sulphide-S & Non-Extractable-S; ASTM 2492-02 method)	Total Carbon	Total Organic Carbon	Carbonate Carbon (CO2; HCl method)	Surface Rinse pH on <2mm fraction (MEND method)	Crushed pH ☐ on Pulp (MEND method) ☐ <1/4" fraction	Single Addition NAG ☐ Egi method (181-712) ☐ MEND method (181-711)	NAG Extract Analysis	Trace Metals by Aqua Regia Digestion ☐ ICP-OES (201073) ☐ ICP-MS (201074)	Total Metals by 4 Acid Digestion ☐ ICP-OES (201070) ☐ ICP-MS (201071)	Whole Rock Analysis ☐ ICP-OES (201076) ☐ XRF (201676)	Shakeflask Extraction (SFE; MEND method; water extraction)	Synthetic Precipitation Leaching Procedure (SPLP; US-EPA 1312 method; water extr.)	Meteoric Water Mobility Procedure (MWMP; EP 1990/STD Method; water extr.)	Mineralogy: Optical Microscopy on polished thin sections	Mineralogy: Rietveld XRD	Humidity Cell Tesing by MEND Method	Humidity Cell Testing by ASTM Method	Particle Size Analysis (Dry Sieve Method using RO-TAP)	Particle Size Distribution (Wet Sieve Method using Hydrometer)	Custom Column Testing	Custom Sub-Aqueous Disposal (SAD) Column Testing
	Burnaby Code		181-033	181-704	181-703	181-705	181-706	181-707		181-708	181-709	181-710	201-037	181-701	181-702	181-712/713		201-074	201-071	201-076/676	181-714	181-716	181716	181-999	185-999	181-740	181-741	181-718	58-640	181-999	181-999
1	S019-20	918551	X	X														X			X										

S. No.	Extract & Leachate Analyses Request	pH	EC	ORP	Acidity	Alkalinity (total/speciation)	Sulphate	Turbidity	Chemical Oxygen Demand (COD)	Biochemical Oxygen Demand (BOD)	TDS	TSS	Nitrate	Nitrite	Nitrate + Nitrite as N (one result)	TKN	Nitrogen, Total	Ammonia, Total	Flouride	Chloride	Total Organic Carbon (TOC)	Total Cyanide (SAD)	WAD Cyanide	Oil & Grease (Total)	Oil & Grease (Mineral)	Total Metals by ICP-MS/ICP-OES Scans	Dissolved Metals by ICP-MS/ICP-OES Scan	Hg by CVAA method ☐ Total ☐ Dissolved	Dissolved Oxygen	
	Burnaby Code	n/a	181-745	181-746	181-748	181-749	n/a						n/a	n/a	181-698			n/a	n/a	n/a						181-762	n/a	181-128		
1	Method Blank-SFE	911971																												
2	S019-20	174																									X			
																											X			

V123475

AGAT Laboratories

5623 McAdam Road
Mississauga, ON
L4Z 1N9
P: 905.501.9998 • F: 905.501.0589

Chain of Custody • Mining

webmining.agatlabs.com • www.agatlabs.com

LABORATORY USE ONLY

Arrival Condition: ☐ Good ☐ Poor (complete notes) AGAT WO#: 20V571389

Notes:

FEB 3 AM 9:40

Client Information

Company: Read E&S
Name: CORINA ALDEA
Address: 3450 Harvester Rd, suite 100, Burlington ON L7N 3W5
Phone: 905-741-5710 AGAT Quotation #: email quote
Fax: Client Project #: CG14367-15

Invoice To Same: Yes ☒ No ☐

Company:
Name:
Address:
Phone: Fax:
PO#:

Report To

Name: CORINA ALDEA
Email: corina.aldea@woodplc.com
Name:
Email:

Turnaround Time Required (TAT)

Regular TAT ☐
Rush TAT ☒ (Specify Below) 2 weeks
Rush surcharges may apply

Material Matter

Drill Core ☐ Pulp ☐
Rock ☐ Water ☐
Till/Soil/Silt ☐ Other ☒ (Specify Below) Aggregate
Concentrate ☐

Sample Preparation

☒ No Prep Required - Run as Received
☐ AGAT Sample Prep Code
☐ Other

Analysis

SAMPLE SEQUENCE NUMBER FROM	SAMPLE SEQUENCE NUMBER TO	QUANTITY	AGAT MINING ANALYSIS METHOD
SO19-20		1	Acid-base accounting (ABA)
SO19-20		1	Whole rock metals analysis: carbon + sulphur
SO19-20		1 S	181714 Shakeflask extraction
		L	181752 ICP-MS scan humidity cell / shake flask extraction / NAG Extraction

Special Instructions:

Governed by terms and conditions of MSSA # M15016

Samples Relinquished by (print name and sign): Corina Aldea — Date/Time: 23 Jan 2020
Samples Received by (print name and sign): — Date/Time:

Sample Storage: (Pulp and Reject Material Handling Upon Analysis Completion)

Return to Client ☐ Store Reject for 90 days (and return to client) ☐
Discard Material ☒ Store Pulp for 90 days (and return to client) ☐
Store beyond 90 days ☐ (Storage fees apply)

Courier

John Chyzyka
Print Name
Jan 24 (11:30)
Date

Page ☐ of ☐

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM - BURNABY

Work Order # 20V571389

RECEIVING BASICS:

Received From: PUROLATOR Waybill #: _____

SAMPLE QUANTITIES:

Coolers: 1 BAG Containers: 1

TIME SENSITIVE ISSUES:

Earliest Date Sampled: Not Indicated ALREADY EXCEEDED? Yes No

NON-CONFORMANCES:

3 temperatures of samples* and average of each cooler: (record differing temperatures on the CoC next to sample ID's) *use jars when available

(1) ___+___+___=____°C (2) ___+___+___=____°C (3) ___+___+___=____°C (4) ___+___+___=____°C

Was ice or ice pack present: Yes No

Integrity Issues:

Account Project Manager: _____ have they been notified of the above issues: Yes No

Whom spoken to: _____ Date and Time: _____

ADDITIONAL NOTES:

PETROGRAPHIC EXAMINATION OF COARSE AGGREGATE

CSA A23.2-15A

wood.

Project: CG14367
Client: Government of Northwest Territories

Lab No.: S019-20
Source: Edie Lake Quarry
Sample Type: Grab sample

Date Sampled: 30 May 2019
Sampled By: B. Brodland & N. Khan of Wood

Date of Analysis: 26 February 2020
Analyst: Graeme Lowry
Reviewer: Amy McCulloch

Sample Constituents	Percent on Sieves (Gradation) 51.9%	24.8%	23.3%	Percent in Entire Sample				Totals
	Percent on Sieves (Constituents) -20 +14mm	-14 +10mm	-10 +5mm	Good	Fair	Poor	Del	
Carbonate - grey; micritic to fine grained; angular - irregular; occasional dendritic staining; hard to medium hard	0.3	0.9	0.0	0.4				0.4
Carbonate - grey; micritic to fine grained; calcite content less than 1%; angular - irregular; hard to medium hard	17.2	36.2	48.9	29.3				29.3
Carbonate - grey; micritic to fine grained; calcite content less than 5%; angular - irregular; hard to medium hard	20.7	15.7	8.9	16.7				16.7
Carbonate - grey; micritic to fine grained; calcite content less than 10%; angular - irregular; hard to medium hard	5.3	4.5	2.9	4.6				4.6
Carbonate - grey; micritic to fine grained; calcite content less than 20%; angular - irregular; hard to medium hard	4.6	0.5	3.0	3.2				3.2
Carbonate - grey; micritic to fine grained; occasional stylolites; angular - irregular; hard to medium hard	0.5	0.7	0.2	0.5				0.5
Carbonate - grey; micritic to fine grained; calcite content less than 1%; occasional stylolites; angular - irregular; hard to medium hard	14.9	13.0	13.1	14.0				14.0
Carbonate - grey; micritic to fine grained; calcite content less than 5%; occasional stylolites; angular - irregular; hard to medium hard	14.7	3.2	4.7	9.5				9.5
Carbonate - grey; micritic to fine grained; calcite content less than 10%; occasional stylolites; angular - irregular; hard to medium hard	1.7	1.4	0.5	1.3				1.3
Carbonate - grey; micritic to fine grained; calcite content less than 20%; occasional stylolites; angular - irregular; hard to medium hard	0.7	0.5	0.0	0.5				0.5
Carbonate - grey; micritic to fine grained; occasional stylolites; angular - irregular; soft.	0.4	1.9	1.5		1.0			1.0
Carbonate - grey; micritic to fine grained; calcite content less than 10%; occasional stylolites; iron staining; angular - irregular; hard to medium hard	0.6	0.0	0.0	0.3				0.3
Carbonate - grey; micritic to fine grained; calcite content less than 20%; occasional stylolites; iron staining; angular - irregular; hard to medium hard	1.7	1.4	0.0	1.2				1.2
Carbonate - grey; micritic to fine grained; calcite content less than 1%; iron staining; angular - irregular; hard to medium hard	0.0	1.3	1.8	0.7				0.7
Carbonate - grey; micritic to fine grained; calcite content less than 5%; iron staining; angular - irregular; hard to medium hard	0.0	1.6	0.6	0.5				0.5
Carbonate - grey; micritic to fine grained; calcite content less than 20%; iron staining; angular - irregular; hard to medium hard	0.0	3.8	0.0	1.0				1.0
Carbonate - grey; micritic to fine grained; calcite content less than 1%; with sphalerite; angular - irregular; hard to medium hard	12.3	6.4	5.7	9.3				9.3
Carbonate - grey; micritic to fine grained; black organic mud; angular - irregular; medium hard.	0.7	0.7	0.5	0.7				0.7
Carbonate - grey; micritic to fine grained; calcite content more than 50%; angular - irregular; soft	0.0	1.3	2.5		0.9			0.9
Carbonate - grey; micritic to fine grained; calcite content more than 50%; iron staining; angular - irregular; soft	0.0	0.3	0.0		0.1			0.1
Carbonate - grey; micritic to fine grained; occasional dendritic staining; surface weathered; angular - irregular; medium hard	0.6	0.0	0.0	0.3				0.3
Carbonate - grey; micritic to fine grained; calcite encrustation less than 20% of particular surface; angular - irregular; medium hard	0.7	1.5	0.0	0.7				0.7
Carbonate - grey; micritic to fine grained; iron staining; calcite encrustation less than 20% of particular surface; angular - irregular; medium hard.	1.0	0.0	0.0	0.5				0.5
Carbonate - grey; micritic to fine grained; iron staining; calcite content more than 20 % angular - irregular; medium hard.	0.0	0.8	0.0	0.2				0.2
Carbonate - grey; micritic to fine grained; calcite content more than 20 %; angular - irregular; medium hard.	0.0	2.6	0.0	0.6				0.6
Carbonate - grey; micritic to fine grained; iron staining ; calcite content more than 30 %; angular - irregular; soft	0.6	0.0	0.0		0.3			0.3
Carbonate - grey; micritic to fine grained; calcite content more than 30 %; angular - irregular; soft	0.6	0.0	0.0		0.3			0.3
Calcite - white; fine grained; irregular; soft	0.0	0.0	2.6		0.6			0.6
Chert - white; very fine grained; compact; leached; rounded - irregular; hard	0.0	0.0	2.7			0.6		0.6
Total	100	100	100					100.0
Weighted average, Good				96.1				
Weighted average, Fair					3.2			
Weighted average, Poor						0.6		
Weighted average, Deleterious							0.0	
Petrographic Number (per fraction)	103	107	127	**Petrographic Number (entire sample)**				**110**

Table 1: Determination of flakiness of aggregates

ATT-49/95 Flakiness Index

Sieve Fraction (mm)	Weight Retained (g)	Weight Passing (g)	Total Weight (g)	Flakiness Index (%)
14 - 20	1463.9	269.9	1733.8	15.6
10 - 14	739.5	165.7	905.2	18.3
6.3 - 10	444.2	147.6	591.8	24.9
Sum of Weights		**583.2**	**3230.8**	
Total Flakiness Index				**18.1**
Tested By:	J. Calderon	Date Tested:	28 January 2020	

Notes:

Table 2: Determination of the degradation using the los angeles abrasion machine

CSA A23.2-16A Resistance to Degradation of small-sized Coarse Aggregate by Abrasion and Impact in the Los Angeles Abrasion Machine

Maximum Aggregate Size Used (mm)	Start Weight (g)	Grading Designation	Percent Loss (%)
14	5004.3	B	**27**
Tested By:	J. Wood	Date Tested:	26 February 2020

Notes: sample ran to 500 revolutions at 33 revolutions/minute