Appendix A: 2019 Geochemical Monitoring

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Memorandum

To:	Peter Kuhn, Blue Star Gold Corp.	**Client:**	Blue Star Gold Corp.
From:	Derrick Midwinter, P.Geo Kirsty Ketchum, P. Geo	**Project No:**	1CB041.001.800
Cc:		**Date:**	March 16, 2020
Subject:	ML/ARD Summary of Waste Rock, Ulu, Nunavut		

1 Introduction

The Ulu Gold project is located on Inuit-owned land in the Kitikmeot Region, Nunavut, 126 km north of the Lupin mine. This memo documents the results of the 2019 geochemical monitoring of historic waste rock used as construction material to determine the metal leaching and acid rock drainage (ML/ARD) potential.

2 Background

Portal excavation at the Ulu site commenced in 1996. Underground development of the ramp ceased in August 1997 at the 155m level. Development waste rock brought to surface was used to construct the camp pad, sections of the road network and to build the existing ore pads and portal laydown. It is estimated that 126,900 tonnes of waste rock had been produced during the underground exploration program (Wolfden 2005). Approximately 2,200 tonnes of mineralized material from a bulk sample was brought to surface and stored on the ore pad (Cowley et al. 2015). The previous operators attempted to determine the ARD potential of the waste rock prior to use for construction. Fifteen samples were collected and analysed as part of a 1990 testwork program (Rescan 1991), and 32 samples were collected and analysed from the 1996 program (Klohn-Crippen 1996). The project did not progress beyond advanced exploration and the infrastructure not required for Blue Star Gold Corp.'s exploration program is being reclaimed.

SRK was contracted to conduct a preliminary assessment of ML/ARD potential of waste rock used in surface construction, to evaluate its use for the construction of a landfill at the site; and to assess the ML/ARD potential of ore to evaluate its need for remediation.

3 Methods

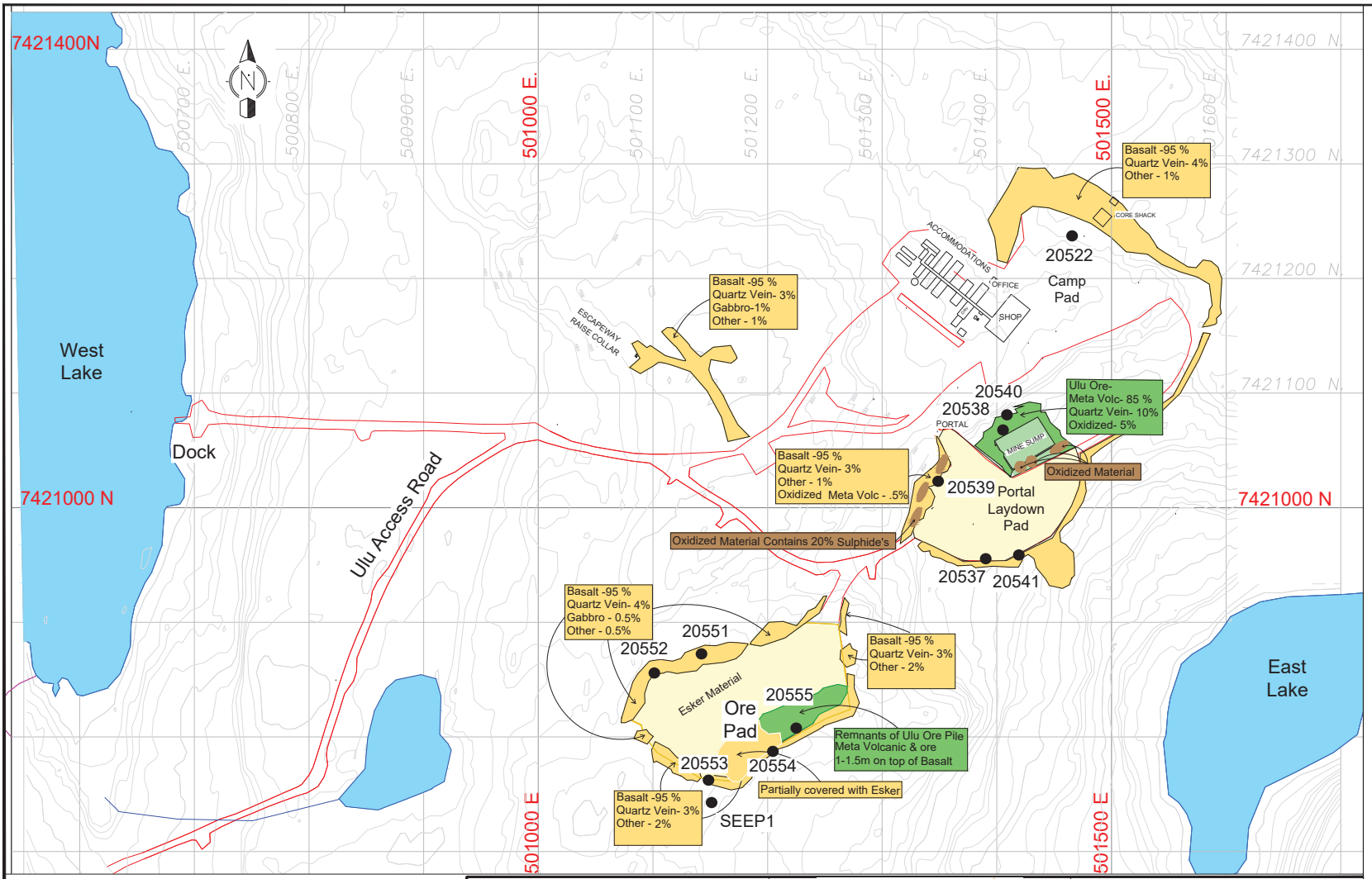
3.1 Study Design

Preliminary characterization of ML/ARD potential of surface waste at the site has been conducted using both a sampling campaign of construction rock, and a seepage survey to characterize contact water chemistry.

3.2 Sample Collection

Sample collection was undertaken September 3 to 5, 2019 by Blue Star Gold Corp's exploration manager under direction from SRK. The sample set comprised 11 grab samples (Figure 3-1) from around the perimeter of the ore pad, camp pad, and portal laydown pad. One sample was collected from the rubble of altered, weathered outcrop near the portal. The pads were constructed using waste rock. Samples were collected using a pick and shovel and sieved to less than 1 cm grain size fraction in the field. The resulting sieved samples were 1.5 to 2 kg.

A seepage survey was conducted during the September 2019 program around the perimeter of the camp infrastructure where locations were established opportunistically in areas where water was observed to be flowing. One seep was identified and sampled by SRK (SEEP-1; Figure 3-1).



LEGEND

- Tank Farm Berm Outline
- Building
- Water Pipeline
- Sewage Pipeline
- Lake Shore, Drainage
- Contour 1 m
- Roads
- Site Features Miscellaneous
- 020540 Sample Location

- 95% basalt,+/- gabro, quartz vein and other
- Ore: 85% meta volcanic,10% quartz vein,5% oxidized
- Oxidized Material:0.5% meta volcanic,20% sulphides

NOTES

1. Topographic information and facilities outline provided by Blue Star Gold Corp.

0 40 80 120 160 200
Scale in Metres

Coordinate System: Nad_1983_UTM_Zone_12N
NTS Map Sheets 076L15

srk consulting

SRK JOB NO.: 1CB041.000.600
FILE NAME: Ulu-SiteFacil-utm-20191030_Blast Rock.dwg

BLUE STAR GOLD CORP.

Ulu Gold Project

ML/ARD Summary of Waste Rock

Sample Location and Geological Descriptions of the Ulu Mine Site

DATE:	APPROVED:	FIGURE:
October 2019	DM	3-1

3.3 Analytical Methods

3.3.1 Solids Analysis

Nine of eleven samples collected were analyzed by Global ARD Testing Services Inc. (Global ARD) under the direction of SRK for:

- Paste pH and electrical conductivity (EC),
- Total sulphur and total carbon (Leco method),
- Total inorganic carbon (TIC),
- Modified Neutralization Potential (NP) (Coastech Research 1991),
- Total sulphur as SO_4 by HCl leach, and
- Element analysis following aqua regia digestion by inductively coupled plasma mass spectrometry (ICP-MS) – including sulphur.

A subset of four samples were selected by SRK for shake flask extraction (SFE) analysis with the tests performed after sieving to the minus 2 mm grain size fraction. Samples were chosen to represent different rock types/sulphide content and mine area. SFE tests followed the MEND (2009) method with 3 parts deionized water to 1 part solid. Parameters analysed were pH, EC, total dissolved solids (TDS), anions (alkalinity, bromide, chloride, fluoride, and sulphate), nutrients (ammonia, nitrate, and nitrite) and dissolved metals.

3.3.2 Seepage Analysis

The water sample was submitted by SRK for analysis at ALS Environmental (ALS) in Burnaby, British Columbia for pH, EC, TDS, anions (alkalinity, bromide, chloride, fluoride, and sulphate), nutrients (ammonia, nitrate and nitrite) and dissolved metals. The sample was filtered and preserved in the field.

3.4 Data QA/QC

SRK reviewed all data for QA/QC purposes, including Global ARD and ALS's internal QC program. One field duplicate was collected for waste rock sample 20555. There was no field duplicate for the seepage sample collected. All data passed the QC criteria for the ABA, metals and SFE results from the rock samples, and the QC criteria for the water chemistry from the seepage sample as summarized in Table 3-1.

Table 3-1: QAQC Summary Table

QC Test	SRK QC Criteria	Results
paste pH		
Pulp Duplicate (n=1)	For any samples, +/- 0.5 difference pH unit	All passed.
Field Duplicate (n=1)	For any samples, +/- 0.5 difference pH unit	All passed.
Standard Reference Material (n=1)	For any samples, +/- 0.5 difference pH unit	All passed.
Total C and TOC by HCl leach/Leco		
Method Blank (n=1) for Total C, (n=0) for TOC	<5X detection limit (DL)	All passed.
Carbon balance (Total C > TOC) (n=10)	For samples > 10X the detection limit (DL), Total Carbon should be greater than Total Inorganic Carbon, if not the % difference should be within +/-20%	All passed.
Field Duplicate (n=1) for Total C and TOC	For samples > 10X the detection limit (DL), % RPD within +/-20%	All passed.
Standard Reference Material (n=1) for Total C, (n=0) for TOC	Within specified tolerance ranges.	All passed.
Total C and TIC by HCl leach/CO2-Coulometer		
Method Blank (n=1) for Total C and (n-1) for TIC	<5X detection limit (DL)	All passed.
Carbon balance (Total C > TIC) (n=10)	For samples > 10X the detection limit (DL), Total Carbon should be greater than Total Inorganic Carbon, if not the % difference should be within +/-20%	All passed.
Field Duplicate (n=1) for Total C and TIC	For samples > 10X the detection limit (DL), % RPD within +/-30%	All passed.
Pulp Duplicate (n=1) for Total C and (n=2) for TIC	For samples > 10X the detection limit (DL), % RPD within +/-20%	All passed.
Standard Reference Material (n=1) for Total C and TIC (n=1)	Within specified tolerance ranges.	All passed.
TIC (by HCl leach/Leco) and TIC (by HCl leach/CO_2-Coulometer)		
Comparison between TIC and TIC (n=10)	For samples > 10X the detection limit (DL), % RPD within +/-20%	All passed.
Total S & Total Sulphate		
Method Blank (n=1) for Total S and SO_4	<2X detection limit (DL)	All passed.
Sulphur balance (total S > sulphate S) (n=10)	For samples > 10X the detection limit (DL), Total Sulphur should be greater than Total Sulphate, if not the % difference should be within +/-20%	All passed.
Field Duplicate (n=1) for Total S and SO_4	For samples > 10X the detection limit (DL), % RPD within +/-30%	All passed.
Pulp Duplicate (n=1) for Total S, (n=0) for SO_4	For samples > 10X the detection limit (DL), % RPD within +/-20%	All passed.
Standard Reference Material (n=1) for Total S, (n=1) for SO_4	% Difference within +/-20%	All passed.
Modified NP		
NP consistent with paste pH (n=10)	Negative NP has paste pH <= 5	Sample ID# 20539 is outside of the criteria. Negative NP has paste pH <=5. Recheck confirmed results, Accepted.
Field Duplicate (n=1) for NP, (n=1) for fizz test	% RPD better than +/-15% for NP>20 kg/t, % RPD better than +/-20% for NP>10 kg/t, Difference within +/-5kg/t for NP<10 kg/t. Fizz test rating is the same.	All passed.
Pulp Duplicate (n=1) for NP, (n=0) for fizz test	% RPD better than +/-15% for NP>20 kg/t, % RPD better than +/-20% for NP>10 kg/t, Difference within +/-5kg/t for NP<10 kg/t. Fizz test rating is the same.	All passed.
Fizz test rating with NP (n=10)	Max NP does not exceed fizz test rating	All passed.
Standard Reference Material (n=1)	Within specified tolerance ranges.	The result is lower than the minimum tolerance range, but within the lab's 10% acceptance criteria. Accepted.
Modified NP and TIC		
Comparison between Modified NP and TIC (n=10)	Check for trends/co-relation	NP is higher than TIC
Total S-Leco and S-ICP		
Comparison between Total S-Leco and S-ICP (n=10)	For samples >10X detection limit (DL), % RPD within +/-20%	All passed.
Trace Elements (Aqua Regia Digestion with ICP Finish)		
Method Blank (n=1)	<2X Detection Limit	All passed.
Field Duplicate (n=1)	For samples >10X detection limit (DL), % RPD within +/- 30%, For ICP metal scan, it is acceptable for 10% of parameters to be outside of this criterion.	All passed.
Pulp Duplicate (n=1)	For samples >10X detection limit (DL), % RPD within +/- 20%, For ICP metal scan, it is acceptable for 10% of parameters to be outside of this criterion.	All passed.
Standard Reference Material (n=1)	Within specified tolerance ranges.	All passed.
Shake Flask Extraction		
Method Blank (n=1)	<2X Detection Limit	All passed.
Field Duplicate (n=1)	For samples >10X detection limit (DL), % RPD within +/- 30%, For ICP metal scan, it is acceptable for 10% of parameters to be outside of this criterion.	All passed.
Leachate Duplicate (n=2)	For samples >10X detection limit (DL), % RPD within +/- 20%, For ICP metal scan, it is acceptable for 10% of parameters to be outside of this criterion.	All passed.
Standard Reference Material (n=1) for SO_4, NO_3 and NH_4	Within specified tolerance ranges.	All passed.
Water Chemistry (Seepage)		
Method Blank (n=1)	<2X Detection Limit	All passed.
Lab Duplicate (n=1) for Anions and Nutrients	For samples >10X detection limit (DL), % RPD within +/- 20%, For ICP metal scan, it is acceptable for 10% of parameters to be outside of this criterion.	All passed.

Source: Y:\01_SITES\Ulu\1CB041.000_Landfill_Design\!020_Project_Data\060_Lab\GlobalARD\COA 11 Ulu Samples (rec'd 20-Sep19) V2_QAQC_mlt.xlsx & Y:\01_SITES\Ulu\1CB041.000_Landfill_Design\!020_Project_Data\060_Lab\ALS_Lab\L2343446_XLR.xls

3.5 Data Calculation Methods

Sulphide sulphur was calculated by subtracting the analyzed sulphur as sulphate from the total sulphur from the Leco analysis.

ARD potential was assessed by reviewing both the ratio of NP to acid potential (AP), and of TIC to AP whereby TIC as kg $CaCO_3$/t (assuming carbonate occurs as minerals that react like calcite) was calculated following Equation 1 and AP was calculated from sulphide sulphur (Equation 2).

TIC (kg $CaCO_3$/t) = TIC (% as C) x 83.3 **(Eq. 1)**

AP (kg $CaCO_3$/t) = sulphide (% as S) x 31.25 **(Eq. 2)**

3.6 Data Interpretation Methods

ARD potential was evaluated on the basis of the ratio of Modified NP to AP, where AP was calculated from total sulphide. Accordingly, the ARD potential classifications are:

- Acid generation (AG): pH < 5.5
- PAG: NP/AP<1
- Uncertain: 3>NP/AP ≥1
- Non-PAG: NP/AP≥3

The ARD potential of samples was also evaluated on the basis of TIC/AP with the same criteria applied as for NP/AP.

Metal leaching potential was evaluated in a number of ways:

- By comparing the solids results to screening criteria (ten times the average crustal abundance of basalt; Price 1997) to evaluate samples for element enrichment.
- By comparing the SFE results to screening criteria which are used as a preliminary guide to indicate whether waste rock/ore contact water will require management to ensure protection of the receiving environment. The screening criteria are based on ten times the CCME (2020) long term guidelines for the protection of freshwater aquatic life. It should be noted that comparing SFE leachate concentrations directly to water quality guidelines does not give a true indication of whether parameters will exceed effluent quality criteria under site conditions, as SFE tests are not representative of site conditions.
- By comparing the seepage results to the Federal Contaminate Sites Action Plan (FCSAP; 2012) federal interim groundwater quality guidelines, valid for groundwater in the active zone of permafrost areas.

4 Results and Discussion

4.1 Lithology

The geological composition of the various rock types used for construction was mapped during the sampling program (Figure 3-1). Rock was predominantly basalt (95%) in the ore pad, camp pad and portal laydown pad, or mafic metavolcanics (85%) in the mineralized outcrop rubble adjacent the portal and adjacent to the mine sump, and as remnants on the ore storage pad (Table 4-1). There were pockets of oxidized material containing up to 20% sulphides in ore material.

Table 4-1: Sample IDs with Rock Descriptions

Mine Area	Sample ID	Rock Description	ABA and Metals Analysis	SFE Analysis
Camp Pad	20522	95% Basalt, 4% Quartz Vein, 1% Other	X	-
Portal Laydown	20537	95% Basalt, 3% Quartz Vein, 1% Other, 0.5% Oxidized Metavolcanics	X	-
	20541	95% Basalt, 3% Quartz Vein, 1% Other, 0.5% Oxidized Metavolcanics	-	-
Mineralized Outcrop	20539	95% Basalt, 3% Quartz Vein, 1% Other, 0.5% Oxidized Metavolcanics	X	X
Ore – Mine Sump	20538	85% Metavolcanics, 10% Quartz Vein, 5% Oxidized Metavolcanics	X	-
	20540	85% Metavolcanics, 10% Quartz Vein, 5% Oxidized Metavolcanics	X	X
Ore Pad	20551	95% Basalt, 4% Quartz Vein, 0.5% Gabbro, 0.5% Other	X	X
	20552	95% Basalt, 4% Quartz Vein, 0.5% Gabbro, 0.5% Other	-	-
	20553	95% Basalt, 3% Quartz Vein, 2% Other	X	-
	20554	95% Basalt, 3% Quartz Vein, 2% Other	X	-
Ore Pad, near Remnants of Ulu Ore Pile	20555	95% Basalt, 3% Quartz Vein, 2% Other	X	X

4.2 Acid-Base Accounting

Table 4-2 presents a summary of ABA data with complete results presented in Attachment 1.

Values of paste pH ranged from 7.0 to 8.4 for all samples with the exception of the mineralized outcrop sample which had a paste pH of 4.3.

Total sulphur was 0.2% to 1.8%. Sulphur speciation data indicates that sulphate was below analytical detection (<0.01%) to 0.04% for the majority of samples. The mineralized outcrop and ore samples had sulphate values up to 0.1%. Paste pH was related to sulphate content, with samples with undetectable sulphate having paste pHs above 8, and lower pH occurring in samples with higher sulphate content (Figure 4-1). This suggests that sulphate minerals (resulting from oxidation of sulphide minerals) have caused pH depression.

Sulphide content was near parity to total sulphur and therefore sulphide was the dominant sulphur species (Table 4-2). Sulphide ranged between 0.20 to 0.68% for waste rock, whereas the ore material had sulphide content between 1.6 and 1.8%. AP ranged from 6.3 to 21 kg $CaCO_3$/t for waste rock whereas ore material was between 48 and 55 kg $CaCO_3$/t.

TIC is a measure of carbonate mineral content. The relationship between TIC and Modified NP (Figure 4-2) indicated greater NP than TIC, with the exception of the mineralized outcrop sample. For all other samples, levels of NP were greater than TIC indicating the presence of silicate minerals likely contributing to acid buffering in the laboratory Modified NP test. NP values ranged from 1.2 to 16 kg $CaCO_3$/t whereas TIC values ranged from 1.7 to 10 kg $CaCO_3$/t. TIC is a more conservative measure of NP for estimating ARD potential as the effectiveness of silicate minerals to neutralize acid under field conditions at the site is unknown. Silicate minerals are substantially less reactive than carbonate minerals.

ARD classifications for all rock samples according to NP/AP and TIC/AP are shown graphically in Figure 4-3 and Figure 4-4. Samples are predominantly classified as PAG, with two samples classified as uncertain ARD potential on the basis of NP/AP, and one sample classified as uncertain ARD potential on the basis of TIC/AP. The mineralized outcrop is classified as acid generating due to the paste pH value (pH < 5.5). Samples had TIC/AP ratios of 0.09 to 1.3 and NP/AP ratios of 0.37 to 1.4 with lower TIC/AP ratios than NP/AP due to the lower carbonate content.

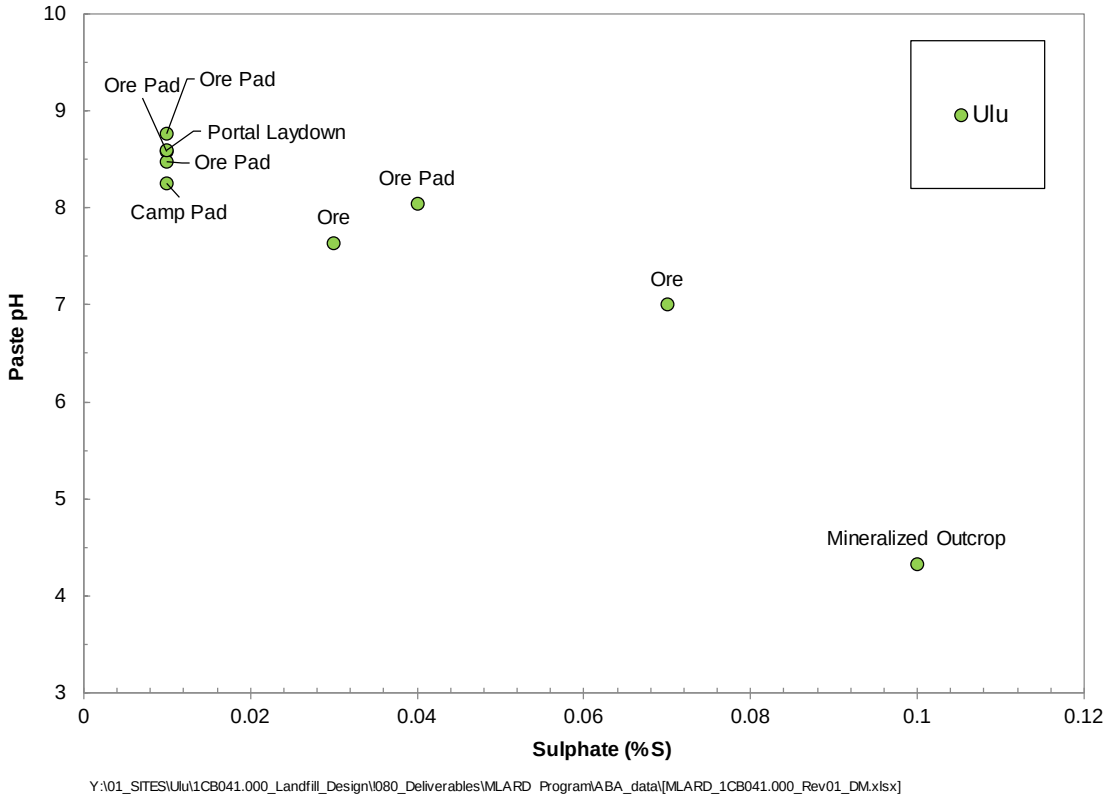


Figure 4-1: Comparison of Paste pH to Sulphate

Table 4-2: Summary of ABA Results for Waste Rock Samples

Area	Sample ID	Paste pH	Total S	Sulphate Sulphur	Sulphide Sulphur	AP	TIC	Modified NP	TIC/AP	NP/AP	TIC/AP ARD Classification	NP/AP ARD Classification
		pH Units	wt%	wt%	wt%	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	-	-		
Camp Pad	20522	8.3	0.68	<0.01	0.68	21	6.7	12	0.56	0.3	PAG	PAG
Mineralized Outcrop	20539	4.3	0.49	0.10	0.39	12	<1.7	1.2	0.1	0.1	AG	AG
Ore	20538	7.6	1.80	0.03	1.8	55	5.8	11	0.2	0.1	PAG	PAG
	20540	7.0	1.61	0.07	1.5	48	4.2	9.5	0.2	0.1	PAG	PAG
Ore Pad	20551	8.8	0.58	<0.01	0.58	18	5.8	13	0.7	0.3	PAG	PAG
	20553	8.6	0.65	<0.01	0.65	20	2.5	6.8	0.33	0.1	PAG	PAG
	20554	8.5	0.20	<0.01	0.20	6.3	8.3	13	2.0	1.3	Uncertain	Uncertain
	20555	8.0	0.64	0.04	0.60	19	10	16	0.85	0.5	PAG	PAG
Portal Laydown	20537	8.6	0.33	<0.01	0.33	10	9.2	15	1.4	0.9	Uncertain	PAG

Source: Y:\01_SITES\Ulu\1CB041.000_Landfill_Design\!080_Deliverables\MLARD Program\ABA_data\MLARD_1CB041.000_Rev01_DM.xlsx

Note: < indicates value below the method detection limit

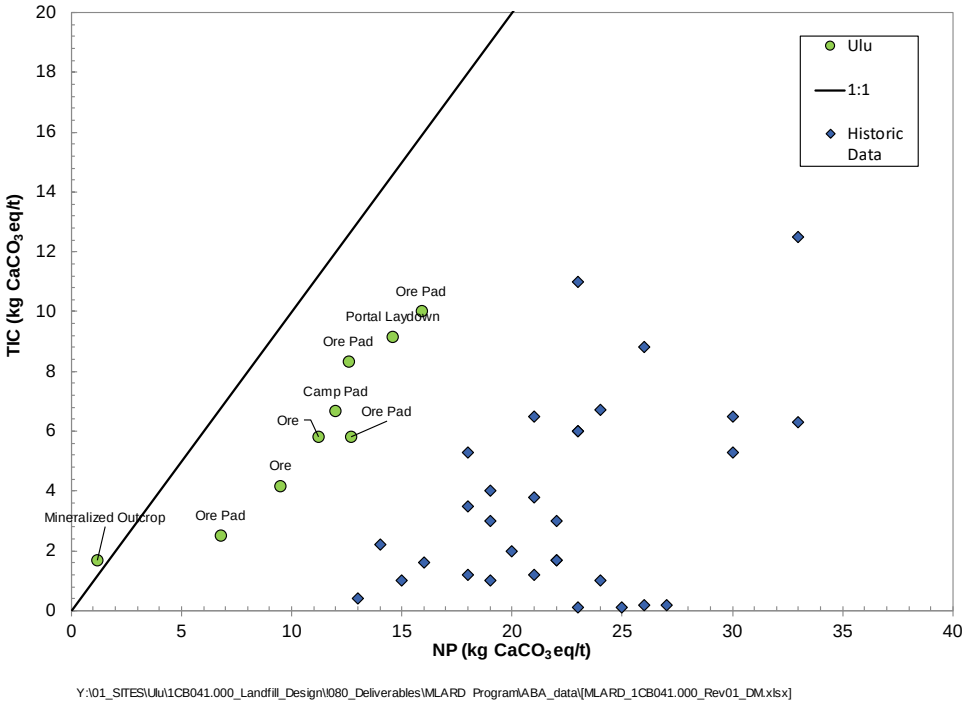


Figure 4-2: Comparison of Modified NP to TIC

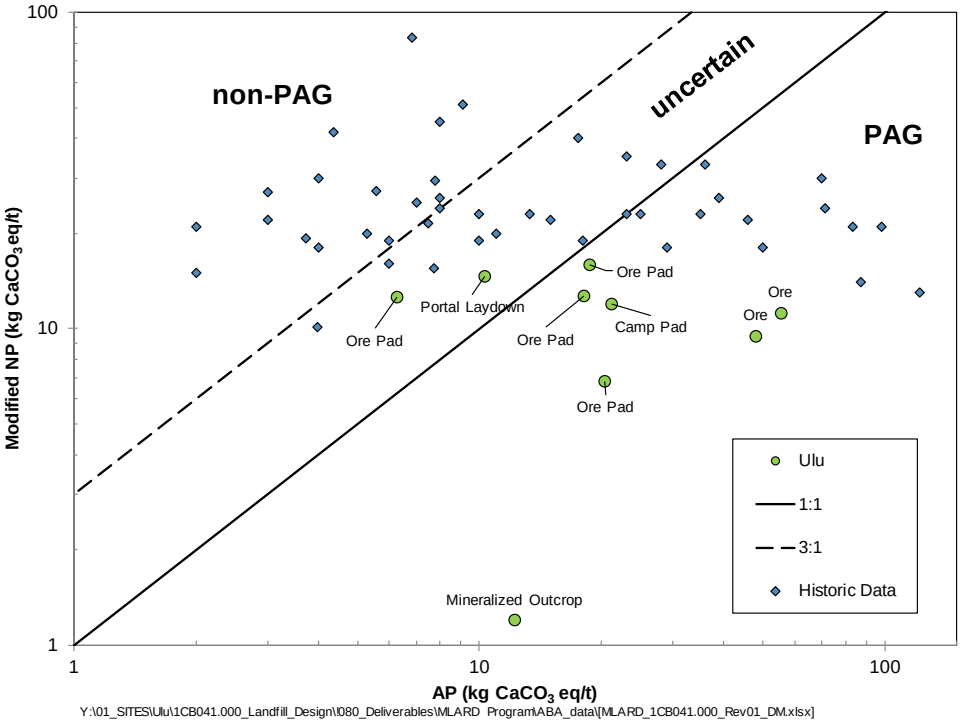


Figure 4-3: ARD Classifications by Modified NP and AP

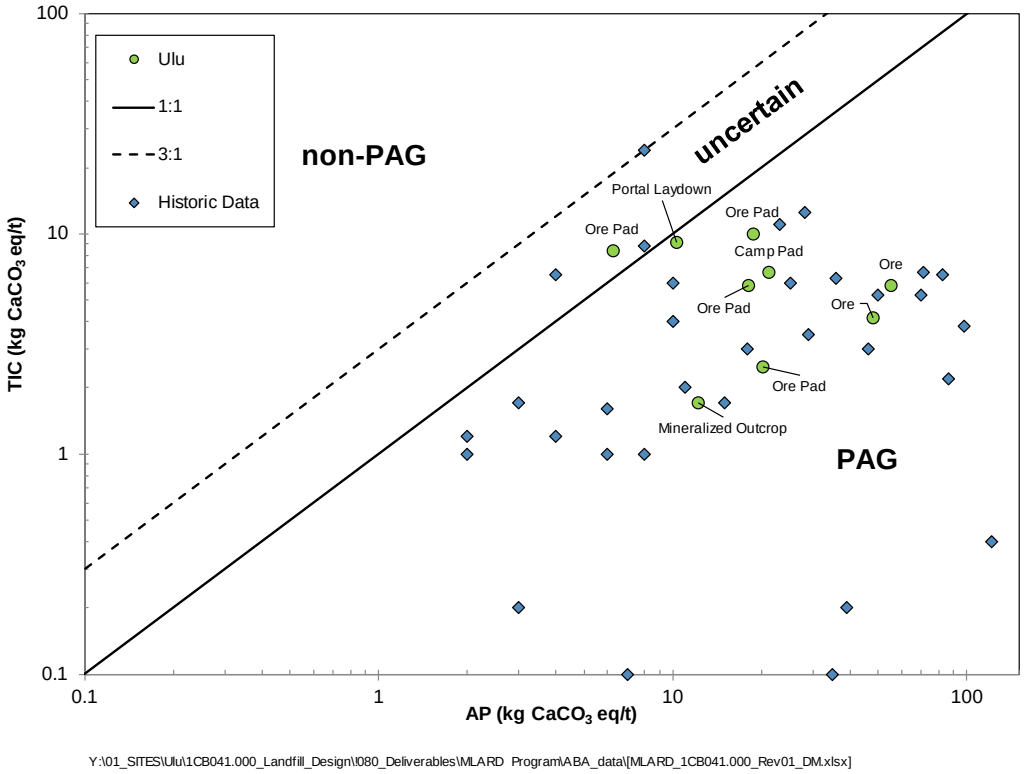


Figure 4-4: ARD Classifications by TIC and AP

4.3 Metal Leaching Potential

4.3.1 Element Enrichment

A summary of major and trace element results (aqua regia digestion) is presented in Attachment 2. Select parameters which were enriched in comparison to the screening criteria are summarized in Table 4-3.

For screening purposes, element concentrations were considered enriched if concentrations were greater than ten times the average crustal abundance of basalt (Price, 1997). This provides an indicator of element enrichment and not element mobility or element release rates. Major elements (i.e. Al, Ca, Fe, Mg, Na, K) were all below the screening criteria. Trace elements arsenic and bismuth were enriched in each sample. Arsenic in the waste rock ranged from 36 to 1800 ppm whereas the ore material exceeded the upper detection limit of 10,000 ppm. Bismuth was greatest in the mineralized outcrop (0.81 ppm) and ranged from 0.20 to 0.38 ppm for all other samples. Selenium was enriched in all but one sample from the ore pad. Antimony and tungsten were only enriched in the ore material. Trace element contents were below the screening criteria for all other parameters. It should be noted that metal leaching under acidic conditions may occur regardless of lack of element enrichment.

Table 4-3: Summary of Select Parameters of Elemental Analyses

Area	Sample ID	As	Bi	Sb	Se	W
		ppm	ppm	ppm	ppm	ppm
10x CA Basalt (Price 1997)		20	0.07	2.0	0.5	7.0
Camp Pad	20522	**1800**	**0.25**	1.6	**0.9**	5.5
Mineralized Outcrop	20539	**63**	**0.81**	1.0	**0.9**	0.93
Ore	20538	**>10000**	**0.30**	**4.9**	**1.0**	**19**
	20540	**>10000**	**0.36**	**4.5**	**1.1**	**21**
Ore Pad	20551	**180**	**0.32**	0.56	**0.6**	1.5
	20553	**36**	**0.32**	0.93	**0.7**	0.75
	20554	**48**	**0.20**	1.9	0.3	2.6
	20555	**61**	**0.38**	0.83	**1.2**	3.2
Portal Laydown	20537	**130**	**0.27**	0.62	**0.5**	2.4

Source: Y:\01_SITES\Ulu\1CB041.000_Landfill_Design\!080_Deliverables\MLARD Program\ABA_data\MLARD_1CB041.000_Rev01_DM.xlsx

Note: CA: Average crustal abundance*Numbers in bold and underlined exceed 10 times the average crustal abundance for basaltic rocks from Price (1997)

4.3.2 Water Soluble Components

A total of four samples, one of the mineralized outcrop, one of ore material, and two of waste rock from the ore pad, were selected for SFE to assess the water soluble constituents of the samples. See Attachment 3 for full results. The results are compared to screening criteria to provide a preliminary indication of whether water in contact with waste rock or ore may require appropriate management to ensure protection of the receiving environment. Comparing SFE leachate concentrations directly to water quality guidelines does not give a true indication of whether parameters will exceed effluent quality criteria under site conditions as the SFE tests are dilute. For results that are below the screening criteria, the comparison does not provide a clear indication that contact water chemistry would not exceed applicable guidelines under site conditions.

Table 4-4: Summary of Select Parameters in Shake Flask Extraction Leachate Samples

Parameter (mg/L)	Screening Criteria	Mineralized Outcrop	Ore	Ore Pad	
		20539	20540	20551	20555
pH	6.5-9	**3.1**	**6.2**	7.4	7.0
Al	1.0/0.05[2]	**1.6**[2]	**<0.001**[2]	0.1	0.003
As	0.05	0.0036	**0.18**	0.0045	0.0003
Cd[1]	0.0023	0.00041	0.00005	0.00001	0.00003
Cu[1]	0.04	**0.18**	0.0022	0.0073	0.0046
Pb[1]	0.07	0.0014	<0.0005	<0.0005	<0.0005
Ni[1]	1.5	0.05	0.01	<0.0005	0.005
Se	0.01	0.0006	0.0009	<0.0005	0.0039
Zn	0.07	**0.20**	0.02	0.001	0.005
SO_4	-	78	230	33	290

Source: Y:\01_SITES\Ulu\1CB041.000_Landfill_Design\!080_Deliverables\MLARD Program\ABA_data\MLARD_1CB041.000_Rev01_DM.xlsx

Notes:

Screening criteria are based on 10 times CCME guidelines as indicated in Section 3.6.

Numbers in bold and underlined exceeded the screening criteria, or were outside of the pH range

< represents result below the method detection limit.

[1] Screening criteria were calculated assuming an average pH of 6.9, and an average hardness of 155 mg/L $CaCO_3$.

[2] For aluminium, if pH is <6.5, screening criteria is 0.05 mg/L, if >6.5, screening criteria is 1.0 mg/L.

The leachates from the SFE tests were circum-neutral (pH 6.2 to 7.4), with the exception of the outcrop sample which had an acidic pH of 3.1.

In the ore and ore pad samples, major cation chemistry was dominated by calcium (ranging from 23 to 110 mg/L) and potassium (2.1 to 14 mg/L), while major anion chemistry was dominated by sulphate (33 to 290 mg/L) and alkalinity (4.5 to 29 mg/L). Concentrations were consistent with oxidation of sulphide minerals releasing sulphate, and dissolution of carbonate minerals releasing calcium and alkalinity. Dissolution of sulphide oxidation products was likely the source of trace elements released in the test leachates. Arsenic was highest in the ore sample, consistent with it typically being mobile at circum-neutral pH, whereas copper, nickel and zinc were highest from the mineralized outcrop sample with acidic pH leachate, consistent with the greater mobility of these elements under acidic conditions.

When compared against the screening criteria, there were various exceedances for the outcrop and ore sample. The mineralized outcrop exceeded the criteria for aluminum, copper and zinc, and had pH outside of the acceptable range. The ore sample exceeded the criteria for arsenic (Table 4-4). The waste rock samples from the ore pad had no parameters that were flagged compared to the screening criteria.

4.4 Seepage Data

Table 4-5 presents key parameters from 2019 seepage data compared to FCSAP groundwater guidelines (2012) for the protection of aquatic life in fresh water (long term). FCSAP groundwater guidelines are considered applicable because the seep location does not support aquatic life; it infiltrates into the tundra within a few metres. Complete results are provided in Attachment 4.

The sample had circum-neutral pH (7.3) with electrical conductivity of 710 uS/cm. Sulphate at 330 mg/L was higher than in the SFE test leachates and again consistent with dissolution of weathering products resulting from oxidation of sulphide minerals. Dissolved sulphate, cadmium, iron and zinc leached at concentrations above the FCSAP guidelines.

Table 4-5: Summary of Select Parameters of Seepage Sample

Sample ID	pH	SO_4	Al	As	Cd	Cu[1]	Fe	Pb[1]	Ni[1]	Se	Zn
	s.u.	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
FSCAP[1]	6.5-9	100	0.1	0.005	0.000017	0.004	0.3	0.007	0.15	0.001	0.01
SEEP-1	7.3	**330**	0.015	0.0005	**0.000025**	0.001	**0.5**	<0.00005	0.026	0.0007	**0.06**

Source: Y:\01_SITES\Ulu\1CB041.000_Landfill_Design\!020_Project_Data\060_Lab\ALS_Lab\L2343446_XLR.xls

[1] FCSAP (2012) guidelines are calculated from the CCME (2020) criteria with a pH result of 7.3, a and hardness result of 366 mg/L $CaCO_3$

5 Delay to Onset of ARD (Discussion of Historical Kinetic Results)

The results from samples analysed for this study confirm that waste rock and ore at site has potential to generate ARD and leach metals (under both acidic and pH neutral conditions). Metal leaching is however expected to be significantly worse under acidic conditions; therefore, timing to onset of acidic conditions is important to consider in the context of management of PAG material. Previous kinetic testing (Klohn 1998) has been conducted on samples from the site and the findings, from a review of the kinetic results by MEMI (2003) are summarized here regarding delay to onset of acid conditions. It should be noted that SRK has not assessed the kinetic results.

Previous findings from ore kinetic tests:

- Net acid generation may be delayed for up to 50 years (from initial exposure) in coarse ore (>1.5mm) based on a sample with 1.1% sulfide (35 kg $CaCO_3$/t AP) and 32 kg$CaCO_3$/t NP.
- Net acid generation may be delayed for up to 30 years (from initial exposure) in fine ore (<1.5mm), due to greater reactivity of material with a higher surface area.

SRK considers that based on the range of static results presented in Figure 4-3, a significant proportion of ore samples, including the ore tested in this study, have higher AP, and lower NP than the sample tested, and therefore will likely generate ARD in a shorter timeframe. See Attachment 1 for historic results from ore and waste rock samples.

Previous findings from waste rock kinetic tests:

- Net acid generation may be delayed for up to 70 years (from initial exposure), from testing of basalt with 1.2% sulphide (36 kg $CaCO_3$/t AP) and 28 kg$CaCO_3$/t NP (and 0.2 to 3.0 mm particle size).

SRK considers that based on the range of static results presented in Figure 4-3, the majority of waste samples have significantly lower AP, and slightly lower NP than the sample tested, and therefore the timeframe indicated likely represents a conservative estimate.

6 Conclusions and Recommendations

The results indicate the following regarding ML/ARD potential of waste rock used for construction at the Ulu project site:

- The majority of waste rock tested (both currently and historically) is potentially acid generating (PAG), based on TIC/AP ratio.
- Waste rock has currently not generated ARD based on paste pH's of 8 and above, and the low rates of sulphide oxidation as indicated by the low sulphate contents of the waste rock samples.
- Regulated elements that were enriched in waste rock (solids) samples include arsenic and selenium. These are likely to be released through sulphide oxidation. Unlike most metal cations (e.g. Cu, Ni, Zn) that have reduced mobility at circum-neutral pH, arsenic and selenium form oxyanions which may be mobile under circum-neutral pH conditions.
- SFE leachate results from waste rock samples were below the screening criteria; however, the comparison does not provide a clear indication that contact water chemistry would not exceed applicable guidelines under site conditions.
- Increased rates of metal leaching may be expected under acidic conditions; however, the delay to onset of acidic conditions is anticipated to be on the order of 70 years (from initial exposure) for waste rock, based on previous kinetic testing.

The results indicate the following regarding ML/ARD potential of ore on surface:

- Ore tested (both currently and historically) is potentially acid generating (PAG), based on TIC/AP ratio.
- Ore has undergone a greater degree of sulphide oxidation than waste rock, based on higher sulphate contents of the rock samples, and this has caused some pH depression in contact water (e.g. SFE leachate pH of 6.2)
- Ore from the mineralized outcrop is acid-generating with a paste pH of 4.3, and a pH of 3.1 from the SFE test.

- Regulated elements that were enriched in ore (solids) samples include arsenic, antimony, and selenium. These are likely to be released through sulphide oxidation and may be mobile under circum-neutral pH and acidic conditions.
- SFE leachate results indicated:
  - Ore from the mineralized outcrop was outside the pH criteria and above the screening criteria for aluminum, copper, and zinc, consistent with mobility of these elements at low pH.
  - Remnant ore from the ore pile was outside the pH criteria and above the screening criteria for arsenic, consistent with mobility of arsenic at mildly acidic pH.
  - This provides an indication that water in contact with ore may require appropriate management to ensure protection of the receiving environment.
- Seepage from the ore pad had circum-neutral pH; however, concentrations of sulphate, cadmium, iron and zinc exceeded the FCSAP Interim groundwater quality guidelines.
- Rates of metal leaching would be expected to increase under acidic conditions. Previous kinetic testing indicated that net acid generation may be delayed for up to 30 years (from initial exposure) in fine ore (<1.5mm). Ore has already been exposed on the surface for approximately 23 years. Given the indications of pH depression in contact waters, ore may generate ARD within a short timeframe.

The following recommendations are provided to manage PAG rock:

- Ore should be managed as soon as possible as it may generate ARD within a short timeframe.
- The delay to onset of acidic conditions in waste rock is likely to be decades. As the rock is PAG however, it will require remediation. This could involve:
  - Application of limestone, or
  - Disposal underground following Blue Star's exploration activities.

If limestone application is considered, then the volume of PAG waste rock present will need to be determined. In addition, it is recommended that a systematic geochemical sampling program be conducted along the existing infrastructure to determine the proportion and distribution of rock with high ML/ARD risk. In addition, particle size analysis should be conducted on all samples to better understand the grain size distribution of the waste rock as finer material may have a shorter lag time to the onset of acidic conditions than coarser material. The grain size distribution of the waste rock piles and infrastructure pads is currently unknown. Once the volume/percentage of fine-grained material is known, the recommended volume of limestone needed to buffer potential acid generation can be calculated.

The following is recommended to monitor metal leaching at the site:

Monitor for the presence of seeps and ephemeral streams around any existing infrastructure during freshet (May/June), in August and September when the waste rock has thawed, and opportunistically following rainfall. These seeps and streams drain into East Lake by exfiltration, the main drainage basin for the ore pad and portal laydown areas, which is a shallow, small water body which may drain by exfiltration to Ulu Lake. East Lake should be sampled in the freshet and fall. Due to the possibility of attenuation or concentration of metals by acidic tundra soils (e.g. Day et al. 2003), collect both upstream and if possible, downstream samples from any seep or streams prior to discharge into East Lake to determine the potential increase or decrease in metal loadings. The program will enable the monitoring of any changes in regard to acid generation and metal concentrations.

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Attachment 1 – ABA Results

Mine Area/Rock Type	Sample ID	Paste pH	Fizz Rating	Total Carbon	TOC	TIC	Sulphur	Sulphate	Sulphide	AP	NP	TIC	NP/AP	TIC/AP	TIC/NP	NP/AP ARD Classification	TIC/AP ARD Classification	Source
		pH Units		%C	%C	%C	Total	HCl	Calc. SRK	Calc. SRK		Calc. SRK	Calc. SRK	Calc. SRK	Calc. SRK			
				%	%	Calc.	%		%	kg $CaCO_3$ eq/t	kg $CaCO_3$ eq/t	kg $CaCO_3$ eq/t						
Camp Pad	20522	8.3	Slight	0.12	0.05	0.08	0.68	<0.01	0.68	21	12	6.7	0.56	0.31	0.56	PAG	PAG	Field Data 2019
Mineralized Outcrop	20539	4.3	None	0.16	0.16	<0.02	0.49	0.1	0.39	12	1.2	<1.7	0.10	0.14	1.4	AG	AG	
Ore	20538	7.6	Slight	0.11	0.06	0.07	1.80	0.03	1.77	55	11	5.8	0.20	0.11	0.52	PAG	PAG	
Ore	20540	7.0	None	0.10	0.06	0.05	1.61	0.07	1.54	48	9.5	4.2	0.20	0.09	0.44	PAG	PAG	
Ore Pad	20551	8.8	Slight	0.14	0.10	0.07	0.58	<0.01	0.58	18	13	5.8	0.70	0.32	0.46	PAG	PAG	
Ore Pad	20553	8.6	None	0.08	0.08	0.03	0.65	<0.01	0.65	20	6.8	2.5	0.33	0.12	0.37	PAG	PAG	
Ore Pad	20554	8.5	Slight	0.18	0.10	0.10	0.20	<0.01	0.20	6.3	13	8.3	2.02	1.3	0.66	Uncertain	Uncertain	
Ore Pad	20555	8.0	Slight	0.16	0.10	0.12	0.64	0.04	0.60	19	16	10	0.85	0.53	0.63	PAG	PAG	
Portal Laydown	20537	8.6	None	0.23	0.16	0.11	0.33	<0.01	0.33	10	15	9.2	1.42	0.89	0.63	Uncertain	PAG	
Basalt	KC-1	8.6					0.26			8.0	45.0	24.1	5.63	3.01	0.54	non-PAG	non-PAG	Klohn-Crippen 1996
Basalt/Gabbro	KC-2	9.6					0.10			3.0	27.0	0.2	9.00	0.07	0.01	non-PAG	PAG	
Sulphide-rich	KC-3	8.1					3.90			122.0	13.0	0.4	0.11	0.00	0.03	PAG	PAG	
Basalt/Gabbro	KC-4	9.3					0.48			15.0	22.0	1.7	1.47	0.11	0.08	Uncertain	PAG	
Portal Material	KC-5	8.6					2.66			83.0	21.0	6.5	0.25	0.08	0.31	PAG	PAG	
Portal Material	KC-6	8.3					2.78			87.0	14.0	2.2	0.16	0.03	0.16	PAG	PAG	
Portal Material	KC-7	8.4					3.14			98.0	21.0	3.8	0.21	0.04	0.18	PAG	PAG	
Portal Material	KC-8	8.7					2.27			71.0	24.0	6.7	0.34	0.09	0.28	PAG	PAG	
Min. Zone	KC-9	8.8					0.13			4.0	30.0	6.5	7.50	1.63	0.22	non-PAG	Uncertain	
Min. Zone	KC-10	8.9					0.26			8.0	26.0	8.8	3.25	1.10	0.34	non-PAG	Uncertain	
Min. Zone	KC-11	8.8					0.90			28.0	33.0	12.5	1.18	0.45	0.38	Uncertain	PAG	
Min. Zone	KC-12	8.8					1.15			36.0	33.0	6.3	0.92	0.18	0.19	PAG	PAG	
Min. Zone	KC-13	8.6					2.24			70.0	30.0	5.3	0.43	0.08	0.18	PAG	PAG	
Min. Zone	KC-14	8.6					1.60			50.0	18.0	5.3	0.36	0.11	0.29	PAG	PAG	
Min. Zone	KC-15	9.4					0.26			8.0	24.0	1.0	3.00	0.13	0.04	non-PAG	PAG	
Min. Zone	KC-16	9.2					0.19			6.0	16.0	1.6	2.67	0.27	0.10	Uncertain	PAG	
Ore Zone Surface	KC-17	8.4					1.12			35.0	23.0	*0.1*	0.66	0.00	0.00	PAG	PAG	
Ore Zone Surface	KC-18	7.2					1.25			39.0	26.0	0.2	0.67	0.01	0.01	PAG	PAG	
Mafic volcanic	KC-19	8.9					0.93			29.0	18.0	3.5	0.62	0.12	0.19	PAG	PAG	
Bt. Schist	KC-20	9.0					0.10			3.0	22.0	1.7	7.33	0.57	0.08	non-PAG	PAG	
Bt. Schist	KC-21	8.8					0.06			2.0	21.0	1.2	10.5	0.60	0.06	non-PAG	PAG	
Gabbro	KC-22	8.5					0.22			7.0	25.0	*0.1*	3.57	0.01	0.00	non-PAG	PAG	
Gabbro	KC-23	9.0					0.13			4.0	18.0	1.2	4.50	0.30	0.07	non-PAG	PAG	
Gabbro	KC-24	9.3					0.06			2.0	15.0	1.0	7.50	0.50	0.07	non-PAG	PAG	
Bslt - Camp Pads	KC-25	9.0					1.47			46.0	22.0	3.0	0.48	0.07	0.14	PAG	PAG	
Bslt - Camp Pads	KC-26	9.0					0.58			18.0	19.0	3.0	1.06	0.17	0.16	Uncertain	PAG	
Bslt - Camp Pads	KC-27	9.2					0.80			25.0	23.0	6.0	0.92	0.24	0.26	PAG	PAG	
Bslt - Camp Pads	KC-28	9.0					0.32			10.0	23.0	6.0	2.30	0.60	0.26	Uncertain	PAG	
Bslt - Camp Pads	KC-29	9.2					0.74			23.0	23.0	11.0	1.00	0.48	0.48	Uncertain	PAG	
Bslt - Camp Pads	KC-30	9.2					0.35			11.0	20.0	2.0	1.82	0.18	0.10	Uncertain	PAG	
Bslt - Camp Pads	KC-31	9.0					0.32			10.0	19.0	4.0	1.90	0.40	0.21	Uncertain	PAG	
Bslt - Camp Pads	KC-32	9.1					0.19			6.0	19.0	1.0	3.17	0.17	0.05	non-PAG	PAG	
Gabbro	ARD-1						0.24			7.5	21.5		2.87			Uncertain		Rescan 1991
Mafic volcanic	ARD-2						0.74			23.1	35.0		1.51			Uncertain		
Diabase	ARD-3						0.29			9.1	50.9		5.59			non-PAG		
Banded Tuff	ARD-4						0.43			13.3	23.0		1.73			Uncertain		
Porphyry	ARD-5						0.18			5.6	27.2		4.88			non-PAG		
Basalt	ARD-6						0.14			4.4	41.9		9.55			non-PAG		
Basalt	ARD-7						0.25			7.8	29.5		3.79			non-PAG		
Greywacke	ARD-8						0.17			5.3	20.1		3.78			non-PAG		
Diabase	ARD-9						0.02			0.6	52.3		87.2			non-PAG		
Gabbro	ARD-10						0.13			4.0	10.2		2.55			Uncertain		
Basalt	ARD-11						0.12			3.7	19.3		5.15			non-PAG		
Porphyry	ARD-12						0.01			0.4	38.5		106.8			non-PAG		
Greywacke	ARD-13						0.25			7.7	15.5		2.01			Uncertain		
Basalt	ARD-14						0.22			6.8	83.1		12.17			non-PAG		
Basalt	ARD-15						0.56			17.5	39.9		2.28			Uncertain		

< represents result below the MDL

Attachment 2 –Multi-Elemental Analysis

Mine Area	Sample ID		Ag	Al	As	Au	B	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu	Fe	Ga
		Unit	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm
		MDL	0.01	0.01	0.1	0.0005	10	10	0.05	0.01	0.01	0.01	0.02	0.1	1	0.05	0.2	0.01	0.05
Camp Pad	20522		0.25	1.25	1760	1.6	-10	66	0.26	0.25	0.88	0.24	66.55	28	62	2.57	100	4.09	6.13
Mineralized Outcrop	20539		0.16	0.98	63	0.014	-10	73	0.17	0.81	0.59	0.1	22.73	8.9	51	1.62	74.8	5.36	5.57
Ore	20538		0.43	1.39	>10000	8.1	12	82	0.31	0.30	0.72	0.12	50.12	32.6	50	4.53	74.2	6.2	7.61
Ore	20540		0.32	1.44	>10000	7.1	-10	94	0.31	0.36	0.69	0.13	51.25	33.7	29	4.52	79.7	6.19	7.82
Ore Pad	20551		0.17	1.4	180.8	0.16	22	79	0.47	0.32	1.13	0.14	72.31	28.8	115	2.06	101.8	4.63	6.9
Ore Pad	20553		0.11	0.94	36	0.014	19	85	0.22	0.32	0.72	0.08	55.86	29.2	61	1.68	116.6	3.41	4.39
Ore Pad	20554		0.11	0.93	48	0.012	-10	52	0.3	0.20	0.65	0.11	49.34	14.7	89	1.22	41.9	2.46	4.17
Ore Pad	20555		0.11	1.31	61	0.0083	19	81	0.36	0.38	1.29	0.56	64.21	32.3	154	2.47	108	4.83	7.04
Portal Laydown	20537		0.1	1.22	125	0.041	26	83	0.43	0.27	1.03	0.1	65.15	24.6	77	2.42	80.5	3.87	6
Crustal Abundance of Basalt			0.11	0.78	2	0.004	5	330	1	0.007	7.6	0.22	48	48	170	1.1	87	8.65	17
(Price, 1997) x10 ->			1.1	7.8	20	0.04	50	3300	10	0.07	76	2.2	480	480	1700	11	870	86.5	170

Mine Area	Sample ID		Ge	Hf	Hg	In	K	La	Li	Mg	Mn	Mo	Na	Nb	Ni	P	Pb	Rb	Re
		Unit	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm
		MDL	0.05	0.02	0.005	0.005	0.01	0.2	0.1	0.01	5	0.05	0.01	0.05	0.2	10	0.2	0.1	0.001
Camp Pad	20522		0.17	0.24	-0.005	0.032	0.37	28.1	20.6	0.78	289	1.23	0.08	0.18	19.2	697	12.7	21.3	0.002
Mineralized Outcrop	20539		0.11	0.23	0.008	0.029	0.15	9.3	13.6	0.66	243	1.32	0.08	0.78	6.9	734	14.9	8.7	0.002
Ore	20538		0.15	0.2	0.008	0.029	0.7	21.7	28.7	0.81	417	1.05	0.06	0.19	17.2	619	15.4	39.4	0.002
Ore	20540		0.14	0.16	0.007	0.028	0.71	22.2	32.8	0.84	402	1.04	0.06	0.27	15.7	668	15.3	40.6	0.003
Ore Pad	20551		0.14	0.29	0.009	0.03	0.19	31.5	21.7	0.91	416	1.28	0.13	0.5	19.1	693	14.1	12.9	0.002
Ore Pad	20553		0.12	0.21	0.006	0.02	0.13	24	14.2	0.69	277	0.89	0.09	0.34	23.7	619	11.2	9.2	0.001
Ore Pad	20554		0.09	0.27	-0.005	0.016	0.15	21.3	19.1	0.72	274	0.9	0.05	0.4	17.4	453	15	11.4	0.002
Ore Pad	20555		0.16	0.34	-0.005	0.06	0.2	26.8	21.7	0.8	328	1.68	0.16	0.37	19.6	781	14.9	12.7	0.002
Portal Laydown	20537		0.15	0.27	0.007	0.028	0.19	27.2	24.3	0.87	345	2.07	0.09	0.54	17.8	711	11.7	12.8	0.003
Crustal Abundance of Basalt			1.3	2	0.09		0.83		17	4.6	1500	1.5	1.8	19	130	1100	6	30	
(Price, 1997) x10 ->			13	20	0.9		8.3		170	46	15000	15	18	190	1300	11000	60	300	

Mine Area	Sample ID		S	Sb	Sc	Se	Sn	Sr	Ta	Te	Th	Ti	Tl	U	V	W	Y	Zn	Zr
		Unit	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm
		MDL	0.01	0.05	0.1	0.2	0.2	0.2	0.01	0.01	0.2	0.01	0.02	0.05	1	0.05	0.05	1	0.5
Camp Pad	20522		0.71	1.6	5.8	0.9	0.5	9.6	-0.01	0.11	4.4	0.12	0.22	0.52	78	5.5	15.71	129	10.6
Mineralized Outcrop	20539		0.44	1.0	5.7	0.9	0.7	3.9	0.03	0.07	4.7	0.13	0.11	0.23	78	0.93	11.12	72	7.9
Ore	20538		1.66	4.9	8.1	1.0	0.5	7.7	-0.01	-0.01	3.7	0.17	0.26	0.37	121	19	11.86	88	7.9
Ore	20540		1.52	4.5	7.5	1.1	0.3	7	-0.01	0.04	3.5	0.17	0.27	0.34	118	21	12.32	94	6.7
Ore Pad	20551		0.53	0.56	7.7	0.6	0.8	10.5	-0.01	0.07	4.4	0.19	0.16	0.6	96	1.5	19.48	97	11.5
Ore Pad	20553		0.57	0.93	5.1	0.7	0.6	6.7	-0.01	0.03	3.9	0.12	0.16	0.5	61	0.75	12.34	68	8.5
Ore Pad	20554		0.19	1.9	3.3	0.3	0.6	11.1	-0.01	0.04	6	0.09	0.11	0.8	44	2.6	15.88	77	10.6
Ore Pad	20555		0.64	0.83	9.4	1.2	1.2	15	-0.01	0.07	4.7	0.17	0.14	0.54	113	3.2	21.98	299	14.1
Portal Laydown	20537		0.33	0.62	6.3	0.5	0.7	10.4	-0.01	0.07	4.4	0.15	0.14	0.58	82	2.4	40.52	77	10.9
Crustal Abundance of Basalt			0.3	0.2	30	0.05	1.5	465	1.1		4	1.38	0.21	1	250	0.7	21	105	140
(Price, 1997) x10 ->			3	2	300	0.5	15	4650	11		40	13.8	2.1	10	2500	7	210	1050	1400

Negative value indicates below detection limit

Red value indicates value greater than 10x the Average Crustal Abundance of Basalt (Price, 1997)

Attachment 3 – SFE Results

	Sample ID	Sample Weight	Volume Used	pH	EC	Total Alkalinity	SO4	Nitrate-N	Nitrite-N	Ammonia	TDS	Hardness CaCO3
	Detection Limit			**0.10**	**1.00**	**0.50**	**0.5**	**0.005**	**0.005**	**0.01**	**5.00**	**0.5**
	Units	**g**	**ml**	**pH Units**	**uS/cm**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Mineralized (	20539	250	750	3.1	429	*0.5*	78	*0.005*	*0.005*	0.2	98	36
Ore	20540	250	750	6.2	520	4.5	232	0.007	*0.005*	0.1	332	217
Ore Pad	20551	100	300	7.4	139	29	33	0.090	0.009	0.14	65	61
Ore Pad	20555	100	300	7.0	650	21	286	0.010	*0.005*	0.0	442	306
	CCME (x10)			6.5-9.0				130		48		

	Sample ID	Diss. Al	Diss. Sb	Diss. As	Diss. Ba	Diss. Be	Diss. Bi	Diss. B	Diss. Cd	Diss. Ca	Diss. Cr	Diss. Co	Diss. Cu	Diss. Fe	Diss. Pb	Diss. Li	Diss. Mg	Diss. Mn	Diss. Hg	Diss. Mo
	Detection Limit	**<0.001**	**<0.0001**	**<0.0002**	**0.00**	**<0.0001**	**<0.0001**	**<0.01**	**<0.00001**	**<0.05**	**<0.0005**	**<0.0001**	**0.0007**	**<0.02**	**<0.0005**	**<0.0005**	**<0.005**	**<0.0002**	**<0.0005**	**<0.0001**
	Units	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Mineralized (	20539	1.6	*0.0001*	0.0036	0.014	0.0002	*0.0001*	*0.01*	0.00041	7.4	*0.0005*	0.083	0.18	0.52	0.0014	0.022	4.2	0.24	<0.0005	*0.0001*
Ore	20540	*0.001*	0.001	0.18	0.017	*0.0001*	*0.0001*	*0.01*	0.00005	80	*0.0005*	0.012	0.0022	*0.02*	*0.0005*	0.017	3.9	0.44	<0.0005	*0.0001*
Ore Pad	20551	0.1	0.0002	0.0045	0.031	*0.0001*	*0.0001*	*0.01*	*0.00001*	23	*0.0005*	0.0003	0.0073	0.06	*0.0005*	0.002	1.1	0.004	<0.0005	0.0006
Ore Pad	20555	0.003	*0.0001*	0.0003	0.046	*0.0001*	*0.0001*	0.04	0.00003	111	*0.0005*	0.0082	0.0046	*0.02*	*0.0005*	0.014	7.0	0.21	<0.0005	*0.0001*
	CCME (x10)	1.0/0.005		0.05				15	0.0023				0.04	3	0.07				0.00026	0.73

	Sample ID	Diss. Ni	Diss. P	Diss. K	Diss. Se	Diss. Si	Diss. Ag	Diss. Na	Diss. Sr	Diss. S	Diss. Te	Diss. Tl	Diss. Th	Diss. Sn	Diss. Ti	Diss. W	Diss. U	Diss. V	Diss. Zn	Diss. Zr
	Detection Limit	**<0.0005**	**<0.05**	**<0.05**	**<0.0005**	**<0.05**	**<0.00008**	**<0.02**	**<0.0002**	**<0.5**	**<0.0002**	**<0.00005**	**<0.0001**	**<0.0005**	**<0.0005**	**<0.0001**	**<0.00005**	**<0.001**	**<0.001**	**<0.0001**
	Units	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Mineralized (	20539	0.05	*0.05*	1.1	0.0006	2.0	*0.00008*	0.81	0.013	25	*0.0002*	0.00021	*0.0001*	*0.0005*	0.0021	*0.0001*	0.0008	*0.001*	0.20	*0.0001*
Ore	20540	0.01	*0.05*	14	0.0009	0.95	*0.00008*	1.3	0.054	72	*0.0002*	*0.00005*	*0.0001*	*0.0005*	*0.0005*	*0.0001*	*0.00005*	*0.001*	0.02	*0.0001*
Ore Pad	20551	*0.0005*	*0.05*	2.1	*0.0005*	0.93	*0.00008*	0.57	0.02	10	*0.0002*	*0.00005*	*0.0001*	*0.0005*	0.0029	0.0013	0.00016	*0.001*	0.001	*0.0001*
Ore Pad	20555	0.005	*0.05*	7.2	0.0039	1.1	*0.00008*	1.2	0.10	93	*0.0002*	*0.00005*	*0.0001*	*0.0005*	*0.0005*	0.003	*0.00005*	*0.001*	0.005	*0.0001*
	CCME (x10)	1.5			0.01		0.0025						0.008				0.15		0.07	

Notes

TDS - total dissolved solids; diss. - dissolved

Italics represents result below the MDL

Red text exceeds CCME criteria

For aluminium, if pH is <6.5, guideline is 0.005 mg/L, if >6.5, guideline is 1.0 mg/L

Screening criteria were calculated assuming an average pH of 6.9, and an average hardness of 155 mg/L $CaCO_3$.

Attachment 4 – Seepage Laboratory Results

Results Summary L2343446

Job Reference
Report To Arlene Stearman, SRK CONSULTING (CANADA) INC.
Date Received 6-Sep-2019 16:30
Report Date 18-Sep-2019 17:11
Report Version 1

Client Sample ID			FCSAP	CCME	SEEP1
Date Sampled					5-Sep-2019
Time Sampled					15:30
ALS Sample ID					L2343446-1
Parameter	Lowest Detection Limit	Units			Water
Physical Tests (Water)					
Conductivity	2.0	uS/cm			713
Hardness (as CaCO3)	0.50	mg/L			366
pH	0.10	pH	6.5-9	6.5-9	7.33
Total Suspended Solids	3.0	mg/L			3.0
Total Dissolved Solids	20	mg/L	3000		598
Anions and Nutrients (Water)					
Acidity (as CaCO3)	1.0	mg/L			4.9
Alkalinity, Total (as CaCO3)	1.0	mg/L			20.9
Ammonia, Total (as N)	0.0050	mg/L		48.4	0.0502
Bromide (Br)	0.050	mg/L			<0.050
Chloride (Cl)	0.50	mg/L	100	1200	1.97
Fluoride (F)	0.020	mg/L			0.185
Nitrate (as N)	0.0050	mg/L	13	130	0.368
Nitrite (as N)	0.0010	mg/L	0.06		0.0020
Sulfate (SO4)	0.30	mg/L	100		329
Total Metals (Water)					
Aluminum (Al)-Total	0.0030	mg/L			0.0425
Antimony (Sb)-Total	0.00010	mg/L			<0.00010
Arsenic (As)-Total	0.00010	mg/L			0.00057
Barium (Ba)-Total	0.00010	mg/L			0.0275
Beryllium (Be)-Total	0.00010	mg/L			<0.00010
Bismuth (Bi)-Total	0.000050	mg/L			<0.000050
Boron (B)-Total	0.010	mg/L			0.104
Cadmium (Cd)-Total	0.0000050	mg/L			0.0000391
Calcium (Ca)-Total	0.050	mg/L			105
Cesium (Cs)-Total	0.000010	mg/L			0.000060
Chromium (Cr)-Total	0.00010	mg/L			0.00014
Cobalt (Co)-Total	0.00010	mg/L			0.0165
Copper (Cu)-Total	0.00050	mg/L			0.00127
Iron (Fe)-Total	0.010	mg/L			1.06
Lead (Pb)-Total	0.000050	mg/L			<0.000050
Lithium (Li)-Total	0.0010	mg/L			0.0145
Magnesium (Mg)-Total	0.0050	mg/L			19.6
Manganese (Mn)-Total	0.00010	mg/L			0.167
Mercury (Hg)-Total	0.0000050	mg/L			<0.0000050
Molybdenum (Mo)-Total	0.000050	mg/L			0.000108
Nickel (Ni)-Total	0.00050	mg/L			0.0248
Phosphorus (P)-Total	0.050	mg/L			<0.050
Potassium (K)-Total	0.050	mg/L			6.96
Rubidium (Rb)-Total	0.00020	mg/L			0.00832
Selenium (Se)-Total	0.000050	mg/L			0.000803
Silicon (Si)-Total	0.10	mg/L			3.41
Silver (Ag)-Total	0.000010	mg/L			<0.000010

Results Summary L2343446

Job Reference
Report To Arlene Stearman, SRK CONSULTING (CANADA) INC.
Date Received 6-Sep-2019 16:30
Report Date 18-Sep-2019 17:11
Report Version 1

Client Sample ID			FCSAP	CCME	SEEP1
Date Sampled					5-Sep-2019
Time Sampled					15:30
ALS Sample ID					L2343446-1
Parameter	Lowest Detection Limit	Units			Water
Sodium (Na)-Total	0.050	mg/L			8.12
Strontium (Sr)-Total	0.00020	mg/L			0.139
Sulfur (S)-Total	0.50	mg/L			125
Tellurium (Te)-Total	0.00020	mg/L			<0.00020
Thallium (Tl)-Total	0.000010	mg/L			<0.000010
Thorium (Th)-Total	0.00010	mg/L			<0.00010
Tin (Sn)-Total	0.00010	mg/L			<0.00010
Titanium (Ti)-Total	0.00030	mg/L			0.00150
Tungsten (W)-Total	0.00010	mg/L			<0.00010
Uranium (U)-Total	0.000010	mg/L			0.000026
Vanadium (V)-Total	0.00050	mg/L			<0.00050
Zinc (Zn)-Total	0.0030	mg/L			0.0543
Zirconium (Zr)-Total	0.00020	mg/L			<0.00020
Dissolved Metals (Water)					
Dissolved Mercury Filtration Location		-			FIELD
Dissolved Metals Filtration Location		-			FIELD
Aluminum (Al)-Dissolved	0.0010	mg/L		0.1	0.0151
Antimony (Sb)-Dissolved	0.00010	mg/L	2		<0.00010
Arsenic (As)-Dissolved	0.00010	mg/L	0.005	0.005	0.00046
Barium (Ba)-Dissolved	0.00010	mg/L	0.5		0.0291
Beryllium (Be)-Dissolved	0.00010	mg/L	0.0053		<0.00010
Bismuth (Bi)-Dissolved	0.000050	mg/L			<0.000050
Boron (B)-Dissolved	0.010	mg/L	0.5		0.096
Cadmium (Cd)-Dissolved	0.0000050	mg/L	0.000017	0.00037	0.0000247
Calcium (Ca)-Dissolved	0.050	mg/L			112
Cesium (Cs)-Dissolved	0.000010	mg/L			0.000053
Chromium (Cr)-Dissolved	0.00010	mg/L			0.00013
Cobalt (Co)-Dissolved	0.00010	mg/L	0.05		0.0112
Copper (Cu)-Dissolved	0.00020	mg/L		0.04	0.00097
Iron (Fe)-Dissolved	0.010	mg/L	0.3	0.3	0.524
Lead (Pb)-Dissolved	0.000050	mg/L		0.07	<0.000050
Lithium (Li)-Dissolved	0.0010	mg/L			0.0150
Magnesium (Mg)-Dissolved	0.0050	mg/L			20.7
Manganese (Mn)-Dissolved	0.00010	mg/L	0.2		0.130
Mercury (Hg)-Dissolved	0.0000050	mg/L			<0.0000050
Molybdenum (Mo)-Dissolved	0.000050	mg/L	0.073		0.000070
Nickel (Ni)-Dissolved	0.00050	mg/L		0.15	0.0259
Phosphorus (P)-Dissolved	0.050	mg/L			<0.050
Potassium (K)-Dissolved	0.050	mg/L			7.45
Rubidium (Rb)-Dissolved	0.00020	mg/L			0.00880
Selenium (Se)-Dissolved	0.000050	mg/L	0.001	0.001	0.000656
Silicon (Si)-Dissolved	0.050	mg/L			3.18
Silver (Ag)-Dissolved	0.000010	mg/L			<0.000010
Sodium (Na)-Dissolved	0.050	mg/L			8.97
Strontium (Sr)-Dissolved	0.00020	mg/L			0.142
Sulfur (S)-Dissolved	0.50	mg/L			110

Results Summary L2343446

Job Reference
Report To Arlene Stearman, SRK CONSULTING (CANADA) INC.
Date Received 6-Sep-2019 16:30
Report Date 18-Sep-2019 17:11
Report Version 1

Client Sample ID			FCSAP	CCME	SEEP1
Date Sampled					5-Sep-2019
Time Sampled					15:30
ALS Sample ID					L2343446-1
Parameter	Lowest Detection Limit	Units			Water
Tellurium (Te)-Dissolved	0.00020	mg/L			<0.00020
Thallium (Tl)-Dissolved	0.000010	mg/L	0.0008	0.0008	<0.000010
Thorium (Th)-Dissolved	0.00010	mg/L			<0.00010
Tin (Sn)-Dissolved	0.00010	mg/L			<0.00010
Titanium (Ti)-Dissolved	0.00030	mg/L	0.1		<0.00030
Tungsten (W)-Dissolved	0.00010	mg/L			<0.00010
Uranium (U)-Dissolved	0.000010	mg/L	0.01		0.000014
Vanadium (V)-Dissolved	0.00050	mg/L	0.1		<0.00050
Zinc (Zn)-Dissolved	0.0010	mg/L	0.01	0.07	0.0561
Zirconium (Zr)-Dissolved	0.00020	mg/L			<0.00020