



ECOLOGICAL LOGISTICS & RESEARCH
LTD.

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Date Received: 06-NOV-14
Report Date: 19-NOV-14 14:07 (MT)
Version: FINAL

Client Phone: 867-668-6386

Certificate of Analysis

Lab Work Order #: L1543778
Project P.O. #: ELR 14-183
Job Reference: HEMMERA 1343-005.04
C of C Numbers: 10-219289
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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L1543778-1 Water 06-NOV-14 12:10 DI TEST-COM	L1543778-2 Water 06-NOV-14 12:10 DI TEST-LAB			
Grouping	Analyte				
WATER					
Physical Tests	Hardness (as CaCO3) (mg/L)	<0.50	<0.50		
Anions and Nutrients	Total Kjeldahl Nitrogen (mg/L)	1.50	<0.050		
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	49.5	<0.50		
Total Metals	Aluminum (Al)-Total (mg/L)	<0.0030	<0.0030		
	Antimony (Sb)-Total (mg/L)	0.00015	<0.00010		
	Arsenic (As)-Total (mg/L)	<0.00010	<0.00010		
	Barium (Ba)-Total (mg/L)	0.000450	<0.000050		
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010		
	Bismuth (Bi)-Total (mg/L)	<0.00050	<0.00050		
	Boron (B)-Total (mg/L)	0.023	<0.010		
	Cadmium (Cd)-Total (mg/L)	<0.000010	<0.000010		
	Calcium (Ca)-Total (mg/L)	0.167	<0.050		
	Chromium (Cr)-Total (mg/L)	<0.00010	<0.00010		
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010		
	Copper (Cu)-Total (mg/L)	0.00069	<0.00050		
	Iron (Fe)-Total (mg/L)	<0.010	0.018		
	Lead (Pb)-Total (mg/L)	0.000082	<0.000050		
	Lithium (Li)-Total (mg/L)	<0.00050	<0.00050		
	Magnesium (Mg)-Total (mg/L)	<0.10	<0.10		
	Manganese (Mn)-Total (mg/L)	0.000067	0.000303		
	Molybdenum (Mo)-Total (mg/L)	<0.000050	<0.000050		
	Nickel (Ni)-Total (mg/L)	<0.00050	0.00055		
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050		
	Potassium (K)-Total (mg/L)	0.12	<0.10		
	Selenium (Se)-Total (mg/L)	<0.00010	<0.00010		
	Silicon (Si)-Total (mg/L)	<0.050	<0.050		
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010		
	Sodium (Na)-Total (mg/L)	1.60	<0.050		
	Strontium (Sr)-Total (mg/L)	0.00105	<0.00020		
	Sulfur (S)-Total (mg/L)	<0.50	<0.50		
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010		
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010		
	Titanium (Ti)-Total (mg/L)	<0.010	<0.010		
	Uranium (U)-Total (mg/L)	<0.000010	<0.000010		
	Vanadium (V)-Total (mg/L)	<0.0010	<0.0010		
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030		

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L1543778-1 Water 06-NOV-14 12:10 DI TEST-COM	L1543778-2 Water 06-NOV-14 12:10 DI TEST-LAB			
Grouping	Analyte				
WATER					
Dissolved Metals	Dissolved Metals Filtration Location	FIELD	FIELD		
	Aluminum (Al)-Dissolved (mg/L)	<0.0010	<0.0010		
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010		
	Arsenic (As)-Dissolved (mg/L)	<0.00010	<0.00010		
	Barium (Ba)-Dissolved (mg/L)	0.000394	<0.000050		
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010		
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050	<0.00050		
	Boron (B)-Dissolved (mg/L)	0.019	<0.010		
	Cadmium (Cd)-Dissolved (mg/L)	<0.000010	<0.000010		
	Calcium (Ca)-Dissolved (mg/L)	0.168	<0.050		
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010		
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010		
	Copper (Cu)-Dissolved (mg/L)	0.00054	<0.00020		
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010		
	Lead (Pb)-Dissolved (mg/L)	0.000050	<0.000050		
	Lithium (Li)-Dissolved (mg/L)	<0.00050	<0.00050		
	Magnesium (Mg)-Dissolved (mg/L)	<0.10	<0.10		
	Manganese (Mn)-Dissolved (mg/L)	<0.000050	<0.000050		
	Molybdenum (Mo)-Dissolved (mg/L)	<0.000050	<0.000050		
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	<0.00050		
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050		
	Potassium (K)-Dissolved (mg/L)	<0.10	<0.10		
	Selenium (Se)-Dissolved (mg/L)	<0.00010	<0.00010		
	Silicon (Si)-Dissolved (mg/L)	<0.050	<0.050		
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010		
	Sodium (Na)-Dissolved (mg/L)	1.51	<0.050		
	Strontium (Sr)-Dissolved (mg/L)	0.00101	<0.00020		
	Sulfur (S)-Dissolved (mg/L)	<0.50	<0.50		
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010		
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010		
	Titanium (Ti)-Dissolved (mg/L)	<0.010	<0.010		
	Uranium (U)-Dissolved (mg/L)	<0.000010	<0.000010		
	Vanadium (V)-Dissolved (mg/L)	<0.0010	<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.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Antimony (Sb)-Dissolved	DLA	L1543778-1, -2
Duplicate	Arsenic (As)-Dissolved	DLA	L1543778-1, -2
Duplicate	Beryllium (Be)-Dissolved	DLA	L1543778-1, -2
Duplicate	Bismuth (Bi)-Dissolved	DLA	L1543778-1, -2
Duplicate	Lead (Pb)-Dissolved	DLA	L1543778-1, -2
Duplicate	Selenium (Se)-Dissolved	DLA	L1543778-1, -2
Duplicate	Silver (Ag)-Dissolved	DLA	L1543778-1, -2
Duplicate	Tin (Sn)-Dissolved	DLA	L1543778-1, -2
Duplicate	Titanium (Ti)-Dissolved	DLA	L1543778-1, -2
Duplicate	Vanadium (V)-Dissolved	DLA	L1543778-1, -2
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1543778-1, -2
Matrix Spike	Dissolved Organic Carbon	MS-B	L1543778-2
Matrix Spike	Dissolved Organic Carbon	MS-B	L1543778-2
Matrix Spike	Dissolved Organic Carbon	MS-B	L1543778-2
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1543778-1, -2
Matrix Spike	Cobalt (Co)-Dissolved	MS-B	L1543778-1, -2
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1543778-1, -2
Matrix Spike	Nickel (Ni)-Dissolved	MS-B	L1543778-1, -2
Matrix Spike	Selenium (Se)-Dissolved	MS-B	L1543778-1, -2
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1543778-1, -2
Matrix Spike	Tin (Sn)-Dissolved	MS-B	L1543778-1, -2
Matrix Spike	Barium (Ba)-Total	MS-B	L1543778-1, -2
Matrix Spike	Strontium (Sr)-Total	MS-B	L1543778-1, -2

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CARBONS-DOC-VA	Water	Dissolved 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)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.			
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 CaCO ₃ equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.			
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

Reference Information

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).

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.

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

10-219289

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.*

