

HEMMERA ENVIROCHEM INC.

ATTN: Natasha Sandys 230 - 2237 2nd Avenue Whitehorse YK Y1A 0K7 Date Received: 23-MAR-15

Report Date: 31-MAR-15 15:40 (MT)

Version: FINAL

Client Phone: 867-456-4865

Certificate of Analysis

Lab Work Order #: L1590448

Project P.O. #: NOT SUBMITTED

Job Reference: 1343-005.06

C of C Numbers: 1

Legal Site Desc:

Brent Mack, B.Sc. Account Manager

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L1590448 CONTD.... PAGE 2 of 14 31-MAR-15 15:40 (MT)

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1590448-1 Water 20-MAR-15 16:10 MW09-18	L1590448-2 Water 20-MAR-15 16:10 MW09-18 FILTERED ALK	L1590448-3 Water 20-MAR-15 13:45 MW09-19	L1590448-4 Water 20-MAR-15 13:45 MW09-19 FILTERED ALK	L1590448-5 Water 20-MAR-15 12:40 CH-P-13-05-/50
Grouping	Analyte					
WATER						
Physical Tests	Conductivity (uS/cm)	2770		2010		2720
	Hardness (as CaCO3) (mg/L)	2060		1300		1910
	pH (pH)	7.57		7.29		6.58
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	491	626	483	482	94.7
	Ammonia, Total (as N) (mg/L)	0.0339		6.88		0.0381
	Chloride (CI) (mg/L)	<5.0 DLA		<5.0 DLA		<5.0
	Fluoride (F) (mg/L)	<0.20		<0.20		<0.20
	Nitrate (as N) (mg/L)	<0.050		<0.050		<0.050
	Nitrite (as N) (mg/L)	<0.010		<0.010		<0.010
	Total Kjeldahl Nitrogen (mg/L)	0.140		7.47		0.149
	Sulfate (SO4) (mg/L)	1570		909		1880
	Sulphide as S (mg/L)	<0.020		0.134		<0.020
	Anion Sum (meq/L)	42.5		28.6		41.1
	Cation Sum (meq/L)	42.0		29.3		41.5
	Cation - Anion Balance (%)	-0.6		1.2		0.5
Cyanides	Cyanide, Weak Acid Diss (mg/L)	<0.0050		<0.0050		<0.0050
	Cyanide, Total (mg/L)	<0.0050		<0.0050		<0.0050
	Thiocyanate (SCN) (mg/L)	<0.50		0.68		<0.50
	Cyanide, Free (mg/L)	<0.0050		<0.0050		<0.0050
Organic / Inorganic Carbon	Total Inorganic Carbon (mg/L)	104		103		14.8
	Total Organic Carbon (mg/L)	2.62		22.2		2.37
Total Metals	Aluminum (Al)-Total (mg/L)					
	Antimony (Sb)-Total (mg/L)					
	Arsenic (As)-Total (mg/L)					
	Barium (Ba)-Total (mg/L)					
	Beryllium (Be)-Total (mg/L)					
	Bismuth (Bi)-Total (mg/L)					
	Boron (B)-Total (mg/L)					
	Cadmium (Cd)-Total (mg/L)					
	Calcium (Ca)-Total (mg/L)					
	Chromium (Cr)-Total (mg/L)					
	Cobalt (Co)-Total (mg/L)					
	Copper (Cu)-Total (mg/L)					
	Iron (Fe)-Total (mg/L)					
	Lead (Pb)-Total (mg/L)					
	Lithium (Li)-Total (mg/L)					

^{*} Please refer to the Reference Information section for an explanation of any qualifiers detected.

L1590448 CONTD.... PAGE 3 of 14 31-MAR-15 15:40 (MT)

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1590448-6 Water 20-MAR-15 12:40 CH-P-13-05-/50 FILTERED ALK	L1590448-7 Water 20-MAR-15 13:45 DUP-1	L1590448-8 Water 20-MAR-15 13:45 DUP-1 FILTERED ALK	L1590448-9 Water 20-MAR-15 12:40 DUP-2	L1590448-10 Water 20-MAR-15 12:40 DUP-2 FILTERED ALK
Grouping	Analyte					
WATER						
Physical Tests	Conductivity (uS/cm)		1910		2710	
	Hardness (as CaCO3) (mg/L)		1330		1920	
	pH (pH)		7.11		6.56	
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	95.1	472	487	96.4	97.6
	Ammonia, Total (as N) (mg/L)		6.75		0.0377	
	Chloride (CI) (mg/L)		<2.5		<5.0 DLA	
	Fluoride (F) (mg/L)		<0.10 DLA		0.20	
	Nitrate (as N) (mg/L)		<0.025		<0.050	
	Nitrite (as N) (mg/L)		<0.0050		<0.010	
	Total Kjeldahl Nitrogen (mg/L)		7.48		0.157	
	Sulfate (SO4) (mg/L)		882		1880	
	Sulphide as S (mg/L)		0.132		<0.020	
	Anion Sum (meq/L)		27.8		41.0	
	Cation Sum (meq/L)		29.9		41.8	
	Cation - Anion Balance (%)		3.6		0.9	
Cyanides	Cyanide, Weak Acid Diss (mg/L)		<0.0050		<0.0050	
	Cyanide, Total (mg/L)		<0.0050		<0.0050	
	Thiocyanate (SCN) (mg/L)		0.66		<0.50	
	Cyanide, Free (mg/L)		<0.0050		<0.0050	
Organic / Inorganic Carbon	Total Inorganic Carbon (mg/L)		101		13.4	
	Total Organic Carbon (mg/L)		21.7		2.44	
Total Metals	Aluminum (Al)-Total (mg/L)					
	Antimony (Sb)-Total (mg/L)					
	Arsenic (As)-Total (mg/L)					
	Barium (Ba)-Total (mg/L)					
	Beryllium (Be)-Total (mg/L)					
	Bismuth (Bi)-Total (mg/L)					
	Boron (B)-Total (mg/L)					
	Cadmium (Cd)-Total (mg/L)					
	Calcium (Ca)-Total (mg/L)					
	Chromium (Cr)-Total (mg/L)					
	Cobalt (Co)-Total (mg/L)					
	Copper (Cu)-Total (mg/L)					
	Iron (Fe)-Total (mg/L)					
	Lead (Pb)-Total (mg/L)					
	Lithium (Li)-Total (mg/L)					

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L1590448 CONTD.... PAGE 4 of 14 31-MAR-15 15:40 (MT)

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1590448-11	L1590448-12	L1590448-13		IIIVAL
	Description	Water	Water	Water		
	Sampled Date	23-MAR-15	20-MAR-15 16:10	20-MAR-15 16:10		
	Sampled Time Client ID	TRAVEL BLANK	FB-3	FB-3 FILTERED ALK		
Grouping	Analyte			ALIX		
WATER						
Physical Tests	Conductivity (uS/cm)	<2.0	<2.0			
,	Hardness (as CaCO3) (mg/L)	<0.50	<0.50			
	pH (pH)	5.45	5.87			
Anions and	Alkalinity, Total (as CaCO3) (mg/L)	<2.0	<2.0	<2.0		
Nutrients		RRV	<2.0	\2.0		
	Ammonia, Total (as N) (mg/L)	0.0118	<0.0050			
	Chloride (CI) (mg/L)	<0.50	<0.50			
	Fluoride (F) (mg/L)	<0.020	<0.020			
	Nitrate (as N) (mg/L)	<0.0050	<0.0050			
	Nitrite (as N) (mg/L)	<0.0010	<0.0010			
	Total Kjeldahl Nitrogen (mg/L)	<0.050	<0.050			
	Sulfate (SO4) (mg/L)	<0.30	<0.30			
	Sulphide as S (mg/L)	<0.020	<0.020			
	Anion Sum (meq/L)	<0.10	<0.10			
	Cation Sum (meq/L)	<0.10	<0.10			
	Cation - Anion Balance (%)	0.0	0.0			
Cyanides	Cyanide, Weak Acid Diss (mg/L)	<0.0050	<0.0050			
	Cyanide, Total (mg/L)	<0.0050	<0.0050			
	Thiocyanate (SCN) (mg/L)	<0.50	<0.50			
	Cyanide, Free (mg/L)	<0.0050	<0.0050			
Organic / Inorganic Carbon	Total Inorganic Carbon (mg/L)	<0.50	<0.50			
	Total Organic Carbon (mg/L)	<0.50	<0.50			
Total Metals	Aluminum (AI)-Total (mg/L)	<0.0030				
	Antimony (Sb)-Total (mg/L)	<0.00010				
	Arsenic (As)-Total (mg/L)	<0.00010				
	Barium (Ba)-Total (mg/L)	<0.000050				
	Beryllium (Be)-Total (mg/L)	<0.00010				
	Bismuth (Bi)-Total (mg/L)	<0.00050				
	Boron (B)-Total (mg/L)	<0.010				
	Cadmium (Cd)-Total (mg/L)	<0.000010				
	Calcium (Ca)-Total (mg/L)	<0.050				
	Chromium (Cr)-Total (mg/L)	<0.00010				
	Cobalt (Co)-Total (mg/L)	<0.00010				
	Copper (Cu)-Total (mg/L)	<0.00050				
	Iron (Fe)-Total (mg/L)	<0.010				
	Lead (Pb)-Total (mg/L)	<0.000050				
	Lithium (Li)-Total (mg/L)	<0.00050				

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L1590448 CONTD.... PAGE 5 of 14 31-MAR-15 15:40 (MT)

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1590448-1 Water 20-MAR-15 16:10 MW09-18	L1590448-2 Water 20-MAR-15 16:10 MW09-18 FILTERED ALK	L1590448-3 Water 20-MAR-15 13:45 MW09-19	L1590448-4 Water 20-MAR-15 13:45 MW09-19 FILTERED ALK	L1590448-5 Water 20-MAR-15 12:40 CH-P-13-05-/50
Grouping	Analyte					
WATER						
Total Metals	Magnesium (Mg)-Total (mg/L)					
	Manganese (Mn)-Total (mg/L)					
	Mercury (Hg)-Total (mg/L)					
	Molybdenum (Mo)-Total (mg/L)					
	Nickel (Ni)-Total (mg/L)					
	Phosphorus (P)-Total (mg/L)					
	Potassium (K)-Total (mg/L)					
	Selenium (Se)-Total (mg/L)					
	Silicon (Si)-Total (mg/L)					
	Silver (Ag)-Total (mg/L)					
	Sodium (Na)-Total (mg/L)					
	Strontium (Sr)-Total (mg/L)					
	Sulfur (S)-Total (mg/L)					
	Thallium (TI)-Total (mg/L)					
	Tin (Sn)-Total (mg/L)					
	Titanium (Ti)-Total (mg/L)					
	Uranium (U)-Total (mg/L)					
	Vanadium (V)-Total (mg/L)					
	Zinc (Zn)-Total (mg/L)					
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD		FIELD		FIELD
	Dissolved Metals Filtration Location	FIELD		FIELD		FIELD
	Aluminum (AI)-Dissolved (mg/L)	DLA <0.0020		0.0134		0.0649
	Antimony (Sb)-Dissolved (mg/L)	0.00041		0.00046		O.00050
	Arsenic (As)-Dissolved (mg/L)	0.0556		0.125		0.00444
	Barium (Ba)-Dissolved (mg/L)	0.00940		0.0520		0.00627
	Beryllium (Be)-Dissolved (mg/L)	DLA <0.00020		<0.00020		O.00050
	Bismuth (Bi)-Dissolved (mg/L)	OLA <0.0010		<0.0010		O.0025
	Boron (B)-Dissolved (mg/L)	DLA <0.020		0.130		OLA <0.050
	Cadmium (Cd)-Dissolved (mg/L)	0.000050		<0.000020		0.330
	Calcium (Ca)-Dissolved (mg/L)	369		302		453
	Chromium (Cr)-Dissolved (mg/L)	<0.00020		0.00041		O.00050
	Cobalt (Co)-Dissolved (mg/L)	0.00030		0.00306		0.0398
	Copper (Cu)-Dissolved (mg/L)	<0.00040		<0.00040		0.0550
	Iron (Fe)-Dissolved (mg/L)	0.037		24.4		11.3
	Lead (Pb)-Dissolved (mg/L)	O.00010		<0.00010		0.00451
	Lithium (Li)-Dissolved (mg/L)	0.0216		0.0081		0.0379
	Magnesium (Mg)-Dissolved (mg/L)	277		133		188

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L1590448 CONTD.... PAGE 6 of 14 31-MAR-15 15:40 (MT)

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1590448-6 Water 20-MAR-15 12:40 CH-P-13-05-/50 FILTERED ALK	L1590448-7 Water 20-MAR-15 13:45 DUP-1	L1590448-8 Water 20-MAR-15 13:45 DUP-1 FILTERED ALK	L1590448-9 Water 20-MAR-15 12:40 DUP-2	L1590448-10 Water 20-MAR-15 12:40 DUP-2 FILTERED ALK
Grouping	Analyte					
WATER						
Total Metals	Magnesium (Mg)-Total (mg/L)					
	Manganese (Mn)-Total (mg/L)					
	Mercury (Hg)-Total (mg/L)					
	Molybdenum (Mo)-Total (mg/L)					
	Nickel (Ni)-Total (mg/L)					
	Phosphorus (P)-Total (mg/L)					
	Potassium (K)-Total (mg/L)					
	Selenium (Se)-Total (mg/L)					
	Silicon (Si)-Total (mg/L)					
	Silver (Ag)-Total (mg/L)					
	Sodium (Na)-Total (mg/L)					
	Strontium (Sr)-Total (mg/L)					
	Sulfur (S)-Total (mg/L)					
	Thallium (TI)-Total (mg/L)					
	Tin (Sn)-Total (mg/L)					
	Titanium (Ti)-Total (mg/L)					
	Uranium (U)-Total (mg/L)					
	Vanadium (V)-Total (mg/L)					
	Zinc (Zn)-Total (mg/L)					
Dissolved Metals	Dissolved Mercury Filtration Location		FIELD		FIELD	
	Dissolved Metals Filtration Location		FIELD		FIELD	
	Aluminum (AI)-Dissolved (mg/L)		0.0127		0.0573	
	Antimony (Sb)-Dissolved (mg/L)		0.00048		<0.00050	
	Arsenic (As)-Dissolved (mg/L)		0.131		0.00455	
	Barium (Ba)-Dissolved (mg/L)		0.0542		0.00639	
	Beryllium (Be)-Dissolved (mg/L)		<0.00020		<0.00050	
	Bismuth (Bi)-Dissolved (mg/L)		<0.0010		<0.0025	
	Boron (B)-Dissolved (mg/L)		0.127		<0.050	
	Cadmium (Cd)-Dissolved (mg/L)		<0.000020		0.349	
	Calcium (Ca)-Dissolved (mg/L)		309		460	
	Chromium (Cr)-Dissolved (mg/L)		0.00035		<0.00050	
	Cobalt (Co)-Dissolved (mg/L)		0.00303		0.0402	
	Copper (Cu)-Dissolved (mg/L)		<0.00040		0.0555	
	Iron (Fe)-Dissolved (mg/L)		25.2		11.6	
	Lead (Pb)-Dissolved (mg/L)		<0.00010		0.00456	
	Lithium (Li)-Dissolved (mg/L)		0.0069		0.0368	
	Magnesium (Mg)-Dissolved (mg/L)		136		187	

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L1590448 CONTD.... PAGE 7 of 14 31-MAR-15 15:40 (MT)

ALS ENVIRONMENTAL ANALYTICAL REPORT

			1			TINAL
	Sample ID Description	L1590448-11 Water	L1590448-12 Water	L1590448-13 Water		
	Sampled Date	23-MAR-15	20-MAR-15	20-MAR-15		
	Sampled Time Client ID	TRAVEL BLANK	16:10 FB-3	16:10 FB-3 FILTERED		
				ALK		
Grouping	Analyte					
WATER						
Total Metals	Magnesium (Mg)-Total (mg/L)	<0.10				
	Manganese (Mn)-Total (mg/L)	<0.000050				
	Mercury (Hg)-Total (mg/L)	<0.000010				
	Molybdenum (Mo)-Total (mg/L)	<0.000050				
	Nickel (Ni)-Total (mg/L)	<0.00050				
	Phosphorus (P)-Total (mg/L)	<0.050				
	Potassium (K)-Total (mg/L)	<0.10				
	Selenium (Se)-Total (mg/L)	<0.00010				
	Silicon (Si)-Total (mg/L)	<0.050				
	Silver (Ag)-Total (mg/L)	<0.000010				
	Sodium (Na)-Total (mg/L)	<0.050				
	Strontium (Sr)-Total (mg/L)	<0.00020				
	Sulfur (S)-Total (mg/L)	<0.50				
	Thallium (TI)-Total (mg/L)	<0.000010				
	Tin (Sn)-Total (mg/L)	<0.00010				
	Titanium (Ti)-Total (mg/L)	<0.010				
	Uranium (U)-Total (mg/L)	<0.000010				
	Vanadium (V)-Total (mg/L)	<0.0010				
	Zinc (Zn)-Total (mg/L)	<0.0030				
Dissolved Metals	Dissolved Mercury Filtration Location		FIELD			
	Dissolved Metals Filtration Location		FIELD			
	Aluminum (AI)-Dissolved (mg/L)		<0.0010			
	Antimony (Sb)-Dissolved (mg/L)		<0.00010			
	Arsenic (As)-Dissolved (mg/L)		<0.00010			
	Barium (Ba)-Dissolved (mg/L)		<0.000050			
	Beryllium (Be)-Dissolved (mg/L)		<0.00010			
	Bismuth (Bi)-Dissolved (mg/L)		<0.00050			
	Boron (B)-Dissolved (mg/L)		<0.010			
	Cadmium (Cd)-Dissolved (mg/L)		<0.000010			
	Calcium (Ca)-Dissolved (mg/L)		<0.050			
	Chromium (Cr)-Dissolved (mg/L)		<0.00010			
	Cobalt (Co)-Dissolved (mg/L)		<0.00010			
	Copper (Cu)-Dissolved (mg/L)		<0.00020			
	Iron (Fe)-Dissolved (mg/L)		<0.010			
	Lead (Pb)-Dissolved (mg/L)		<0.00050			
	Lithium (Li)-Dissolved (mg/L)		<0.00050			
	Magnesium (Mg)-Dissolved (mg/L)		<0.10			

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L1590448 CONTD.... PAGE 8 of 14 31-MAR-15 15:40 (MT)

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1590448-1 Water 20-MAR-15 16:10 MW09-18	L1590448-2 Water 20-MAR-15 16:10 MW09-18 FILTERED ALK	L1590448-3 Water 20-MAR-15 13:45 MW09-19	L1590448-4 Water 20-MAR-15 13:45 MW09-19 FILTERED ALK	L1590448-5 Water 20-MAR-15 12:40 CH-P-13-05-/50
Grouping	Analyte					
WATER						
Dissolved Metals	Manganese (Mn)-Dissolved (mg/L) Mercury (Hg)-Dissolved (mg/L) Molybdenum (Mo)-Dissolved (mg/L) Nickel (Ni)-Dissolved (mg/L) Phosphorus (P)-Dissolved (mg/L) Potassium (K)-Dissolved (mg/L) Selenium (Se)-Dissolved (mg/L) Silicon (Si)-Dissolved (mg/L) Silver (Ag)-Dissolved (mg/L) Sodium (Na)-Dissolved (mg/L) Strontium (Sr)-Dissolved (mg/L) Sulfur (S)-Dissolved (mg/L) Thallium (TI)-Dissolved (mg/L) Tin (Sn)-Dissolved (mg/L) Titanium (Ti)-Dissolved (mg/L)	0.848 <0.000010 0.00011 <0.00010 <0.050 7.61 0LA <0.00020 5.35 0LA <0.000020 13.1 1.08 525 0.000257 0.000257 CDLA <0.00020 0.00020 0.00020 0.00020 0.00020 0.00020 0.00020 0.00020 0.00020 0.00020 0.00020 0.00020 0.00020		9.20 <0.000010 0.00013 0.0012 0.207 9.21 <0.00020 11.0 <0.00020 20.6 1.04 311 <0.000020 DLA <0.000020 DLA <0.00020 DLA <0.00020		37.5 <0.000010 0.00040 0.0143 <0.050 5.00 DLA <0.00050 7.20 0.00050 8.37 0.567 658 0.000520 DLA <0.00050 DLA <0.00050 ACC COLD COLD COLD COLD COLD COLD COLD CO
	Uranium (U)-Dissolved (mg/L) Vanadium (V)-Dissolved (mg/L) Zinc (Zn)-Dissolved (mg/L)	0.00779 DLA <0.0020 0.0031		0.000291 DLA <0.0020 DLA <0.0020		0.000695 DLA <0.0050 31.7

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ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1590448-6 Water 20-MAR-15 12:40 CH-P-13-05-/50 FILTERED ALK	L1590448-7 Water 20-MAR-15 13:45 DUP-1	L1590448-8 Water 20-MAR-15 13:45 DUP-1 FILTERED ALK	L1590448-9 Water 20-MAR-15 12:40 DUP-2	L1590448-10 Water 20-MAR-15 12:40 DUP-2 FILTERED ALK
Grouping	Analyte					
WATER						
Dissolved Metals	Manganese (Mn)-Dissolved (mg/L)		9.24		37.5	
	Mercury (Hg)-Dissolved (mg/L)		<0.000010		<0.000010	
	Molybdenum (Mo)-Dissolved (mg/L)		0.00014		0.00042	
	Nickel (Ni)-Dissolved (mg/L)		0.0015		0.0142	
	Phosphorus (P)-Dissolved (mg/L)		0.211		<0.050	
	Potassium (K)-Dissolved (mg/L)		9.85		5.15	
	Selenium (Se)-Dissolved (mg/L)		<0.00020		<0.00050	
	Silicon (Si)-Dissolved (mg/L)		11.4		7.34	
	Silver (Ag)-Dissolved (mg/L)		<0.000020		<0.000050	
	Sodium (Na)-Dissolved (mg/L)		20.4		8.31	
	Strontium (Sr)-Dissolved (mg/L)		1.10		0.578	
	Sulfur (S)-Dissolved (mg/L)		313		645	
	Thallium (TI)-Dissolved (mg/L)		<0.000020		0.000543	
	Tin (Sn)-Dissolved (mg/L)		<0.00020		<0.00050	
	Titanium (Ti)-Dissolved (mg/L)		<0.020		<0.050	
	Uranium (U)-Dissolved (mg/L)		0.000296		0.000709	
	Vanadium (V)-Dissolved (mg/L)		<0.0020		<0.0050	
	Zinc (Zn)-Dissolved (mg/L)		<0.0020		31.8	

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L1590448 CONTD.... PAGE 10 of 14 31-MAR-15 15:40 (MT)

ALS ENVIRONMENTAL ANALYTICAL REPORT

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	Sample ID Description Sampled Date Sampled Time Client ID	L1590448-11 Water 23-MAR-15 TRAVEL BLANK	L1590448-12 Water 20-MAR-15 16:10 FB-3	L1590448-13 Water 20-MAR-15 16:10 FB-3 FILTERED ALK		
Grouping	Analyte					
WATER						
Dissolved Metals	Manganese (Mn)-Dissolved (mg/L)		<0.000050			
	Mercury (Hg)-Dissolved (mg/L)		<0.000030			
	Molybdenum (Mo)-Dissolved (mg/L)		<0.000010			
	Nickel (Ni)-Dissolved (mg/L)		<0.00050			
	Phosphorus (P)-Dissolved (mg/L)		<0.050			
	Potassium (K)-Dissolved (mg/L)		<0.10			
	Selenium (Se)-Dissolved (mg/L)		<0.00010			
	Silicon (Si)-Dissolved (mg/L)		<0.050			
	Silver (Ag)-Dissolved (mg/L)		<0.00010			
	Sodium (Na)-Dissolved (mg/L)		<0.050			
	Strontium (Sr)-Dissolved (mg/L)		<0.00020			
	Sulfur (S)-Dissolved (mg/L)		<0.50			
	Thallium (TI)-Dissolved (mg/L)		<0.00010			
	Tin (Sn)-Dissolved (mg/L)		<0.00010			
	Titanium (Ti)-Dissolved (mg/L)		<0.010			
	Uranium (U)-Dissolved (mg/L)		<0.00010			
	Vanadium (V)-Dissolved (mg/L)		<0.0010			
	Zinc (Zn)-Dissolved (mg/L)		<0.0010			
	, , , , ,		<0.0010			

^{*} Please refer to the Reference Information section for an explanation of any qualifiers detected.

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Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1590448-1, -12, -3, -5, -7, -9
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1590448-1, -12, -3, -5, -7, -9
Matrix Spike	Molybdenum (Mo)-Dissolved	MS-B	L1590448-1, -12, -3, -5, -7, -9
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1590448-1, -12, -3, -5, -7, -9
Matrix Spike	Total Organic Carbon	MS-B	L1590448-12, -5, -7, -9
Matrix Spike	Total Inorganic Carbon	MS-B	L1590448-1, -11, -12, -3, -9
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1590448-1, -12, -3, -5, -7, -9
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1590448-1, -12, -3, -5, -7, -9
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1590448-1, -12, -3, -5, -7, -9
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1590448-1, -12, -3, -5, -7, -9
Matrix Spike	Total Organic Carbon	MS-B	L1590448-1, -11, -3
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1590448-1, -12, -3, -5, -7, -9
Matrix Spike	Iron (Fe)-Dissolved	MS-B	L1590448-1, -12, -3, -5, -7, -9
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1590448-1, -12, -3, -5, -7, -9
Matrix Spike	Total Kjeldahl Nitrogen	MSTN	L1590448-1, -12, -3, -5, -7, -9

Qualifiers for Individual Parameters Listed:

Qualifier	Description
CNP	Cyanide test sample appears to have been preserved, but pH was <10 at time of testing. Results may be biased low, particularly for Free CN species.
DLA	Detection Limit adjusted for required dilution
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
MSTN	TKN Matrix Spike recovery was low due to interference from high nitrate, which causes negative bias on TKN.
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-COL-VA	Water	Alkalinity by Colourimetric (Automated)	EPA 310.2

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.

ALK-PCT-VA Water Alkalinity by Auto. Titration APHA 2320 "Alkalinity"

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

ALK-PCT-VA Water Alkalinity by Auto. Titration APHA 2320 Alkalinity

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

CARBONS-TIC-VA Water Total inorganic carbon by CO2 purge APHA 5310 TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

CARBONS-TOC-VA Water Total organic carbon by combustion APHA 5310 TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

CL-IC-N-WR Water Chloride in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

CN-FREE-CFA-VA Water Free Cyanide in water by CFA ASTM 7237

This analysis is carried out using procedures adapted from ASTM Method 7237 "Free Cyanide with Flow Injection Analysis (FIA) Utilizing Gas Diffusion Separation and Amperometric Detection". Free cyanide is determined by in-line gas diffusion at pH 6 with final determination by colourimetric analysis.

CN-SCN-VA Water Thiocyanate by Colour APHA 4500-CN CYANIDE

This analysis is carried out using procedures adapted from APHA Method 4500-CN- M "Thiocyanate" Thiocyanate is determined by the ferric nitrate colourimetric method.

CN-T-CFA-VA Water Total Cyanide in water by CFA ISO 14403:2002

This analysis is carried out using procedures adapted from ISO Method 14403:2002 "Determination of Total Cyanide using Flow Analysis (FIA and CFA)". Total or strong acid dissociable (SAD) cyanide is determined by in-line UV digestion along with sample distillation and final determination by colourimetric analysis. Method Limitation: This method is susceptible to interference from thiocyanate (SCN). If SCN is present in the sample, there

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could be a positive interference with this method, but it would be less than 1% and could be as low as zero.

CN-WAD-CFA-VA

Water

Weak Acid Diss. Cyanide in water by CFA

APHA 4500-CN CYANIDE

This analysis is carried out using procedures adapted from APHA Method 4500-CN I. "Weak Acid Dissociable Cyanide". Weak Acid Dissociable (WAD) cyanide is determined by in-line sample distillation with final determination by colourimetric analysis.

EC-PCT-VA

Water

Conductivity (Automated)

APHA 2510 Auto, Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

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F-IC-N-WR Water

Fluoride in Water by IC

EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

HARDNESS-CALC-VA

Water Hardness

APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-DIS-LOW-CVAFS-VA

Water

Dissolved Mercury in Water by CVAFS(Low)

EPA SW-846 3005A & EPA 245.7

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by filtration (EPA Method 3005A) and involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

HG-TOT-LOW-CVAFS-VA Water

Total Mercury in Water by CVAFS(Low)

FPA 245 7

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

IONBALANCE-VA

Water

Ion Balance Calculation

APHA 1030E

Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.

Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:

Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]

MET-D-CCMS-VA

Water

Dissolved Metals in Water by CRC ICPMS

APHA 3030 B&E / EPA SW-846 6020A

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

MET-DIS-LOW-ICP-VA

Water

Dissolved Metals in Water by ICPOES

EPA 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma optical emission spectrophotometry (EPA Method 6010B).

MET-T-CCMS-VA

Water

Total Metals in Water by CRC ICPMS

APHA 3030 B&E / EPA SW-846 6020A

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

MET-TOT-LOW-ICP-VA

Water

Total Metals in Water by ICPOES

EPA 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

NH3-F-VA

Water

Ammonia in Water by Fluorescence

J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et

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al.

NO2-L-IC-N-WR Water Nitrite in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-WR Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H "pH Value"

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

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It is recommended that this analysis be conducted in the field.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH

electrode

It is recommended that this analysis be conducted in the field.

S-DIS-ICP-VA Water Dissolved Sulfur in Water by ICPOES EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

S-TOT-ICP-VA Water Total Sulfur in Water by ICPOES EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

S2-T-COL-VA Water Total Sulphide by Colorimetric APHA 4500-S2 Sulphide

This analysis is carried out using procedures adapted from APHA Method 4500-S2 "Sulphide". Sulphide is determined using the methlyene blue

colourimetric method.

SO4-IC-N-WR

Water Sulfate in Water by IC

EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TKN-F-VA Water TKN in Water by Fluorescence APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

** 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:

Laboratory Definition Code	Laboratory Location
WR	ALS ENVIRONMENTAL - WHITEHORSE, YUKON, CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA
Chain of Custody Numbers:	

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GLOSSARY OF REPORT TERMS

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

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

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.

ALS Environmental

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1590448-COFC

COC Number: 1 -

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