

Undertaking Number: DAR-MVEIRB-UT2-11 (Errata)

Source: Undertaking from Day 3 (Sept 16) of the Public Hearings

Subject: Water Quality and Quantity – Additional Sediment Sampling Results

DAR Section(s): 8

Request:

DDEC will provide the results of the recent additional sediment sampling from within the diked area to the Review Board and IEMA. DDEC will make every effort to provide these results by the undertaking deadline.

Response:

A supplemental sediment sampling program in the proposed diked area of Lac du Sauvage was conducted on September 14, 2015 (Map 11-1). This work was undertaken to address a potential mercury concern in the lake sediments within this area based on baseline sediment quality data in Rescan (2007).

For this supplemental program, five stations were sampled within the diked area, with Station Ac-13 corresponding with the previously sampled location (LdS3; Rescan [2007]), which reported sediment mercury concentrations that exceeded Canadian Council of Ministers of the Environment (CCME) Interim Sediment Quality Guideline (ISQG), and the probable effects level (PEL) guidelines (CCME 2001). Similarly, Stations Ac-14 and Ac-15 corresponded with stations LdS4 and LdS5 from the Rescan (2007) survey, respectively.

For the five stations within the proposed diked area, composite surficial sediment samples were generated from three proximal grab samples using an Ekman sampler. In addition to sediment mercury (Table 11-1), these samples were analyzed for particle size, total organic carbon, and metals (Table 11-2). The ALS analytical laboratory data report for these sediment samples is provided in Appendix A.

Table 11-1 Sediment Mercury Concentrations from Stations in the Proposed Diked Area of Lac du Sauvage

Sediment Constituent	Unit	CCME SQG		Lac du Sauvage Median ^(a)	Rescan (2007)			Sampling Stations within the Proposed Diked Area				
		ISQG	PEL		LdS3(1)	LdS3(2)	LdS3(3)	Ac-13	Ac-14	Ac-15	Ac-16	Ac-17
Mercury	mg/kg dw	0.17	0.486	0.0175	5.6 ^(l,P)	0.29 ^(l)	0.11	0.0414	0.0211	0.0204 ^(b)	0.0224	0.0192

^(a) Source: Table 8.2-57 of the Developer's Assessment Report (DAR); Dominion Diamond (2014). The sample count for this dataset is 54 samples.

^(b) Corrected concentration. The sediment mercury concentration for Station Ac-15 was previously reported as 0.204 mg/kg dw.

^(l) Concentration is higher than the CCME (2001) Interim Sediment Quality Guideline.

^(P) Concentration is higher than the CCME (2001) Probable Effects Level.

CCME = Canadian Council of Ministers for the Environment; ISQG = Interim Sediment Quality Guideline; SQG = Sediment Quality Guidelines; PEL = probable effects level; mg/kg dw = milligrams per kilogram as dry weight.

Sediment mercury concentrations from all five stations within the proposed diked area were below the CCME ISQG and the PEL (CCME 2001) for the protection of aquatic life (Table 11-1). They were also lower than the individual replicate concentrations reported for LdS3 (Table 11-1). Consistent with the baseline sediment data for Lac du Sauvage reported in the Developer's Assessment Report (DAR; Table 8.2-57), guideline exceedances for arsenic (ISQG and PEL) and chromium (ISQG) were also measured in all samples (Table 11-2). All other sediment constituents concentrations were consistent with baseline sediment data collected from Lac du Sauvage in 2006 (Rescan 2007), 2011 (Rescan 2012) and 2013 (Section 8.2.5.3.1 of the DAR [Table 11-2]).

As discussed in the responses to the Technical Reports (LKDFN-08 and IEMA-07), and presented on the Aquatics Day at the Technical Hearing on September 16, the two previously reported sediment samples from Lac du Sauvage with exceedances to sediment mercury guidelines were considered anomalous and not representative of sediment mercury concentrations in this area. This follow-up work supports this contention.

Table 11-2 Sediment Quality from Stations in the Proposed Diked Area of Lac du Sauvage

Location	Unit (Dry Weight)	Guideline ^(a)		Lac du Sauvage					
Sample Name		ISQG	PEL	Ac-13	Ac-14	Ac-15	Ac-16	Ac-17	Median LDS Baseline ^(b)
Sampling Season		-	-						
Sample Date		-	-	14-Sep-15	14-Sep-15	14-Sep-15	14-Sep-15	14-Sep-15	-
Easting (NAD 83, 12W)		-	-	542100	541562	542807	542395	541886	-
Northing (NAD 83, 12W)		-	-	7165897	7165829	7165661	7166291	7165204	-
Physical Parameters									
Water depth	m	-	-	18	9.2	4	9	12	-
% Clay (<0.002 mm)	%	-	-	5.69	16.9	18.6	18.1	14.7	30.5
% Silt (0.002-0.05 mm)	%	-	-	92.4	81.3	76.6	79.6	71.5	49.5
% Sand (2-5 mm)	%	-	-	1.92	1.79	4.83	2.31	13.8	1.9
Texture	-	-	-	Silt	Silt loam	Silt loam	Silt loam	Silt loam	-
Nutrients									
Carbon, Total Organic	%	-	-	1.71	2.11	2.28	2.71	1.46	1.27
Total Metals									
Aluminum	mg/kg	-	-	13,200	17,600	15,300	14,100	16,100	15,300
Antimony	mg/kg	-	-	0.16	0.322	<0.10	<0.10	<0.10	<0.10
Arsenic	mg/kg	5.9	17	277 ^(I,P)	39.1 ^(I,P)	127 ^(I,P)	15.3 ^(I)	20.6 ^(I,P)	39.1 ^(I,P)
Barium	mg/kg	-	-	292	148	197	144	171	171
Beryllium	mg/kg	-	-	0.40	0.51	0.50	0.45	0.48	0.48
Bismuth	mg/kg	-	-	0.26	0.34	0.28	0.26	0.28	0.28
Boron	mg/kg	-	-	<5	<5	<5	<5	<5	-
Cadmium	mg/kg	0.6	3.5	0.132	0.173	0.192	0.115	0.369	0.170
Chromium	mg/kg	37.3	90	46.2 ^(I)	62.5 ^(I)	54.3 ^(I)	51.2 ^(I)	55.2 ^(I)	54.3 ^(I)
Cobalt	mg/kg	-	-	19.0	19.7	22.7	11.7	26.0	19.7
Copper	mg/kg	35.7	197	23.8	31.7	27.2	25.6	27.9	27.2
Iron	mg/kg	-	-	56,600	32,500	48,600	24,100	26,700	32,500
Lead	mg/kg	35	91.3	6.17	8.2	5.59	4.64	5.68	5.70

Table 11-2 Sediment Quality from Stations in the Proposed Diked Area of Lac du Sauvage

Location	Unit (Dry Weight)	Guideline ^(a)		Lac du Sauvage					
Sample Name		ISQG	PEL	Ac-13	Ac-14	Ac-15	Ac-16	Ac-17	Median LDS Baseline ^(b)
Sampling Season		-	-						
Sample Date		-	-	14-Sep-15	14-Sep-15	14-Sep-15	14-Sep-15	14-Sep-15	-
Easting (NAD 83, 12W)		-	-	542100	541562	542807	542395	541886	-
Northing (NAD 83, 12W)		-	-	7165897	7165829	7165661	7166291	7165204	-
Lithium	mg/kg	-	-	37.0	41.5	45.2	42.6	42.9	42.6
Manganese	mg/kg	-	-	8,340	753	2,960	384	3,460	2,960
Molybdenum	mg/kg	-	-	8.08	1.74	3.67	1.28	2.01	2.00
Nickel	mg/kg	-	-	34.3	43.5	44.3	33.4	49.8	43.5
Selenium	mg/kg	-	-	<0.20	0.19	<0.20	<0.20	<0.20	<0.20
Silver	mg/kg	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Strontium	mg/kg	-	-	12.3	12.1	12.0	10.8	10.2	12.0
Sulfur	mg/kg	-	-	470	427	700	730	460	470
Thallium	mg/kg	-	-	0.210	0.31	0.268	0.219	0.438	0.270
Tin	mg/kg	-	-	<2	4.63	<2	<2	<2	<2
Titanium	mg/kg	-	-	634	925	769	740	784	769
Uranium	mg/kg	-	-	2.05	3.03	2.55	2.59	2.49	2.55
Vanadium	mg/kg	-	-	39.8	52.6	45.9	43.1	47.7	45.9
Zinc	mg/kg	123	315	53.8	71.4	64.9	56.3	62.8	62.8

Notes:

Bolded concentrations are higher than sediment quality guidelines (CCME 2001).

⁽ⁱ⁾ = value higher than the Interim Sediment Quality Guideline.

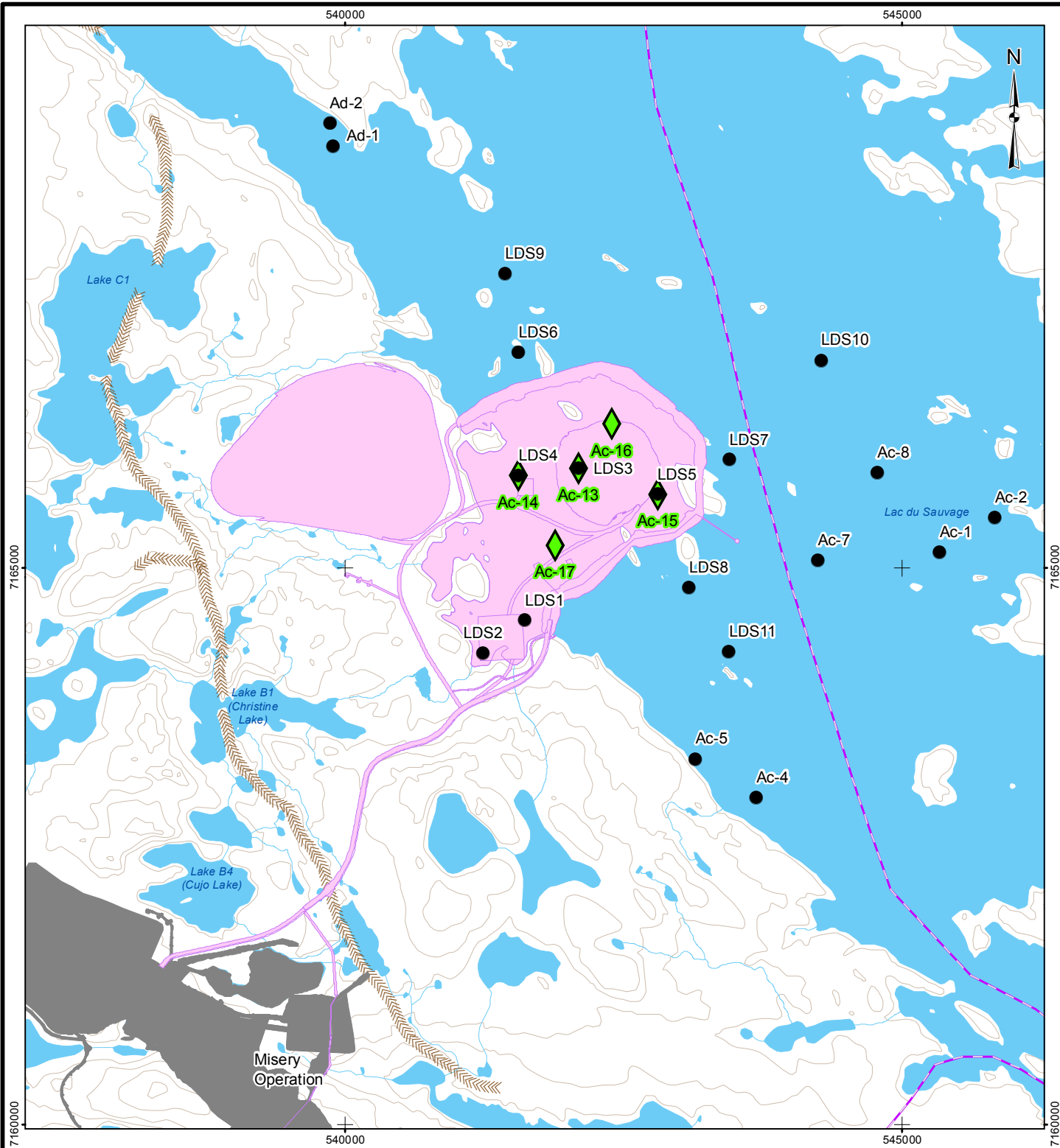
^(P) = value higher than the Probable Effects Level.

a) Source: CCME (2001). Canadian Environmental Quality Guidelines. Winnipeg, MB, Canada

b) Source: Table 8.2-57, Developer's Assessment Report, Dominion Diamond Jay Project (Oct 2014)

ISQG = Interim Sediment Quality Guideline; PEL = Probable Effects Level; - = no guideline or data; m = metre; mg/kg = milligrams per kilogram; NAD = North American Datum; % = percent; < = less than.

G:\CLIENTS\DOMINION\DEC Jay and Lynx Projects\Figures\1419751 Jay Project Stage 33600_Hearing60_Follow-up\Baseline_and_Supplemental_Sediment_Stations_LDS.mxd



LEGEND

- EKATI MINE FOOTPRINT
- PROPOSED JAY FOOTPRINT
- NORTHERN PORTION OF TIBBITT TO CONTWOYTO WINTER ROAD
- ELEVATION CONTOUR (10 m INTERVAL)
- ESKER
- WATERCOURSE
- WATERBODY
- BASELINE SEDIMENT QUALITY STATION
- ◆ SUPPLEMENTAL SEDIMENT STATION

REFERENCE

CANVEC © NATURAL RESOURCES CANADA, 2012
NATURAL RESOURCES CANADA, CENTRE FOR TOPOGRAPHIC INFORMATION, 2012
DATUM: NAD83 PROJECTION: UTM ZONE 12N

1 0 1
SCALE 1:50,000 KILOMETRES

PROJECT		JAY PROJECT NORTHWEST TERRITORIES, CANADA					
		DOMINION DIAMOND					
TITLE							
BASELINE AND SUPPLEMENTAL SEDIMENT STATIONS IN LAC DU SAUVAGE							
 Golder Associates		PROJECT		1419751.3600.60	FILE No.		
		DESIGN	CP	29/09/15	SCALE AS SHOWN		REV. 1
		GIS	ANK	02/10/15	MAP 11-1		
		CHECK	CP	02/10/15			
		REVIEW	JF	02/10/15			

References:

- CCME (Canadian Council of Ministers of the Environment). 2001. Canadian Sediment Quality Guidelines for the Protection of Aquatic Life: Introduction. Updated. Canadian Environmental Quality Guidelines, 1999, update 2001. Winnipeg, MB, Canada.
- Dominion Diamond (Dominion Diamond Ekati Corporation). 2014. Developer's Assessment Report for the Jay Project. Prepared by Golder Associates Ltd., October 2014. Yellowknife, NWT, Canada.
- Rescan (Rescan Environmental Services Ltd.). 2007. Ekati Diamond Mine 2006 Jay Pipe Aquatic Baseline. Prepared for BHP Billiton Canada Inc. Yellowknife, NWT, Canada.
- Rescan. 2012. Ekati Diamond Mine 2011 Aquatic Effects Monitoring Program Annual Report. Prepared for BHP Billiton Canada Inc. Yellowknife, NWT, Canada.

Appendix A

ALS Analytical Report for Lac du Sauvage Sediment Samples



GOLDER ASSOCIATES LTD
ATTN: Megan McLean
16820 - 107 ave
Edmonton AB T5P 4C3

Date Received: 16-SEP-15
Report Date: 08-OCT-15 10:04 (MT)
Version: FINAL REV. 3

Client Phone: 780-930-8638

Certificate of Analysis

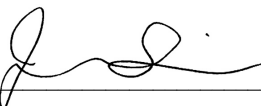
Lab Work Order #: L1674574
Project P.O. #: PHASE 7015 TASK 25
Job Reference: 1419751
C of C Numbers:
Legal Site Desc:

Comments: ADDITIONAL 07-OCT-15 08:57

7-OCT-2015 REVISED REPORT: "DUPLICATE" METALS RECHECK DATA TO BE USED IS UNDER L1674574-8. "DUPLICATE" METALS DATA FOR L1674574-6 WAS REVISED AFTER RECHECK INVESTIGATION AND ANALYSIS.

"AC-14" RECHECK CONFIRMED ORIGINAL RESULT BY RECHECK REANALYSIS.

8-OCT-2015 REVISED REPORT: METALS DATA REMOVED FROM L1674574-2 & -6



Jessica Spira, Env. Tech. DIPL
Senior Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1674574-1 AC-13 Sampled By: JI/CD on 14-SEP-15 @ 09:00 Matrix: SOIL Metals in Sediment for Golder Calgary Lithium in Soil by CRC ICPMS Lithium (Li) 37.0 0.50 mg/kg 20-SEP-15 21-SEP-15 R3271805 Mercury in Soil by CVAAS Mercury (Hg) 0.0414 0.0050 mg/kg 20-SEP-15 21-SEP-15 R3271738 Metals in Soil by CRC ICPMS Aluminum (Al) 13200 50 mg/kg 20-SEP-15 21-SEP-15 R3271805 Antimony (Sb) 0.16 0.10 mg/kg 20-SEP-15 21-SEP-15 R3271805 Arsenic (As) 277 0.10 mg/kg 20-SEP-15 21-SEP-15 R3271805 Barium (Ba) 292 0.50 mg/kg 20-SEP-15 21-SEP-15 R3271805 Beryllium (Be) 0.40 0.10 mg/kg 20-SEP-15 21-SEP-15 R3271805 Bismuth (Bi) 0.26 0.20 mg/kg 20-SEP-15 21-SEP-15 R3271805 Boron (B) <5.0 5.0 mg/kg 20-SEP-15 21-SEP-15 R3271805 Cadmium (Cd) 0.132 0.020 mg/kg 20-SEP-15 21-SEP-15 R3271805 Calcium (Ca) 1330 100 mg/kg 20-SEP-15 21-SEP-15 R3271805 Chromium (Cr) 46.2 0.50 mg/kg 20-SEP-15 21-SEP-15 R3271805 Cobalt (Co) 19.0 0.10 mg/kg 20-SEP-15 21-SEP-15 R3271805 Copper (Cu) 23.8 0.50 mg/kg 20-SEP-15 21-SEP-15 R3271805 Iron (Fe) 56600 50 mg/kg 20-SEP-15 21-SEP-15 R3271805 Lead (Pb) 6.17 0.50 mg/kg 20-SEP-15 21-SEP-15 R3271805 Magnesium (Mg) 6770 20 mg/kg 20-SEP-15 21-SEP-15 R3271805 Manganese (Mn) 8340 1.0 mg/kg 20-SEP-15 21-SEP-15 R3271805 Molybdenum (Mo) 8.08 0.10 mg/kg 20-SEP-15 21-SEP-15 R3271805 Nickel (Ni) 34.3 0.50 mg/kg 20-SEP-15 21-SEP-15 R3271805 Selenium (Se) <0.20 0.20 mg/kg 20-SEP-15 21-SEP-15 R3271805 Silver (Ag) <0.10 0.10 mg/kg 20-SEP-15 21-SEP-15 R3271805 Sodium (Na) 200 100 mg/kg 20-SEP-15 21-SEP-15 R3271805 Strontium (Sr) 12.3 0.50 mg/kg 20-SEP-15 21-SEP-15 R3271805 Thallium (Tl) 0.210 0.050 mg/kg 20-SEP-15 21-SEP-15 R3271805 Tin (Sn) <2.0 2.0 mg/kg 20-SEP-15 21-SEP-15 R3271805 Titanium (Ti) 634 1.0 mg/kg 20-SEP-15 21-SEP-15 R3271805 Uranium (U) 2.05 0.050 mg/kg 20-SEP-15 21-SEP-15 R3271805 Vanadium (V) 39.8 0.20 mg/kg 20-SEP-15 21-SEP-15 R3271805 Zinc (Zn) 53.8 2.0 mg/kg 20-SEP-15 21-SEP-15 R3271805 Potassium in Soil by CRC ICPMS Potassium (K) 3410 50 mg/kg 20-SEP-15 21-SEP-15 R3271805 Sulfur in Soil by ICPOES Sulfur (S) 470 100 mg/kg 20-SEP-15 21-SEP-15 R3271850 Miscellaneous Parameters Total Organic Carbon 1.71 0.10 % 22-SEP-15 22-SEP-15 R3273283 Particle size - Pipette removal OM & CO3 % Sand (2.0mm - 0.05mm) 1.92 0.10 % 21-SEP-15 22-SEP-15 R3273197 % Silt (0.05mm - 2um) 92.4 0.10 % 21-SEP-15 22-SEP-15 R3273197 % Clay (<2um) 5.69 0.10 % 21-SEP-15 22-SEP-15 R3273197 Texture Silt 21-SEP-15 22-SEP-15 R3273197							
L1674574-2 AC-14 Sampled By: JI/CD on 14-SEP-15 @ 12:10 Matrix: SOIL Metals in Sediment for Golder Calgary Miscellaneous Parameters Total Organic Carbon 2.11 0.10 % 22-SEP-15 22-SEP-15 R3273283 Particle size - Pipette removal OM & CO3							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1674574-2	AC-14							
Sampled By: JI/CD on 14-SEP-15 @ 12:10								
Matrix: SOIL								
Particle size - Pipette removal OM & CO3								
% Sand (2.0mm - 0.05mm)		1.79		0.10	%	21-SEP-15	22-SEP-15	R3273197
% Silt (0.05mm - 2um)		81.3		0.10	%	21-SEP-15	22-SEP-15	R3273197
% Clay (<2um)		16.9		0.10	%	21-SEP-15	22-SEP-15	R3273197
Texture		Silt loam				21-SEP-15	22-SEP-15	R3273197
L1674574-3	AC-15							
Sampled By: JI/CD on 14-SEP-15 @ 11:30								
Matrix: SOIL								
Metals in Sediment for Golder Calgary								
Lithium in Soil by CRC ICPMS								
Lithium (Li)		45.2		0.50	mg/kg	20-SEP-15	21-SEP-15	R3271805
Mercury in Soil by CVAAS								
Mercury (Hg)		0.0204		0.0050	mg/kg	20-SEP-15	21-SEP-15	R3271738
Metals in Soil by CRC ICPMS								
Aluminum (Al)		15300		50	mg/kg	20-SEP-15	21-SEP-15	R3271805
Antimony (Sb)		<0.10		0.10	mg/kg	20-SEP-15	21-SEP-15	R3271805
Arsenic (As)		127		0.10	mg/kg	20-SEP-15	21-SEP-15	R3271805
Barium (Ba)		197		0.50	mg/kg	20-SEP-15	21-SEP-15	R3271805
Beryllium (Be)		0.50		0.10	mg/kg	20-SEP-15	21-SEP-15	R3271805
Bismuth (Bi)		0.28		0.20	mg/kg	20-SEP-15	21-SEP-15	R3271805
Boron (B)		<5.0		5.0	mg/kg	20-SEP-15	21-SEP-15	R3271805
Cadmium (Cd)		0.192		0.020	mg/kg	20-SEP-15	21-SEP-15	R3271805
Calcium (Ca)		1530		100	mg/kg	20-SEP-15	21-SEP-15	R3271805
Chromium (Cr)		54.3		0.50	mg/kg	20-SEP-15	21-SEP-15	R3271805
Cobalt (Co)		22.7		0.10	mg/kg	20-SEP-15	21-SEP-15	R3271805
Copper (Cu)		27.2		0.50	mg/kg	20-SEP-15	21-SEP-15	R3271805
Iron (Fe)		48600		50	mg/kg	20-SEP-15	21-SEP-15	R3271805
Lead (Pb)		5.59		0.50	mg/kg	20-SEP-15	21-SEP-15	R3271805
Magnesium (Mg)		7740		20	mg/kg	20-SEP-15	21-SEP-15	R3271805
Manganese (Mn)		2960		1.0	mg/kg	20-SEP-15	21-SEP-15	R3271805
Molybdenum (Mo)		3.67		0.10	mg/kg	20-SEP-15	21-SEP-15	R3271805
Nickel (Ni)		44.3		0.50	mg/kg	20-SEP-15	21-SEP-15	R3271805
Selenium (Se)		<0.20		0.20	mg/kg	20-SEP-15	21-SEP-15	R3271805
Silver (Ag)		<0.10		0.10	mg/kg	20-SEP-15	21-SEP-15	R3271805
Sodium (Na)		250		100	mg/kg	20-SEP-15	21-SEP-15	R3271805
Strontium (Sr)		12.0		0.50	mg/kg	20-SEP-15	21-SEP-15	R3271805
Thallium (Tl)		0.268		0.050	mg/kg	20-SEP-15	21-SEP-15	R3271805
Tin (Sn)		<2.0		2.0	mg/kg	20-SEP-15	21-SEP-15	R3271805
Titanium (Ti)		769		1.0	mg/kg	20-SEP-15	21-SEP-15	R3271805
Uranium (U)		2.55		0.050	mg/kg	20-SEP-15	21-SEP-15	R3271805
Vanadium (V)		45.9		0.20	mg/kg	20-SEP-15	21-SEP-15	R3271805
Zinc (Zn)		64.9		2.0	mg/kg	20-SEP-15	21-SEP-15	R3271805
Potassium in Soil by CRC ICPMS								
Potassium (K)		3940		50	mg/kg	20-SEP-15	21-SEP-15	R3271805
Sulfur in Soil by ICPOES								
Sulfur (S)		700		100	mg/kg	20-SEP-15	21-SEP-15	R3271850
Miscellaneous Parameters								
Total Organic Carbon		2.28		0.10	%	22-SEP-15	22-SEP-15	R3273283
Particle size - Pipette removal OM & CO3								
% Sand (2.0mm - 0.05mm)		4.83		0.10	%	21-SEP-15	22-SEP-15	R3273197
% Silt (0.05mm - 2um)		76.6		0.10	%	21-SEP-15	22-SEP-15	R3273197
% Clay (<2um)		18.6		0.10	%	21-SEP-15	22-SEP-15	R3273197

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1674574-3	AC-15							
Sampled By: JI/CD on 14-SEP-15 @ 11:30								
Matrix: SOIL								
Particle size - Pipette removal OM & CO3 Texture		Silt loam				21-SEP-15	22-SEP-15	R3273197
L1674574-4	AC-16							
Sampled By: JI/CD on 14-SEP-15 @ 10:30								
Matrix: SOIL								
Metals in Sediment for Golder Calgary								
Lithium in Soil by CRC ICPMS								
Lithium (Li)		42.6		0.50	mg/kg	20-SEP-15	21-SEP-15	R3271805
Mercury in Soil by CVAAS								
Mercury (Hg)		0.0224		0.0050	mg/kg	20-SEP-15	21-SEP-15	R3271738
Metals in Soil by CRC ICPMS								
Aluminum (Al)		14100		50	mg/kg	20-SEP-15	21-SEP-15	R3271805
Antimony (Sb)		<0.10		0.10	mg/kg	20-SEP-15	21-SEP-15	R3271805
Arsenic (As)		15.3		0.10	mg/kg	20-SEP-15	21-SEP-15	R3271805
Barium (Ba)		144		0.50	mg/kg	20-SEP-15	21-SEP-15	R3271805
Beryllium (Be)		0.45		0.10	mg/kg	20-SEP-15	21-SEP-15	R3271805
Bismuth (Bi)		0.26		0.20	mg/kg	20-SEP-15	21-SEP-15	R3271805
Boron (B)		<5.0		5.0	mg/kg	20-SEP-15	21-SEP-15	R3271805
Cadmium (Cd)		0.115		0.020	mg/kg	20-SEP-15	21-SEP-15	R3271805
Calcium (Ca)		1810		100	mg/kg	20-SEP-15	21-SEP-15	R3271805
Chromium (Cr)		51.2		0.50	mg/kg	20-SEP-15	21-SEP-15	R3271805
Cobalt (Co)		11.7		0.10	mg/kg	20-SEP-15	21-SEP-15	R3271805
Copper (Cu)		25.6		0.50	mg/kg	20-SEP-15	21-SEP-15	R3271805
Iron (Fe)		24100		50	mg/kg	20-SEP-15	21-SEP-15	R3271805
Lead (Pb)		4.64		0.50	mg/kg	20-SEP-15	21-SEP-15	R3271805
Magnesium (Mg)		7460		20	mg/kg	20-SEP-15	21-SEP-15	R3271805
Manganese (Mn)		384		1.0	mg/kg	20-SEP-15	21-SEP-15	R3271805
Molybdenum (Mo)		1.28		0.10	mg/kg	20-SEP-15	21-SEP-15	R3271805
Nickel (Ni)		33.4		0.50	mg/kg	20-SEP-15	21-SEP-15	R3271805
Selenium (Se)		<0.20		0.20	mg/kg	20-SEP-15	21-SEP-15	R3271805
Silver (Ag)		<0.10		0.10	mg/kg	20-SEP-15	21-SEP-15	R3271805
Sodium (Na)		210		100	mg/kg	20-SEP-15	21-SEP-15	R3271805
Strontium (Sr)		10.8		0.50	mg/kg	20-SEP-15	21-SEP-15	R3271805
Thallium (Tl)		0.219		0.050	mg/kg	20-SEP-15	21-SEP-15	R3271805
Tin (Sn)		<2.0		2.0	mg/kg	20-SEP-15	21-SEP-15	R3271805
Titanium (Ti)		740		1.0	mg/kg	20-SEP-15	21-SEP-15	R3271805
Uranium (U)		2.59		0.050	mg/kg	20-SEP-15	21-SEP-15	R3271805
Vanadium (V)		43.1		0.20	mg/kg	20-SEP-15	21-SEP-15	R3271805
Zinc (Zn)		56.3		2.0	mg/kg	20-SEP-15	21-SEP-15	R3271805
Potassium in Soil by CRC ICPMS								
Potassium (K)		3770		50	mg/kg	20-SEP-15	21-SEP-15	R3271805
Sulfur in Soil by ICPOES								
Sulfur (S)		730		100	mg/kg	20-SEP-15	21-SEP-15	R3271850
Miscellaneous Parameters								
Total Organic Carbon		2.71		0.10	%	22-SEP-15	22-SEP-15	R3273283
Particle size - Pipette removal OM & CO3								
% Sand (2.0mm - 0.05mm)		2.31		0.10	%	21-SEP-15	22-SEP-15	R3273197
% Silt (0.05mm - 2um)		79.6		0.10	%	21-SEP-15	22-SEP-15	R3273197
% Clay (<2um)		18.1		0.10	%	21-SEP-15	22-SEP-15	R3273197
Texture		Silt loam				21-SEP-15	22-SEP-15	R3273197

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1674574-5 AC-17 Sampled By: JI/CD on 14-SEP-15 @ 12:52 Matrix: SOIL Metals in Sediment for Golder Calgary Lithium in Soil by CRC ICPMS Lithium (Li)							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1674574-6 DUPLICATE								
Sampled By: JI/CD on 14-SEP-15 @ 12:00								
Matrix: SOIL								
Particle size - Pipette removal OM & CO3								
% Sand (2.0mm - 0.05mm)		2.29		0.10	%	21-SEP-15	22-SEP-15	R3273197
% Silt (0.05mm - 2um)		81.1		0.10	%	21-SEP-15	22-SEP-15	R3273197
% Clay (<2um)		16.6		0.10	%	21-SEP-15	22-SEP-15	R3273197
Texture		Silt loam				21-SEP-15	22-SEP-15	R3273197
L1674574-7 AC-14 (L1674574-2) RECHECK								
Sampled By: JI/CD on 14-SEP-15 @ 12:10								
Matrix: SOIL								
Miscellaneous Parameters								
Mercury (Hg)		0.0211		0.0050	mg/kg	07-OCT-15	07-OCT-15	R3285192
Sulfur (S)		427		50	mg/kg	07-OCT-15	07-OCT-15	R3285220
Low Level Metals in Soil by CRC ICPMS								
Aluminum (Al)		17600		20	mg/kg	07-OCT-15	07-OCT-15	R3285235
Antimony (Sb)		0.322		0.050	mg/kg	07-OCT-15	07-OCT-15	R3285235
Arsenic (As)		39.1		0.050	mg/kg	07-OCT-15	07-OCT-15	R3285235
Barium (Ba)		148		0.50	mg/kg	07-OCT-15	07-OCT-15	R3285235
Beryllium (Be)		0.51		0.10	mg/kg	07-OCT-15	07-OCT-15	R3285235
Bismuth (Bi)		0.34		0.10	mg/kg	07-OCT-15	07-OCT-15	R3285235
Cadmium (Cd)		0.173		0.020	mg/kg	07-OCT-15	07-OCT-15	R3285235
Calcium (Ca)		1680		50	mg/kg	07-OCT-15	07-OCT-15	R3285235
Chromium (Cr)		62.5		0.20	mg/kg	07-OCT-15	07-OCT-15	R3285235
Cobalt (Co)		19.7		0.10	mg/kg	07-OCT-15	07-OCT-15	R3285235
Copper (Cu)		31.7		0.50	mg/kg	07-OCT-15	07-OCT-15	R3285235
Iron (Fe)		32500		20	mg/kg	07-OCT-15	07-OCT-15	R3285235
Lead (Pb)		8.21		0.10	mg/kg	07-OCT-15	07-OCT-15	R3285235
Lithium (Li)		41.5		1.0	mg/kg	07-OCT-15	07-OCT-15	R3285235
Magnesium (Mg)		8900		20	mg/kg	07-OCT-15	07-OCT-15	R3285235
Manganese (Mn)		753		0.20	mg/kg	07-OCT-15	07-OCT-15	R3285235
Molybdenum (Mo)		1.74		0.10	mg/kg	07-OCT-15	07-OCT-15	R3285235
Nickel (Ni)		43.5		0.10	mg/kg	07-OCT-15	07-OCT-15	R3285235
Phosphorus (P)		1030		30	mg/kg	07-OCT-15	07-OCT-15	R3285235
Potassium (K)		4380		50	mg/kg	07-OCT-15	07-OCT-15	R3285235
Selenium (Se)		0.19		0.10	mg/kg	07-OCT-15	07-OCT-15	R3285235
Silver (Ag)		0.082		0.050	mg/kg	07-OCT-15	07-OCT-15	R3285235
Sodium (Na)		254		30	mg/kg	07-OCT-15	07-OCT-15	R3285235
Strontium (Sr)		12.1		0.20	mg/kg	07-OCT-15	07-OCT-15	R3285235
Thallium (Tl)		0.31		0.20	mg/kg	07-OCT-15	07-OCT-15	R3285235
Tin (Sn)		4.63		0.10	mg/kg	07-OCT-15	07-OCT-15	R3285235
Titanium (Ti)		925		0.50	mg/kg	07-OCT-15	07-OCT-15	R3285235
Uranium (U)		3.03		0.050	mg/kg	07-OCT-15	07-OCT-15	R3285235
Vanadium (V)		52.6		0.10	mg/kg	07-OCT-15	07-OCT-15	R3285235
Zinc (Zn)		71.4		2.0	mg/kg	07-OCT-15	07-OCT-15	R3285235
L1674574-8 DUPLICATE (L1674574-6) RECHECK								
Sampled By: JI/CD on 14-SEP-15 @ 12:00								
Matrix: SOIL								
Miscellaneous Parameters								
Mercury (Hg)		0.0209		0.0050	mg/kg	07-OCT-15	07-OCT-15	R3285192
Sulfur (S)		400		50	mg/kg	07-OCT-15	07-OCT-15	R3285220
Low Level Metals in Soil by CRC ICPMS								
Aluminum (Al)		18100		20	mg/kg	07-OCT-15	07-OCT-15	R3285235
Antimony (Sb)		0.156		0.050	mg/kg	07-OCT-15	07-OCT-15	R3285235

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1674574-8	DUPLICATE (L1674574-6) RECHECK							
Sampled By:	Jl/CD on 14-SEP-15 @ 12:00							
Matrix:	SOIL							
Low Level Metals in Soil by CRC ICPMS								
Arsenic (As)		55.8		0.050	mg/kg	07-OCT-15	07-OCT-15	R3285235
Barium (Ba)		158		0.50	mg/kg	07-OCT-15	07-OCT-15	R3285235
Beryllium (Be)		0.54		0.10	mg/kg	07-OCT-15	07-OCT-15	R3285235
Bismuth (Bi)		0.34		0.10	mg/kg	07-OCT-15	07-OCT-15	R3285235
Cadmium (Cd)		0.164		0.020	mg/kg	07-OCT-15	07-OCT-15	R3285235
Calcium (Ca)		1950		50	mg/kg	07-OCT-15	07-OCT-15	R3285235
Chromium (Cr)		62.8		0.20	mg/kg	07-OCT-15	07-OCT-15	R3285235
Cobalt (Co)		16.4		0.10	mg/kg	07-OCT-15	07-OCT-15	R3285235
Copper (Cu)		30.6		0.50	mg/kg	07-OCT-15	07-OCT-15	R3285235
Iron (Fe)		34900		20	mg/kg	07-OCT-15	07-OCT-15	R3285235
Lead (Pb)		8.28		0.10	mg/kg	07-OCT-15	07-OCT-15	R3285235
Lithium (Li)		43.6		1.0	mg/kg	07-OCT-15	07-OCT-15	R3285235
Magnesium (Mg)		8960		20	mg/kg	07-OCT-15	07-OCT-15	R3285235
Manganese (Mn)		2090	DLHC	0.50	mg/kg	07-OCT-15	07-OCT-15	R3285235
Molybdenum (Mo)		2.50		0.10	mg/kg	07-OCT-15	07-OCT-15	R3285235
Nickel (Ni)		41.7		0.10	mg/kg	07-OCT-15	07-OCT-15	R3285235
Phosphorus (P)		943		30	mg/kg	07-OCT-15	07-OCT-15	R3285235
Potassium (K)		4320		50	mg/kg	07-OCT-15	07-OCT-15	R3285235
Selenium (Se)		0.19		0.10	mg/kg	07-OCT-15	07-OCT-15	R3285235
Silver (Ag)		0.082		0.050	mg/kg	07-OCT-15	07-OCT-15	R3285235
Sodium (Na)		266		30	mg/kg	07-OCT-15	07-OCT-15	R3285235
Strontium (Sr)		13.5		0.20	mg/kg	07-OCT-15	07-OCT-15	R3285235
Thallium (Tl)		0.30		0.20	mg/kg	07-OCT-15	07-OCT-15	R3285235
Tin (Sn)		1.71		0.10	mg/kg	07-OCT-15	07-OCT-15	R3285235
Titanium (Ti)		900		0.50	mg/kg	07-OCT-15	07-OCT-15	R3285235
Uranium (U)		3.01		0.050	mg/kg	07-OCT-15	07-OCT-15	R3285235
Vanadium (V)		52.2		0.10	mg/kg	07-OCT-15	07-OCT-15	R3285235
Zinc (Zn)		70.9		2.0	mg/kg	07-OCT-15	07-OCT-15	R3285235

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
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C-TOT-ORG-LECO-SK	Soil	Organic Carbon by combustion method	SSSA (1996) p. 973
Total Organic Carbon (C-TOT-ORG-LECO-SK, C-TOT-ORG-SK)			

Total C and inorganic C are determined on separate samples. The total C is determined by combustion and thermal conductivity detection, while inorganic C is determined by weight loss after addition of hydrochloric acid. Organic C is calculated by the difference between these two determinations.

Reference for Total C:

Nelson, D.W. and Sommers, L.E. 1996. Total Carbon, organic carbon and organic matter. P. 961-1010 In: J.M. Bartels et al. (ed.) Methods of soil analysis: Part 3 Chemical methods. (3rd ed.) ASA and SSSA, Madison, WI. Book series no. 5

Reference for Inorganic C:

Loeppert, R.H. and Suarez, D.L. 1996. Gravimetric Method for Loss of Carbon Dioxide. P. 455-456 In: J.M. Bartels et al. (ed.) Methods of soil analysis: Part 3 Chemical methods. (3rd ed.) ASA and SSSA, Madison, WI. Book series no. 5

HG-200.2-CVAA-ED	Soil	Mercury in Soil by CVAAS	EPA 200.2/1631E (Mod)
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Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAAS.

HG-200.2-CVAF-SK	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)
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Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.

K-200.2-L-CCMS-ED	Soil	Potassium in Soil by CRC ICPMS	EPA 200.2/6020A
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LI-200.2-L-CCMS-ED	Soil	Lithium in Soil by CRC ICPMS	EPA 200.2/6020A
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MET-200.2-CCMS-ED	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)
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Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CRC ICPMS.

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may be environmentally available. This method does not dissolve all silicate materials and may result in a partial extraction, depending on the sample matrix, for some metals, including, but not limited to Al, Ba, Be, Cr, Sr, Ti, Tl, and V.

MET-200.2-L-CCMS-SK	Soil	Low Level Metals in Soil by CRC ICPMS	EPA 200.2/6020A
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This analysis is carried out using procedures from CSR Analytical Method: "Strong Acid Leachable Metals (SALM) in Soil", BC Ministry of Environment, 26 June 2009, and procedures adapted from EPA Method 200.2. The sample is dried at 40 C, then ground to < 2 mm particle size using a stainless steel flail grinder. A representative portion is digested with concentrated nitric and hydrochloric acids for 2 hours in an open vessel digester at 95 degrees. Instrumental analysis of the digested extract is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

PSA-3-SK	Soil	Particle size - Pipette removal OM & CO ₃	Forestry Canada (1991) p. 46-53
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Dry, < 2 mm soil is treated hydrochloric acid to remove carbonates, then hydrogen peroxide to remove organic matter. The remaining soil is treated with sodium hexametaphosphate to ensure complete dispersion of primary soil particles. The homogenized suspension is allowed to settle in accordance with Stoke's Law so that only clay particles remain in suspension. To determine the clay fraction, an aliquot of the clay suspension is removed, then dried and weighed. The sand fraction is determined by wet sieving the remaining suspension, then drying and weighing the sand retained on the sieve. The silt fraction is determined by calculation where % Silt = 100 - (%Sand+%Clay)

Reference:

Burt, R. (2009). Soil Survey Field and Laboratory Methods Manual. Soil Survey Investigations Report No. 5. Method 3.2.1.2.2. United States Department of Agriculture Natural Resources Conservation Service.

S-200.2-ICP-ED	Soil	Sulfur in Soil by ICPOES	EPA 200.2/6010B
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S-SALM-ICP-SK	Soil	Strong Acid Leachable Sulphur	EPA 200.2
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This analysis is carried out using procedures from CSR Analytical Method: "Strong Acid Leachable Metals (SALM) in Soil", BC Ministry of Environment, 26 June 2009, and procedures adapted from EPA Method 200.2. The sample is dried at 40 C, then ground to < 2 mm particle size using a stainless steel flail grinder. A representative portion is digested with concentrated nitric and hydrochloric acids for 2 hours in an open vessel digester at 95 degrees. Instrumental analysis of the digested extract is by ICP-OES.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
Laboratory Definition Code	Laboratory Location		

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg ww - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.

< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L1674574

Report Date: 08-OCT-15

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Client: GOLDER ASSOCIATES LTD

16820 - 107 ave

Edmonton AB T5P 4C3

Contact: Megan McLean

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
C-TOT-ORG-LECO-SK		Soil						
Batch	R3273283							
WG2174807-1	DUP	L1674574-4						
Total Organic Carbon		2.71	2.72		%	0.4	30	22-SEP-15
WG2174807-2	IRM	08-109_SOIL						
Total Organic Carbon			1.01		%		0.77-1.43	22-SEP-15
WG2174807-3	MB							
Total Organic Carbon			<0.10		%		0.1	22-SEP-15
HG-200.2-CVAA-ED		Soil						
Batch	R3271738							
WG2174971-5	CRM	TILL-1_SOIL						
Mercury (Hg)			86.0		%		70-130	21-SEP-15
WG2174971-6	CRM	TILL-1_SOIL						
Mercury (Hg)			89.3		%		70-130	21-SEP-15
WG2174971-3	LCS							
Mercury (Hg)			87.1		%		70-130	21-SEP-15
WG2174971-4	LCS							
Mercury (Hg)			79.8		%		70-130	21-SEP-15
WG2174971-1	MB							
Mercury (Hg)			<0.0050		mg/kg		0.005	21-SEP-15
WG2174971-2	MB							
Mercury (Hg)			<0.0050		mg/kg		0.005	21-SEP-15
HG-200.2-CVAF-SK		Soil						
Batch	R3285192							
WG2187653-3	CRM	TILL-1						
Mercury (Hg)			102.3		%		70-130	07-OCT-15
WG2187653-2	DUP	L1674574-7						
Mercury (Hg)		0.0211	0.0224		mg/kg	5.8	40	07-OCT-15
WG2187653-5	DUP	L1674574-8						
Mercury (Hg)		0.0209	0.0207		mg/kg	1.0	40	07-OCT-15
WG2187653-4	LCS							
Mercury (Hg)			81.6		%		70-130	07-OCT-15
WG2187653-1	MB							
Mercury (Hg)			<0.0050		mg/kg		0.005	07-OCT-15
K-200.2-L-CCMS-ED		Soil						
Batch	R3271805							
WG2174971-3	LCS							
Potassium (K)			90.9		%		80-120	21-SEP-15
WG2174971-4	LCS							
Potassium (K)			91.4		%		80-120	21-SEP-15

Quality Control Report

Workorder: L1674574

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
K-200.2-L-CCMS-ED								
Soil								
Batch	R3271805							
WG2174971-1 MB								
Potassium (K)			<50		mg/kg		50	21-SEP-15
WG2174971-2 MB								
Potassium (K)			<50		mg/kg		50	21-SEP-15
LI-200.2-L-CCMS-ED								
Soil								
Batch	R3271805							
WG2174971-3 LCS								
Lithium (Li)			91.9		%		80-120	21-SEP-15
WG2174971-4 LCS								
Lithium (Li)			97.4		%		80-120	21-SEP-15
WG2174971-1 MB								
Lithium (Li)			<0.50		mg/kg		0.5	21-SEP-15
WG2174971-2 MB								
Lithium (Li)			<0.50		mg/kg		0.5	21-SEP-15
MET-200.2-CCMS-ED								
Soil								
Batch	R3271805							
WG2174971-5 CRM		TILL-1_SOIL						
Aluminum (Al)			94.1		%		70-130	21-SEP-15
Antimony (Sb)			103.9		%		70-130	21-SEP-15
Arsenic (As)			104.9		%		70-130	21-SEP-15
Barium (Ba)			105.1		%		70-130	21-SEP-15
Beryllium (Be)			99.8		%		70-130	21-SEP-15
Bismuth (Bi)			104.1		%		70-130	21-SEP-15
Cadmium (Cd)			96.7		%		70-130	21-SEP-15
Calcium (Ca)			102.8		%		70-130	21-SEP-15
Chromium (Cr)			97.1		%		70-130	21-SEP-15
Cobalt (Co)			100.0		%		70-130	21-SEP-15
Copper (Cu)			96.4		%		70-130	21-SEP-15
Iron (Fe)			96.9		%		70-130	21-SEP-15
Lead (Pb)			89.5		%		70-130	21-SEP-15
Magnesium (Mg)			91.4		%		70-130	21-SEP-15
Manganese (Mn)			97.2		%		70-130	21-SEP-15
Molybdenum (Mo)			104.4		%		70-130	21-SEP-15
Nickel (Ni)			98.4		%		70-130	21-SEP-15
Selenium (Se)			101.3		%		70-130	21-SEP-15
Sodium (Na)			104.0		%		70-130	21-SEP-15

Quality Control Report

Workorder: L1674574

Report Date: 08-OCT-15

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-ED		Soil						
Batch	R3271805							
WG2174971-5	CRM	TILL-1_SOIL						
Strontium (Sr)			98.8		%		70-130	21-SEP-15
Titanium (Ti)			91.2		%		70-130	21-SEP-15
Uranium (U)			98.7		%		70-130	21-SEP-15
Vanadium (V)			100.7		%		70-130	21-SEP-15
Zinc (Zn)			96.5		%		70-130	21-SEP-15
WG2174971-6	CRM	TILL-1_SOIL						
Aluminum (Al)			91.2		%		70-130	21-SEP-15
Antimony (Sb)			94.9		%		70-130	21-SEP-15
Arsenic (As)			103.6		%		70-130	21-SEP-15
Barium (Ba)			107.9		%		70-130	21-SEP-15
Beryllium (Be)			92.2		%		70-130	21-SEP-15
Bismuth (Bi)			92.9		%		70-130	21-SEP-15
Cadmium (Cd)			95.5		%		70-130	21-SEP-15
Calcium (Ca)			99.8		%		70-130	21-SEP-15
Chromium (Cr)			94.5		%		70-130	21-SEP-15
Cobalt (Co)			98.2		%		70-130	21-SEP-15
Copper (Cu)			94.8		%		70-130	21-SEP-15
Iron (Fe)			96.1		%		70-130	21-SEP-15
Lead (Pb)			87.1		%		70-130	21-SEP-15
Magnesium (Mg)			92.5		%		70-130	21-SEP-15
Manganese (Mn)			97.8		%		70-130	21-SEP-15
Molybdenum (Mo)			91.3		%		70-130	21-SEP-15
Nickel (Ni)			97.9		%		70-130	21-SEP-15
Selenium (Se)			89.4		%		70-130	21-SEP-15
Sodium (Na)			103.2		%		70-130	21-SEP-15
Strontium (Sr)			96.4		%		70-130	21-SEP-15
Thallium (Tl)			119.0		%		70-130	21-SEP-15
Titanium (Ti)			88.5		%		70-130	21-SEP-15
Uranium (U)			95.2		%		70-130	21-SEP-15
Vanadium (V)			98.7		%		70-130	21-SEP-15
Zinc (Zn)			96.7		%		70-130	21-SEP-15
WG2174971-3	LCS							
Aluminum (Al)			92.4		%		80-120	21-SEP-15
Antimony (Sb)			85.1		%		80-120	21-SEP-15
Arsenic (As)			91.8		%		80-120	21-SEP-15

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-ED		Soil						
Batch R3271805								
WG2174971-3 LCS								
Barium (Ba)			95.4		%		80-120	21-SEP-15
Beryllium (Be)			90.8		%		80-120	21-SEP-15
Bismuth (Bi)			84.8		%		80-120	21-SEP-15
Boron (B)			89.1		%		80-120	21-SEP-15
Cadmium (Cd)			94.0		%		80-120	21-SEP-15
Calcium (Ca)			89.2		%		80-120	21-SEP-15
Chromium (Cr)			88.1		%		80-120	21-SEP-15
Cobalt (Co)			91.9		%		80-120	21-SEP-15
Copper (Cu)			88.8		%		80-120	21-SEP-15
Iron (Fe)			88.8		%		80-120	21-SEP-15
Lead (Pb)			86.7		%		80-120	21-SEP-15
Magnesium (Mg)			87.3		%		80-120	21-SEP-15
Manganese (Mn)			92.4		%		80-120	21-SEP-15
Molybdenum (Mo)			87.9		%		80-120	21-SEP-15
Nickel (Ni)			90.4		%		80-120	21-SEP-15
Selenium (Se)			87.0		%		80-120	21-SEP-15
Silver (Ag)			85.5		%		80-120	21-SEP-15
Sodium (Na)			94.3		%		80-120	21-SEP-15
Strontium (Sr)			90.8		%		80-120	21-SEP-15
Thallium (Tl)			86.3		%		80-120	21-SEP-15
Tin (Sn)			89.1		%		80-120	21-SEP-15
Titanium (Ti)			86.2		%		80-120	21-SEP-15
Uranium (U)			84.6		%		80-120	21-SEP-15
Vanadium (V)			90.9		%		80-120	21-SEP-15
Zinc (Zn)			87.1		%		80-120	21-SEP-15
WG2174971-4 LCS								
Aluminum (Al)			91.7		%		80-120	21-SEP-15
Antimony (Sb)			89.1		%		80-120	21-SEP-15
Arsenic (As)			91.2		%		80-120	21-SEP-15
Barium (Ba)			94.8		%		80-120	21-SEP-15
Beryllium (Be)			91.4		%		80-120	21-SEP-15
Bismuth (Bi)			89.0		%		80-120	21-SEP-15
Boron (B)			92.2		%		80-120	21-SEP-15
Cadmium (Cd)			90.8		%		80-120	21-SEP-15

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-ED		Soil						
Batch R3271805								
WG2174971-4 LCS								
Calcium (Ca)			89.3		%		80-120	21-SEP-15
Chromium (Cr)			88.7		%		80-120	21-SEP-15
Cobalt (Co)			91.4		%		80-120	21-SEP-15
Copper (Cu)			88.3		%		80-120	21-SEP-15
Iron (Fe)			88.4		%		80-120	21-SEP-15
Lead (Pb)			90.5		%		80-120	21-SEP-15
Magnesium (Mg)			88.1		%		80-120	21-SEP-15
Manganese (Mn)			92.1		%		80-120	21-SEP-15
Molybdenum (Mo)			87.7		%		80-120	21-SEP-15
Nickel (Ni)			90.7		%		80-120	21-SEP-15
Selenium (Se)			87.5		%		80-120	21-SEP-15
Silver (Ag)			85.1		%		80-120	21-SEP-15
Sodium (Na)			97.4		%		80-120	21-SEP-15
Strontium (Sr)			88.3		%		80-120	21-SEP-15
Thallium (Tl)			88.1		%		80-120	21-SEP-15
Tin (Sn)			90.2		%		80-120	21-SEP-15
Titanium (Ti)			86.4		%		80-120	21-SEP-15
Uranium (U)			86.7		%		80-120	21-SEP-15
Vanadium (V)			91.5		%		80-120	21-SEP-15
Zinc (Zn)			88.5		%		80-120	21-SEP-15
WG2174971-1 MB								
Aluminum (Al)			<50		mg/kg		50	21-SEP-15
Antimony (Sb)			<0.10		mg/kg		0.1	21-SEP-15
Arsenic (As)			<0.10		mg/kg		0.1	21-SEP-15
Barium (Ba)			<0.50		mg/kg		0.5	21-SEP-15
Beryllium (Be)			<0.10		mg/kg		0.1	21-SEP-15
Bismuth (Bi)			<0.20		mg/kg		0.2	21-SEP-15
Boron (B)			<5.0		mg/kg		5	21-SEP-15
Cadmium (Cd)			<0.020		mg/kg		0.02	21-SEP-15
Calcium (Ca)			<50		mg/kg		50	21-SEP-15
Chromium (Cr)			<0.50		mg/kg		0.5	21-SEP-15
Cobalt (Co)			<0.10		mg/kg		0.1	21-SEP-15
Copper (Cu)			<0.50		mg/kg		0.5	21-SEP-15
Iron (Fe)			<50		mg/kg		50	21-SEP-15

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-ED		Soil						
Batch R3271805								
WG2174971-1 MB								
Lead (Pb)			<0.50		mg/kg		0.5	21-SEP-15
Magnesium (Mg)			<20		mg/kg		20	21-SEP-15
Manganese (Mn)			<1.0		mg/kg		1	21-SEP-15
Molybdenum (Mo)			<0.10		mg/kg		0.1	21-SEP-15
Nickel (Ni)			<0.50		mg/kg		0.5	21-SEP-15
Selenium (Se)			<0.20		mg/kg		0.2	21-SEP-15
Silver (Ag)			<0.10		mg/kg		0.1	21-SEP-15
Sodium (Na)			<50		mg/kg		50	21-SEP-15
Strontium (Sr)			<0.50		mg/kg		0.5	21-SEP-15
Thallium (Tl)			<0.050		mg/kg		0.05	21-SEP-15
Tin (Sn)			<2.0		mg/kg		2	21-SEP-15
Titanium (Ti)			<1.0		mg/kg		1	21-SEP-15
Uranium (U)			<0.050		mg/kg		0.05	21-SEP-15
Vanadium (V)			<0.20		mg/kg		0.2	21-SEP-15
Zinc (Zn)			<2.0		mg/kg		2	21-SEP-15
WG2174971-2 MB								
Aluminum (Al)			<50		mg/kg		50	21-SEP-15
Antimony (Sb)			<0.10		mg/kg		0.1	21-SEP-15
Arsenic (As)			<0.10		mg/kg		0.1	21-SEP-15
Barium (Ba)			<0.50		mg/kg		0.5	21-SEP-15
Beryllium (Be)			<0.10		mg/kg		0.1	21-SEP-15
Bismuth (Bi)			<0.20		mg/kg		0.2	21-SEP-15
Boron (B)			<5.0		mg/kg		5	21-SEP-15
Cadmium (Cd)			<0.020		mg/kg		0.02	21-SEP-15
Calcium (Ca)			<50		mg/kg		50	21-SEP-15
Chromium (Cr)			<0.50		mg/kg		0.5	21-SEP-15
Cobalt (Co)			<0.10		mg/kg		0.1	21-SEP-15
Copper (Cu)			<0.50		mg/kg		0.5	21-SEP-15
Iron (Fe)			<50		mg/kg		50	21-SEP-15
Lead (Pb)			<0.50		mg/kg		0.5	21-SEP-15
Magnesium (Mg)			<20		mg/kg		20	21-SEP-15
Manganese (Mn)			<1.0		mg/kg		1	21-SEP-15
Molybdenum (Mo)			<0.10		mg/kg		0.1	21-SEP-15
Nickel (Ni)			<0.50		mg/kg		0.5	21-SEP-15

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MET-200.2-CCMS-ED		Soil						
Batch	R3271805							
WG2174971-2	MB							
Selenium (Se)			<0.20		mg/kg		0.2	21-SEP-15
Silver (Ag)			<0.10		mg/kg		0.1	21-SEP-15
Sodium (Na)			<50		mg/kg		50	21-SEP-15
Strontium (Sr)			<0.50		mg/kg		0.5	21-SEP-15
Thallium (Tl)			<0.050		mg/kg		0.05	21-SEP-15
Tin (Sn)			<2.0		mg/kg		2	21-SEP-15
Titanium (Ti)			<1.0		mg/kg		1	21-SEP-15
Uranium (U)			<0.050		mg/kg		0.05	21-SEP-15
Vanadium (V)			<0.20		mg/kg		0.2	21-SEP-15
Zinc (Zn)			<2.0		mg/kg		2	21-SEP-15
MET-200.2-L-CCMS-SK		Soil						
Batch	R3285235							
WG2187653-3	CRM	TILL-1						
Aluminum (Al)			94.2		%		70-130	07-OCT-15
Antimony (Sb)			103.6		%		70-130	07-OCT-15
Arsenic (As)			101.7		%		70-130	07-OCT-15
Barium (Ba)			91.7		%		70-130	07-OCT-15
Beryllium (Be)			94.0		%		50-150	07-OCT-15
Bismuth (Bi)			97.5		%		70-130	07-OCT-15
Cadmium (Cd)			88.5		%		50-150	07-OCT-15
Calcium (Ca)			102.2		%		70-130	07-OCT-15
Chromium (Cr)			98.3		%		70-130	07-OCT-15
Cobalt (Co)			95.5		%		70-130	07-OCT-15
Copper (Cu)			95.8		%		70-130	07-OCT-15
Iron (Fe)			86.1		%		70-130	07-OCT-15
Lead (Pb)			96.1		%		70-130	07-OCT-15
Lithium (Li)			91.3		%		70-130	07-OCT-15
Magnesium (Mg)			96.4		%		70-130	07-OCT-15
Manganese (Mn)			95.9		%		70-130	07-OCT-15
Molybdenum (Mo)			93.1		%		70-130	07-OCT-15
Nickel (Ni)			96.6		%		70-130	07-OCT-15
Phosphorus (P)			93.4		%		70-130	07-OCT-15
Potassium (K)			90.1		%		70-130	07-OCT-15
Selenium (Se)			93.9		%		70-130	07-OCT-15

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-L-CCMS-SK		Soil						
Batch	R3285235							
WG2187653-3	CRM	TILL-1						
Silver (Ag)			110.1		%		70-130	07-OCT-15
Sodium (Na)			94.5		%		50-150	07-OCT-15
Strontium (Sr)			101.6		%		70-130	07-OCT-15
Thallium (Tl)			98.8		%		70-130	07-OCT-15
Tin (Sn)			116.5		%		70-130	07-OCT-15
Titanium (Ti)			87.1		%		70-130	07-OCT-15
Uranium (U)			107.4		%		70-130	07-OCT-15
Vanadium (V)			100.6		%		70-130	07-OCT-15
Zinc (Zn)			93.0		%		70-130	07-OCT-15
WG2187653-2	DUP	L1674574-7						
Aluminum (Al)		17600	18200		mg/kg	3.2	30	07-OCT-15
Antimony (Sb)		0.322	0.314		mg/kg	2.7	30	07-OCT-15
Arsenic (As)		39.1	37.7		mg/kg	3.7	30	07-OCT-15
Barium (Ba)		148	147		mg/kg	0.7	30	07-OCT-15
Beryllium (Be)		0.51	0.53		mg/kg	3.7	30	07-OCT-15
Bismuth (Bi)		0.34	0.34		mg/kg	2.0	30	07-OCT-15
Cadmium (Cd)		0.173	0.161		mg/kg	7.5	30	07-OCT-15
Calcium (Ca)		1680	1810		mg/kg	7.7	30	07-OCT-15
Chromium (Cr)		62.5	62.7		mg/kg	0.4	30	07-OCT-15
Cobalt (Co)		19.7	19.8		mg/kg	0.7	30	07-OCT-15
Copper (Cu)		31.7	31.9		mg/kg	0.6	30	07-OCT-15
Iron (Fe)		32500	31900		mg/kg	2.0	30	07-OCT-15
Lead (Pb)		8.21	8.42		mg/kg	2.5	40	07-OCT-15
Lithium (Li)		41.5	42.9		mg/kg	3.4	30	07-OCT-15
Magnesium (Mg)		8900	9080		mg/kg	2.0	30	07-OCT-15
Manganese (Mn)		753	733		mg/kg	2.7	30	07-OCT-15
Molybdenum (Mo)		1.74	1.75		mg/kg	0.4	30	07-OCT-15
Nickel (Ni)		43.5	43.9		mg/kg	1.1	30	07-OCT-15
Phosphorus (P)		1030	1020		mg/kg	0.4	30	07-OCT-15
Potassium (K)		4380	4440		mg/kg	1.2	30	07-OCT-15
Selenium (Se)		0.19	0.19		mg/kg	1.8	30	07-OCT-15
Silver (Ag)		0.082	0.080		mg/kg	2.2	30	07-OCT-15
Sodium (Na)		254	267		mg/kg	5.0	30	07-OCT-15
Strontium (Sr)		12.1	13.3		mg/kg	9.3	30	07-OCT-15

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MET-200.2-L-CCMS-SK		Soil						
Batch	R3285235							
WG2187653-2	DUP	L1674574-7						
Thallium (Tl)		0.31	0.31		mg/kg	0.6	30	07-OCT-15
Tin (Sn)		4.63	4.81		mg/kg	4.0	30	07-OCT-15
Titanium (Ti)		925	954		mg/kg	3.1	30	07-OCT-15
Uranium (U)		3.03	3.12		mg/kg	3.0	30	07-OCT-15
Vanadium (V)		52.6	53.1		mg/kg	0.9	30	07-OCT-15
Zinc (Zn)		71.4	71.6		mg/kg	0.4	30	07-OCT-15
WG2187653-5	DUP	L1674574-8						
Aluminum (Al)		18100	17900		mg/kg	1.4	30	07-OCT-15
Antimony (Sb)		0.156	0.097	J	mg/kg	0.058	0.1	07-OCT-15
Arsenic (As)		55.8	50.6		mg/kg	9.9	30	07-OCT-15
Barium (Ba)		158	155		mg/kg	1.4	30	07-OCT-15
Beryllium (Be)		0.54	0.54		mg/kg	1.2	30	07-OCT-15
Bismuth (Bi)		0.34	0.32		mg/kg	3.9	30	07-OCT-15
Cadmium (Cd)		0.164	0.155		mg/kg	5.5	30	07-OCT-15
Calcium (Ca)		1950	1950		mg/kg	0.1	30	07-OCT-15
Chromium (Cr)		62.8	62.7		mg/kg	0.2	30	07-OCT-15
Cobalt (Co)		16.4	15.9		mg/kg	3.4	30	07-OCT-15
Copper (Cu)		30.6	30.1		mg/kg	1.6	30	07-OCT-15
Iron (Fe)		34900	33300		mg/kg	4.6	30	07-OCT-15
Lead (Pb)		8.28	10.4		mg/kg	22	40	07-OCT-15
Lithium (Li)		43.6	44.7		mg/kg	2.3	30	07-OCT-15
Magnesium (Mg)		8960	9040		mg/kg	0.9	30	07-OCT-15
Manganese (Mn)		2090	2020		mg/kg	3.5	30	07-OCT-15
Molybdenum (Mo)		2.50	2.44		mg/kg	2.1	30	07-OCT-15
Nickel (Ni)		41.7	40.7		mg/kg	2.2	30	07-OCT-15
Phosphorus (P)		943	965		mg/kg	2.3	30	07-OCT-15
Potassium (K)		4320	4330		mg/kg	0.3	30	07-OCT-15
Selenium (Se)		0.19	0.17		mg/kg	12	30	07-OCT-15
Silver (Ag)		0.082	0.075		mg/kg	8.6	30	07-OCT-15
Sodium (Na)		266	263		mg/kg	1.2	30	07-OCT-15
Strontium (Sr)		13.5	12.9		mg/kg	4.8	30	07-OCT-15
Thallium (Tl)		0.30	0.28		mg/kg	5.2	30	07-OCT-15
Tin (Sn)		1.71	1.62		mg/kg	5.7	30	07-OCT-15
Titanium (Ti)		900	883		mg/kg	1.9	30	07-OCT-15



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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-L-CCMS-SK	Soil							
Batch	R3285235							
WG2187653-5	DUP	L1674574-8						
Uranium (U)		3.01	3.09		mg/kg	2.6	30	07-OCT-15
Vanadium (V)		52.2	51.4		mg/kg	1.5	30	07-OCT-15
Zinc (Zn)		70.9	68.9		mg/kg	2.8	30	07-OCT-15
WG2187653-4	LCS							
Aluminum (Al)			99.3		%		80-120	07-OCT-15
Antimony (Sb)			107.1		%		80-120	07-OCT-15
Arsenic (As)			98.7		%		80-120	07-OCT-15
Barium (Ba)			96.1		%		80-120	07-OCT-15
Beryllium (Be)			98.0		%		80-120	07-OCT-15
Bismuth (Bi)			104.4		%		80-120	07-OCT-15
Cadmium (Cd)			99.2		%		80-120	07-OCT-15
Calcium (Ca)			100.5		%		80-120	07-OCT-15
Chromium (Cr)			95.3		%		80-120	07-OCT-15
Cobalt (Co)			94.7		%		80-120	07-OCT-15
Copper (Cu)			95.2		%		80-120	07-OCT-15
Iron (Fe)			93.9		%		80-120	07-OCT-15
Lead (Pb)			106.7		%		80-120	07-OCT-15
Lithium (Li)			89.7		%		80-120	07-OCT-15
Magnesium (Mg)			96.0		%		80-120	07-OCT-15
Manganese (Mn)			94.1		%		80-120	07-OCT-15
Molybdenum (Mo)			106.6		%		80-120	07-OCT-15
Nickel (Ni)			94.2		%		80-120	07-OCT-15
Phosphorus (P)			102.4		%		80-120	07-OCT-15
Potassium (K)			95.2		%		80-120	07-OCT-15
Selenium (Se)			98.5		%		80-120	07-OCT-15
Silver (Ag)			105.4		%		80-120	07-OCT-15
Sodium (Na)			97.1		%		80-120	07-OCT-15
Strontium (Sr)			105.1		%		80-120	07-OCT-15
Thallium (Tl)			107.8		%		80-120	07-OCT-15
Tin (Sn)			100.2		%		80-120	07-OCT-15
Titanium (Ti)			91.6		%		80-120	07-OCT-15
Uranium (U)			99.96		%		80-120	07-OCT-15
Vanadium (V)			98.7		%		80-120	07-OCT-15
Zinc (Zn)			89.6		%		80-120	07-OCT-15
WG2187653-1	MB							

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-L-CCMS-SK	Soil							
Batch	R3285235							
WG2187653-1 MB								
Aluminum (Al)			<20		mg/kg		20	07-OCT-15
Antimony (Sb)			<0.050		mg/kg		0.05	07-OCT-15
Arsenic (As)			<0.050		mg/kg		0.05	07-OCT-15
Barium (Ba)			<0.50		mg/kg		0.5	07-OCT-15
Beryllium (Be)			<0.10		mg/kg		0.1	07-OCT-15
Bismuth (Bi)			<0.10		mg/kg		0.1	07-OCT-15
Cadmium (Cd)			<0.020		mg/kg		0.02	07-OCT-15
Calcium (Ca)			<50		mg/kg		50	07-OCT-15
Chromium (Cr)			<0.20		mg/kg		0.2	07-OCT-15
Cobalt (Co)			<0.10		mg/kg		0.1	07-OCT-15
Copper (Cu)			<0.50		mg/kg		0.5	07-OCT-15
Iron (Fe)			<20		mg/kg		20	07-OCT-15
Lead (Pb)			<0.10		mg/kg		0.1	07-OCT-15
Lithium (Li)			<1.0		mg/kg		1	07-OCT-15
Magnesium (Mg)			<20		mg/kg		20	07-OCT-15
Manganese (Mn)			<0.20		mg/kg		0.2	07-OCT-15
Molybdenum (Mo)			<0.10		mg/kg		0.1	07-OCT-15
Nickel (Ni)			<0.10		mg/kg		0.1	07-OCT-15
Phosphorus (P)			<30		mg/kg		30	07-OCT-15
Potassium (K)			<50		mg/kg		50	07-OCT-15
Selenium (Se)			<0.10		mg/kg		0.1	07-OCT-15
Silver (Ag)			<0.050		mg/kg		0.05	07-OCT-15
Sodium (Na)			<30		mg/kg		30	07-OCT-15
Strontium (Sr)			<0.20		mg/kg		0.2	07-OCT-15
Thallium (Tl)			<0.20		mg/kg		0.2	07-OCT-15
Tin (Sn)			<0.10		mg/kg		0.1	07-OCT-15
Titanium (Ti)			<0.50		mg/kg		0.5	07-OCT-15
Uranium (U)			<0.050		mg/kg		0.05	07-OCT-15
Vanadium (V)			<0.10		mg/kg		0.1	07-OCT-15
Zinc (Zn)			<2.0		mg/kg		2	07-OCT-15
PSA-3-SK	Soil							

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PSA-3-SK		Soil						
Batch	R3273197							
WG2174811-3	DUP	L1674574-3						
% Sand (2.0mm - 0.05mm)		4.83	4.66	J	%	0.17	10	22-SEP-15
% Silt (0.05mm - 2um)		76.6	77.9	J	%	1.39	10	22-SEP-15
% Clay (<2um)		18.6	17.4	J	%	1.22	10	22-SEP-15
WG2174811-2	IRM	FARM2010						
% Sand (2.0mm - 0.05mm)			36.1		%		29-49	22-SEP-15
% Silt (0.05mm - 2um)			40.9		%		28-48	22-SEP-15
% Clay (<2um)			23.0		%		18-28	22-SEP-15
S-200.2-ICP-ED		Soil						
Batch	R3271850							
WG2174971-5	CRM	TILL-1_SOIL						
Sulfur (S)			88.9		%		50-150	21-SEP-15
WG2174971-3	LCS							
Sulfur (S)			107.1		%		80-120	21-SEP-15
WG2174971-1	MB							
Sulfur (S)			<100		mg/kg		100	21-SEP-15
S-SALM-ICP-SK		Soil						
Batch	R3285220							
WG2187778-3	DUP	L1674574-8						
Sulfur (S)		400	384		mg/kg	4.1	30	07-OCT-15
WG2187778-4	DUP	L1674574-7						
Sulfur (S)		427	474		mg/kg	10	30	07-OCT-15
WG2187778-1	MB							
Sulfur (S)			<50		mg/kg		50	07-OCT-15

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Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

[illegible]