ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L829174-1	L829174-2	L829174-3	L829174-4	L829174-5
	Description					
	Sampled Date	08-OCT-09	08-OCT-09	08-OCT-09	08-OCT-09	08-OCT-09
	Sampled Time					
	Client ID	MW08-127	MW08-128	MW09-152	L08-124	DUP1
Grouping	**Analyte**					
WATER						
Dissolved Metals	Phosphorus (P)-Dissolved (mg/L)	<0.30	<0.30	<0.30	<0.30	<0.30
	Potassium (K)-Dissolved (mg/L)	2.7	3.0	3.2	3.5	3.2
	Selenium (Se)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)-Dissolved (mg/L)	1.88	3.52	4.36	4.78	4.37
	Silver (Ag)-Dissolved (mg/L)	<0.000010	0.000013	<0.000010	0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	58.8	36.0	112	8.1	112
	Strontium (Sr)-Dissolved (mg/L)	0.110	0.122	0.375	0.0932	0.388
	Thallium (Tl)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)-Dissolved (mg/L)	0.00036	0.00048	0.00022	0.00014	0.00022
	Titanium (Ti)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Dissolved (mg/L)	0.000918	0.00428	0.00764	0.0175	0.00765
	Vanadium (V)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)-Dissolved (mg/L)	0.0076	0.0063	0.0018	0.0022	0.0031
Speciated Metals	Hexavalent Chromium (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Aggregate Organics	COD (mg/L)	35	23	64	94	59

Reference Information

Additional Comments for Sample Listed:

Samplenum	Matrix	Report Remarks	Sample Comments

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Analytical Method Reference(Based On)
ALK-SCR-VA	Water	Alkalinity by colour or titration	EPA 310.2 OR APHA 2320

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

ANIONS-BR-IC-VA	Water	Bromide by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-CL-IC-VA	Water	Chloride by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-F-IC-VA	Water	Fluoride by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-NO2-IC-VA	Water	Nitrite by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Specifically, the nitrite detection is by UV absorbance and not conductivity.

ANIONS-NO3-IC-VA	Water	Nitrate by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Specifically, the nitrate detection is by UV absorance and not conductivity.

ANIONS-SO4-IC-VA	Water	Sulfate by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

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)".

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)".

COD-COL-VA	Water	Chemical Oxygen Demand by Colorimetric	APHA 5220 D. CHEMICAL OXYGEN DEMAND

This analysis is carried out using procedures adapted from APHA Method 5220 "Chemical Oxygen Demand (COD)". Chemical oxygen demand is determined using the closed reflux colourimetric method.

CR-CR6-ED	Water	Chromium, Hexavalent (Cr +6)	APHA 3500-Cr C (Ion Chromatography)
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.

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Analytical Method Reference(Based On)
HARDNESS-CALC-VA	Water	Hardness	APHA 2340B

Hardness is calculated from Calcium and Magnesium concentrations, and is expressed as calcium carbonate equivalents.

MET-DIS-ICP-VA	Water	Dissolved Metals 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 procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

MET-DIS-LOW-MS-VA	Water	Dissolved Metals in Water by ICPMS(Low)	EPA SW-846 3005A/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 involves preliminary sample treatment by filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

MET-DIS-ULTRA-MS-VA	Water	Diss. Metals in Water by ICPMS (Ultra)	EPA SW-846 3005A/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 involves preliminary sample treatment by filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

NH3-SIE-VA	Water	Ammonia by SIE	APHA 4500 D. - NH3 NITROGEN (AMMONIA)

This analysis is carried out, on sulphuric acid preserved samples, using procedures adapted from APHA Method 4500-NH3 "Nitrogen (Ammonia)". Ammonia is determined using an ammonia selective electrode.

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

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

PO4-DO-COL-VA	Water	Dissolved ortho Phosphate by Colour	APHA 4500-P "Phosphorous"

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". All forms of phosphate are determined by the ascorbic acid colourimetric method. Dissolved ortho-phosphate (dissolved reactive phosphorous) is determined by direct measurement. Total phosphate (total phosphorous) is determined after persulphate digestion of a sample. Total dissolved phosphate (total dissolved phosphorous) is determined by filtering a sample through a 0.45 micron membrane filter followed by persulfate digestion of the filtrate.

PO4-DO-COL-VA	Water	Dissolved ortho Phosphate by Colour	APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". All forms of phosphate are determined by the ascorbic acid colourimetric method. Dissolved ortho-phosphate (dissolved reactive phosphorous) is determined by direct measurement. Total phosphate (total phosphorous) is determined after persulphate digestion of a sample. Total dissolved phosphate (total dissolved phosphorous) is determined by filtering a sample through a 0.45 micron membrane filter followed by persulfate digestion of the filtrate.

PO4-T-COL-VA	Water	Total Phosphate P by Color	APHA 4500-P "Phosphorous"

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". All forms of phosphate are determined by the ascorbic acid colourimetric method. Dissolved ortho-phosphate (dissolved reactive phosphorous) is determined by direct measurement. Total phosphate (total phosphorous) is determined after persulphate digestion of a sample. Total dissolved phosphate (total dissolved phosphorous) is determined by filtering a sample through a 0.45 micron membrane filter followed by persulfate digestion of the filtrate.

PO4-T-COL-VA	Water	Total Phosphate P by Color	APHA 4500-P Phosphorous

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Analytical Method Reference(Based On)
		This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". All forms of phosphate are determined by the ascorbic acid colourimetric method. Dissolved ortho-phosphate (dissolved reactive phosphorous) is determined by direct measurement. Total phosphate (total phosphorous) is determined after persulphate digestion of a sample. Total dissolved phosphate (total dissolved phosphorous) is determined by filtering a sample through a 0.45 micron membrane filter followed by persulfate digestion of the filtrate.	
TDS-VA	Water	Total Dissolved Solids by Gravimetric	APHA 2540 C - GRAVIMETRIC
		This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.	
TKN-SIE-VA	Water	Total Kjeldahl Nitrogen by SIE	APHA 4500-Norg (TKN)
		This analysis is carried out using procedures adapted from APHA Method 4500-Norg "Nitrogen (Organic)". Total kjeldahl nitrogen is determined by sample digestion at 367 celcius with analysis using an ammonia selective electrode.	
TSS-VA	Water	Total Suspended Solids by Gravimetric	APHA 2540 D - GRAVIMETRIC
		This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.	
TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 "Turbidity"
		This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.	
TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 Turbidity
		This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.	

** Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies.
The last two letters of the above ALS Test Code column indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location	Laboratory Definition Code	Laboratory Location
VA	ALS LABORATORY GROUP - VANCOUVER, BC, CANADA	ED	ALS LABORATORY GROUP - EDMONTON, ALBERTA, CANADA

GLOSSARY OF REPORT TERMS
Surr - A surrogate is an organic compound that is similar to the target analyte(s) in chemical composition and behavior but not normally detected in enviromental samples. Prior to sample processing, samples are fortified with one or more surrogate compounds.
The reported surrogate recovery value provides a measure of method efficiency.
mg/kg (units) - unit of concentration based on mass, parts per million
mg/L (units) - unit of concentration based on volume, parts per million
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.
Although test results are generated under strict QA/QC protocols, any unsigned test reports, faxes, or emails are considered preliminary.

ALS Laboratory Group has an extensive QA/QC program where all analytical data reported is analyzed using approved referenced procedures followed by checks and reviews by senior managers and quality assurance personnel. However, since the results are obtained from chemical measurements and thus cannot be guaranteed, ALS Laboratory Group assumes no liability for the use or interpretation of the results.

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC # 09-020378

Page 1 of 1

Report To		**Report Format / Distribution**		**Service Requested:** (Rush subject to availability)
Company:	Stantec	Standard: ✓	Other (specify):	(Regular) (Standard Turnaround Times))
Contact:	Jennifer Todd	Select: PDF ✓	Excel ✓ Digital	Fax	Priority, Date Req'd: _____ (Surcharges apply)
Address:	4370 Dominion St. Burnaby, B.C.	Email 1:	jennifer.todd@stantec.com	Emergency (1 Business Day) - 100% Surcharge
Phone:	604 436 3014 Fax:	Email 2:	billing info to cindy@andersenco.ca bmercer@avalonrareMetals.com	For Emergency < 1 Day, ASAP or Weekend - Contact ALS
Invoice To	Same as Report ? (circle) Yes or (No) (if No, provide details)	**Client / Project Information**		**Analysis Request**
	Copy of Invoice with Report? (circle) Yes or No	Job #:	036222.02 / Z9100	(Indicate Filtered or Preserved, F/P)
Company:	Avalon Rare Metals Inc	PO / AFE:	Thor Lake	
Contact:	Bill Mercer / Cindy Hu	LSD:	Groundwater Samples	
Address:	130 Adelaide St. W, Toronto, ON, M5H 3P5	Quote #:		
Phone:	416 364.4938 Fax: 416 364.5162	ALS Contact:	Natash Markovic-Milovanovic	Sampler: Jennifer Todd
Lab Work Order # (lab use only)	L829174			

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Dissolved Metals F	Cr VI F	TOC F	COD/TKN/Nitrate F	General	Ca/Mg/Na/TDS/Alk/Turbidity/pH	Conductivity/TSS	TPO4/DPO4	Specified Anions				Number of Containers
	MW08-127	Oct 8/09		gw	✓	✓	✓	✓	✓								5
	MW08-128	Oct 8/09		gw	✓	✓	✓	✓	✓								5
	MW09-152	Oct 8/09		gw	✓	✓	✓	✓	✓								5
	LOB-124	Oct 8/09		gw	✓	✓	✓	✓	✓								5
	Dup 1	Oct 8/09		gw	✓	✓	✓	✓	✓								5

Special Instructions / Regulations / Hazardous Details

CCME / CSR EDT / QA/QC

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date:	Time:	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Mee Todd.	Oct 9/09		HD	09/10/13	1156	5 °C				

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION | WHITE - LABORATORY COPY | YELLOW - CLIENT COPY | GENF 18.01 Front

Certificate of Analysis

STANTEC CONSULTING LTD.

ATTN: JEN TODD

4370 DOMINION STREET, 5TH FLOOR
PO BOX 21
BURNABY BC V5G 4L7

Report Date: 06-JUL-10 16:38 (MT)
Version: FINAL

Lab Work Order #: **L897555** **Date Received:** **15-JUN-10**

Project P.O. #: NOT SUBMITTED
Job Reference: 123510431 THOR LAKE
Legal Site Desc:
CofC Numbers: 123510431-203-0610

Other Information:

Comments: Detection limits for some analytes have been raised due to matrix interference

Natasha Markovic-Mirovic
Account Manager

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L897555-1				
	Description					
	Sampled Date	11-JUN-10				
	Sampled Time	11:00				
	Client ID	MWL08-128				
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	419				
	Hardness (as CaCO3) (mg/L)	253				
	pH (pH)	7.49				
	Total Suspended Solids (mg/L)	10.9				
	Total Dissolved Solids (mg/L)	333				
	Turbidity (NTU)	13.6				
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	262				
	Ammonia as N (mg/L)	0.563				
	Bromide (Br) (mg/L)	<0.50				
	Chloride (Cl) (mg/L)	<5.0				
	Fluoride (F) (mg/L)	0.92				
	Nitrate and Nitrite as N (mg/L)	<0.050				
	Nitrate (as N) (mg/L)	<0.050				
	Nitrite (as N) (mg/L)	<0.010				
	Total Kjeldahl Nitrogen (mg/L)	1.79				
	Ortho Phosphate as P (mg/L)	0.0120				
	Total Phosphate as P (mg/L)	0.027				
	Sulfate (SO4) (mg/L)	<5.0				
Organic / Inorganic Carbon	Total Organic Carbon (mg/L)	30.6				
Total Metals	Aluminum (Al)-Total (mg/L)	0.149				
	Antimony (Sb)-Total (mg/L)	<0.00010				
	Arsenic (As)-Total (mg/L)	0.00478				
	Barium (Ba)-Total (mg/L)	0.208				
	Beryllium (Be)-Total (mg/L)	<0.00050				
	Bismuth (Bi)-Total (mg/L)	<0.00050				
	Boron (B)-Total (mg/L)	0.027				
	Cadmium (Cd)-Total (mg/L)	0.000038				
	Calcium (Ca)-Total (mg/L)	44.8				
	Chromium (Cr)-Total (mg/L)	0.00151				
	Cobalt (Co)-Total (mg/L)	0.00021				
	Copper (Cu)-Total (mg/L)	0.00063				
	Iron (Fe)-Total (mg/L)	16.2				
	Lead (Pb)-Total (mg/L)	0.000266				
	Lithium (Li)-Total (mg/L)	0.0069				
	Magnesium (Mg)-Total (mg/L)	31.4				
	Manganese (Mn)-Total (mg/L)	0.508				

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L897555-1				
	Description					
	Sampled Date	11-JUN-10				
	Sampled Time	11:00				
	Client ID	MWL08-128				
Grouping	**Analyte**					
WATER						
Total Metals	Mercury (Hg)-Total (mg/L)	<0.000010				
	Molybdenum (Mo)-Total (mg/L)	0.00862				
	Nickel (Ni)-Total (mg/L)	0.00073				
	Phosphorus (P)-Total (mg/L)	<0.30				
	Potassium (K)-Total (mg/L)	3.9				
	Selenium (Se)-Total (mg/L)	<0.0010				
	Silicon (Si)-Total (mg/L)	6.91				
	Silver (Ag)-Total (mg/L)	0.000064				
	Sodium (Na)-Total (mg/L)	5.0				
	Strontium (Sr)-Total (mg/L)	0.116				
	Thallium (Tl)-Total (mg/L)	<0.00010				
	Tin (Sn)-Total (mg/L)	0.00013				
	Titanium (Ti)-Total (mg/L)	<0.010				
	Uranium (U)-Total (mg/L)	0.00494				
	Vanadium (V)-Total (mg/L)	0.0026				
	Zinc (Zn)-Total (mg/L)	<0.0010				
Dissolved Metals	Aluminum (Al)-Dissolved (mg/L)	0.0504				
	Antimony (Sb)-Dissolved (mg/L)	<0.00010				
	Arsenic (As)-Dissolved (mg/L)	0.00469				
	Barium (Ba)-Dissolved (mg/L)	0.204				
	Beryllium (Be)-Dissolved (mg/L)	<0.00050				
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050				
	Boron (B)-Dissolved (mg/L)	0.024				
	Cadmium (Cd)-Dissolved (mg/L)	0.000041				
	Calcium (Ca)-Dissolved (mg/L)	46.8				
	Chromium (Cr)-Dissolved (mg/L)	<0.0015				
	Cobalt (Co)-Dissolved (mg/L)	0.00017				
	Copper (Cu)-Dissolved (mg/L)	0.00025				
	Iron (Fe)-Dissolved (mg/L)	15.4				
	Lead (Pb)-Dissolved (mg/L)	<0.000050				
	Lithium (Li)-Dissolved (mg/L)	0.0070				
	Magnesium (Mg)-Dissolved (mg/L)	33.0				
	Manganese (Mn)-Dissolved (mg/L)	0.485				
	Mercury (Hg)-Dissolved (mg/L)	<0.000010				
	Molybdenum (Mo)-Dissolved (mg/L)	0.00663				
	Nickel (Ni)-Dissolved (mg/L)	<0.00050				
	Phosphorus (P)-Dissolved (mg/L)	<0.30				

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L897555-1				
	Description					
	Sampled Date	11-JUN-10				
	Sampled Time	11:00				
	Client ID	MWL08-128				
Grouping	**Analyte**					
WATER						
Dissolved Metals	Potassium (K)-Dissolved (mg/L)	4.3				
	Selenium (Se)-Dissolved (mg/L)	<0.0010				
	Silicon (Si)-Dissolved (mg/L)	7.14				
	Silver (Ag)-Dissolved (mg/L)	0.000039				
	Sodium (Na)-Dissolved (mg/L)	5.4				
	Strontium (Sr)-Dissolved (mg/L)	0.114				
	Thallium (Tl)-Dissolved (mg/L)	<0.00010				
	Tin (Sn)-Dissolved (mg/L)	<0.00010				
	Titanium (Ti)-Dissolved (mg/L)	<0.010				
	Uranium (U)-Dissolved (mg/L)	0.00470				
	Vanadium (V)-Dissolved (mg/L)	0.0023				
	Zinc (Zn)-Dissolved (mg/L)	0.0045				

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
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.			
ANIONS-BR-IC-VA	Water	Bromide by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
ANIONS-CL-IC-VA	Water	Chloride by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
ANIONS-F-IC-VA	Water	Fluoride by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
ANIONS-N+N-CALC-VA	Water	Nitrite+Nitrate by Ion Chromatography	CALCULATION
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Specifically, nitrate and nitrite are detected indvidually using UV absorbance and 'Nitrate and Nitrite" is determined by calculation.			
ANIONS-NO2-IC-VA	Water	Nitrite by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Specifically, the nitrite detection is by UV absorbance and not conductivity.			
ANIONS-NO3-IC-VA	Water	Nitrate by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Specifically, the nitrate detection is by UV absorance and not conductivity.			
ANIONS-SO4-IC-VA	Water	Sulfate by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
C-TOT-ORG-LOW-CL	Water	Total Organic Carbon	APHA 5310 C-Instrumental
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.			
HARDNESS-CALC-VA	Water	Hardness	APHA 2340B
Hardness is calculated from Calcium and Magnesium concentrations, and is expressed as calcium carbonate equivalents.			
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 (EPA Method 245.7).			
HG-TOT-LOW-CVAFS-VA	Water	Total Mercury in Water by CVAFS(Low)	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 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 (EPA Method 245.7).			
MET-DIS-ICP-VA	Water	Dissolved Metals 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 procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).			
MET-DIS-LOW-MS-VA	Water	Dissolved Metals in Water by ICPMS(Low)	EPA SW-846 3005A/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 involves preliminary sample treatment by filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).			

Reference Information

MET-DIS-ULTRA-MS-VA Water Diss. Metals in Water by ICPMS (Ultra) EPA SW-846 3005A/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 involves preliminary sample treatment by filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

MET-TOT-ICP-VA Water Total Metals 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 (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

MET-TOT-LOW-MS-VA Water Total Metals in Water by ICPMS(Low) EPA SW-846 3005A/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 either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

MET-TOT-ULTRA-MS-VA Water Total Metals in Water by ICPMS (Ultra) EPA SW-846 3005A/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 either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

NH3-F-VA Water Ammonia by Fluorescence J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulphuric 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 al.

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.

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.

PO4-DO-COL-VA Water Dissolved ortho Phosphate by Colour APHA 4500-P "Phosphorous"

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". All forms of phosphate are determined by the ascorbic acid colourimetric method. Dissolved ortho-phosphate (dissolved reactive phosphorous) is determined by direct measurement. Total phosphate (total phosphorous) is determined after persulphate digestion of a sample. Total dissolved phosphate (total dissolved phosphorous) is determined by filtering a sample through a 0.45 micron membrane filter followed by persulfate digestion of the filtrate.

PO4-DO-COL-VA Water Dissolved ortho Phosphate by Colour APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". All forms of phosphate are determined by the ascorbic acid colourimetric method. Dissolved ortho-phosphate (dissolved reactive phosphorous) is determined by direct measurement. Total phosphate (total phosphorous) is determined after persulphate digestion of a sample. Total dissolved phosphate (total dissolved phosphorous) is determined by filtering a sample through a 0.45 micron membrane filter followed by persulfate digestion of the filtrate.

PO4-T-COL-VA Water Total Phosphate P by Color APHA 4500-P "Phosphorous"

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". All forms of phosphate are determined by the ascorbic acid colourimetric method. Dissolved ortho-phosphate (dissolved reactive phosphorous) is determined by direct measurement. Total phosphate (total phosphorous) is determined after persulphate digestion of a sample. Total dissolved phosphate (total dissolved phosphorous) is determined by filtering a sample through a 0.45 micron membrane filter followed by persulfate digestion of the filtrate.

PO4-T-COL-VA Water Total Phosphate P by Color APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". All forms of phosphate are determined by the ascorbic acid colourimetric method. Dissolved ortho-phosphate (dissolved reactive phosphorous) is determined by direct measurement. Total phosphate (total phosphorous) is determined after persulphate digestion of a sample. Total dissolved phosphate (total dissolved phosphorous) is determined by filtering a sample through a 0.45 micron membrane filter followed by persulfate digestion of the filtrate.

TDS-VA Water Total Dissolved Solids by Gravimetric APHA 2540 C - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TKN-SIE-VA Water Total Kjeldahl Nitrogen by SIE APHA 4500-Norg (TKN)

Reference Information

This analysis is carried out using procedures adapted from APHA Method 4500-Norg "Nitrogen (Organic)". Total kjeldahl nitrogen is determined by sample digestion at 367 celcius with analysis using an ammonia selective electrode.

TSS-VA Water Total Suspended Solids by Gravimetric APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.

TURBIDITY-VA Water Turbidity by Meter APHA 2130 "Turbidity"

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

TURBIDITY-VA Water Turbidity by Meter APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** 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
CL	ALS LABORATORY GROUP - CALGARY, ALBERTA, CANADA
VA	ALS LABORATORY GROUP - VANCOUVER, BC, CANADA

Chain of Custody Numbers:

123510431-203-0610

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 receieved 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.

Short Holding Time

Rush Processing

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC # 123510431-203-0610

Page 1 of 1

Report To		**Report Format / Distribution**	**Service Requested** (Rush for routine analysis subject to availability)
Company:	Stantec Consulting Ltd.	☑ Standard ☐ Other	◉ Regular (Default)
Contact:	~~Carey Gibbald~~ Jen Todd	☑ PDF ☑ Excel ☐ Digital ☐ Fax	○ Priority (Specify Date Required → →) Surcharges apply
Address:	PO Box 1680, 5021-49 St. YELLOWKNIFE, NT, X1A 2N4	Email 1: ~~carey.gibbald@stantec.com~~	○ Emergency (1 Business Day) - 100% Surcharge
	4370 Dominion St, Burnaby, BC	Email 2: jennifer.todd@stantec.com	○ For Emergency < 1 Day, ASAP or Weekend - Contact ALS
Phone:	~~604-867-920-2216~~ 436-3014 Fax:		**Analysis Request**
Invoice To	Same as Report ? ☐ Yes ☑ No	**Client / Project Information**	Please indicate below Filtered, Preserved or both (F, P, F/P)
Company:	Avalon Rare Metals	Job #: 123510431 Thor Lake	
Contact:	Cindy Hu / David Swisher	PO / AFE:	
Address:	Suite 1901, 130 Adelainde St. Toronto, ON, M5H 3P5	LSD:	
	JAC375-AVA200-VA		
Phone:	Fax:	Quote #: Q24554	
	L697855	ALS Contact: Natasha M-M	Sampler: CS/SN

Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	PH, EC, Turbidity, Tot-ALK	TDS, TSS	Anion Scan	TKN, HN3, NO3+NO2 by calc (P)	~~DOC~~ ToC (P)	T-PO4, DO-PO4	HG-TOT-LOW-CVAFS-VA (P)	MET-TOT-ICP+MS+CD-VA (P)	MET-DIS-ICP+MS+CD-VA (F/P)	HG-DIS-LOW-CVAFS-VA (F/P)	Chlorophyll-a	Pheopigments	Number of Containers
MWL08-128	11-Jun-10	11:00	Water	X	X	X	X	X	X	X	X	X	X			5

Special Instructions / Regulations / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Carey Gibbald	12-Jun-10	08:30	HD	10/06/15	11:45	8 °C				

GENF 18.02 Front

STANTEC CONSULTING LTD.
ATTN: HEATHER PROVOST
4370 DOMINION STREET, 5TH FLOOR
PO BOX 21
BURNABY BC V5G 4L7
Phone: 604-436-3014

Date Received: 14-SEP-10
Report Date: 24-SEP-10 09:48 (MT)
Version: FINAL

Certificate of Analysis

Lab Work Order #: L931109
Project P.O. #: NOT SUBMITTED
Job Reference: 123510431-203
Legal Site Desc:
C of C Numbers: 10-022826

Heather Easton
Account Manager

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L931109-1	L931109-2			
	Description					
	Sampled Date	03-SEP-10	03-SEP-10			
	Sampled Time	09:30	09:45			
	Client ID	MWL08-128	MWL08-129			
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	498	502			
	Hardness (as CaCO3) (mg/L)	303	302			
	pH (pH)	8.00	8.00			
	Total Suspended Solids (mg/L)	38.8	34.3			
	Total Dissolved Solids (mg/L)	312	302			
	Turbidity (NTU)	19.8	18.1			
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	275	276			
	Ammonia as N (mg/L)	0.437	0.450			
	Bromide (Br) (mg/L)	<0.050	<0.050			
	Chloride (Cl) (mg/L)	1.96	1.50			
	Fluoride (F) (mg/L)	1.32	1.39			
	Nitrate and Nitrite as N (mg/L)	0.0138	<0.0051			
	Nitrate (as N) (mg/L)	0.0138	<0.0050			
	Nitrite (as N) (mg/L)	<0.0010	<0.0010			
	Total Kjeldahl Nitrogen (mg/L)	0.91	0.92			
	Ortho Phosphate as P (mg/L)	0.0018	0.0015			
	Total Phosphate as P (mg/L)	0.034	0.447			
	Sulfate (SO4) (mg/L)	8.08	8.30			
Organic / Inorganic Carbon	Total Organic Carbon (mg/L)	17.4 DLA	15.2			
Total Metals	Aluminum (Al)-Total (mg/L)	0.220	0.193			
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010			
	Arsenic (As)-Total (mg/L)	0.00829	0.00794			
	Barium (Ba)-Total (mg/L)	0.194	0.191			
	Beryllium (Be)-Total (mg/L)	<0.00050	<0.00050			
	Bismuth (Bi)-Total (mg/L)	<0.00050	<0.00050			
	Boron (B)-Total (mg/L)	0.020	0.021			
	Cadmium (Cd)-Total (mg/L)	0.000212	0.000198			
	Calcium (Ca)-Total (mg/L)	53.7	53.1			
	Chromium (Cr)-Total (mg/L)	0.00109	0.00090			
	Cobalt (Co)-Total (mg/L)	0.00022	0.00020			
	Copper (Cu)-Total (mg/L)	0.00104	<0.00090 DLB			
	Iron (Fe)-Total (mg/L)	9.04	9.45			
	Lead (Pb)-Total (mg/L)	0.000305	0.000268			
	Lithium (Li)-Total (mg/L)	0.0077	0.0079			
	Magnesium (Mg)-Total (mg/L)	39.0	38.3			
	Manganese (Mn)-Total (mg/L)	0.404	0.400			

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

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L931109-1	L931109-2			
	Description					
	Sampled Date	03-SEP-10	03-SEP-10			
	Sampled Time	09:30	09:45			
	Client ID	MWL08-128	MWL08-129			
Grouping	**Analyte**					
WATER						
Total Metals	Mercury (Hg)-Total (mg/L)	<0.000010	<0.000010			
	Molybdenum (Mo)-Total (mg/L)	0.0164	0.0163			
	Nickel (Ni)-Total (mg/L)	0.00073	0.00058			
	Phosphorus (P)-Total (mg/L)	<0.30	<0.30			
	Potassium (K)-Total (mg/L)	3.5	3.5			
	Selenium (Se)-Total (mg/L)	<0.0010	<0.0010			
	Silicon (Si)-Total (mg/L)	6.31	6.19			
	Silver (Ag)-Total (mg/L)	0.000059	0.000050			
	Sodium (Na)-Total (mg/L)	4.3	4.2			
	Strontium (Sr)-Total (mg/L)	0.111	0.109			
	Thallium (Tl)-Total (mg/L)	<0.00010	<0.00010			
	Tin (Sn)-Total (mg/L)	0.00012	0.00012			
	Titanium (Ti)-Total (mg/L)	<0.010	<0.010			
	Uranium (U)-Total (mg/L)	0.0115	0.0113			
	Vanadium (V)-Total (mg/L)	0.0013	0.0013			
	Zinc (Zn)-Total (mg/L)	<0.0030 DLB	<0.0020 DLB			
Dissolved Metals	Aluminum (Al)-Dissolved (mg/L)	0.0335	0.0344			
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010			
	Arsenic (As)-Dissolved (mg/L)	0.00944	0.00905			
	Barium (Ba)-Dissolved (mg/L)	0.195	0.199			
	Beryllium (Be)-Dissolved (mg/L)	<0.00050	<0.00050			
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050	<0.00050			
	Boron (B)-Dissolved (mg/L)	0.017	0.018			
	Cadmium (Cd)-Dissolved (mg/L)	0.000208	0.000209			
	Calcium (Ca)-Dissolved (mg/L)	55.2	55.2			
	Chromium (Cr)-Dissolved (mg/L)	<0.0010 DLM	<0.0010 DLM			
	Cobalt (Co)-Dissolved (mg/L)	0.00014	0.00016			
	Copper (Cu)-Dissolved (mg/L)	0.00024	0.00031			
	Iron (Fe)-Dissolved (mg/L)	9.00	8.96			
	Lead (Pb)-Dissolved (mg/L)	<0.000050	0.000335			
	Lithium (Li)-Dissolved (mg/L)	0.0077	0.0074			
	Magnesium (Mg)-Dissolved (mg/L)	40.0	39.8			
	Manganese (Mn)-Dissolved (mg/L)	0.392	0.389			
	Mercury (Hg)-Dissolved (mg/L)	<0.000010	<0.000010			
	Molybdenum (Mo)-Dissolved (mg/L)	0.0154	0.0152			
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	<0.00050			
	Phosphorus (P)-Dissolved (mg/L)	<0.30	<0.30			

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

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L931109-1	L931109-2			
	Description					
	Sampled Date	03-SEP-10	03-SEP-10			
	Sampled Time	09:30	09:45			
	Client ID	MWL08-128	MWL08-129			
Grouping	**Analyte**					
WATER						
Dissolved Metals	Potassium (K)-Dissolved (mg/L)	3.6	3.6			
	Selenium (Se)-Dissolved (mg/L)	<0.0010	<0.0010			
	Silicon (Si)-Dissolved (mg/L)	6.06	6.06			
	Silver (Ag)-Dissolved (mg/L)	0.000031	0.000037			
	Sodium (Na)-Dissolved (mg/L)	4.4	4.4			
	Strontium (Sr)-Dissolved (mg/L)	0.110	0.109			
	Thallium (Tl)-Dissolved (mg/L)	<0.00010	<0.00010			
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010			
	Titanium (Ti)-Dissolved (mg/L)	<0.010	<0.010			
	Uranium (U)-Dissolved (mg/L)	0.0114	0.0114			
	Vanadium (V)-Dissolved (mg/L)	0.0011	0.0011			
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	0.0014			

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

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLA	Detection Limit Adjusted For required dilution
DLB	Detection limit was raised due to detection of analyte at comparable level in Method Blank.
DLM	Detection Limit Adjusted For Sample Matrix Effects

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
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.			
ANIONS-BR-IC-VA	Water	Bromide by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
ANIONS-CL-IC-VA	Water	Chloride by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
ANIONS-F-IC-VA	Water	Fluoride by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
ANIONS-N+N-CALC-VA	Water	Nitrite+Nitrate by Ion Chromatography	CALCULATION
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Specifically, nitrate and nitrite are detected indvidually using UV absorbance and 'Nitrate and Nitrite" is determined by calculation.			
ANIONS-NO2-IC-VA	Water	Nitrite by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Specifically, the nitrite detection is by UV absorbance and not conductivity.			
ANIONS-NO3-IC-VA	Water	Nitrate by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Specifically, the nitrate detection is by UV absorance and not conductivity.			
ANIONS-SO4-IC-VA	Water	Sulfate by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
C-TOT-ORG-LOW-CL	Water	Total Organic Carbon	APHA 5310 C-Instrumental
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.			
HARDNESS-CALC-VA	Water	Hardness	APHA 2340B
Hardness is calculated from Calcium and Magnesium concentrations, and is expressed as calcium carbonate equivalents.			
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 (EPA Method 245.7).			
HG-TOT-LOW-CVAFS-VA	Water	Total Mercury in Water by CVAFS(Low)	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 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 (EPA Method 245.7).			
MET-DIS-ICP-VA	Water	Dissolved Metals 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			

Reference Information

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-DIS-LOW-MS-VA Water Dissolved Metals in Water by ICPMS(Low) EPA SW-846 3005A/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 involves preliminary sample treatment by filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

MET-DIS-ULTRA-MS-VA Water Diss. Metals in Water by ICPMS (Ultra) EPA SW-846 3005A/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 involves preliminary sample treatment by filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

MET-TOT-ICP-VA Water Total Metals 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 (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

MET-TOT-LOW-MS-VA Water Total Metals in Water by ICPMS(Low) EPA SW-846 3005A/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 either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

MET-TOT-ULTRA-MS-VA Water Total Metals in Water by ICPMS (Ultra) EPA SW-846 3005A/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 either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

NH3-F-VA Water Ammonia by Fluorescence J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulphuric 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 al.

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.

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.

PO4-DO-COL-VA Water Dissolved ortho Phosphate by Colour APHA 4500-P "Phosphorous"

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". All forms of phosphate are determined by the ascorbic acid colourimetric method. Dissolved ortho-phosphate (dissolved reactive phosphorous) is determined by direct measurement. Total phosphate (total phosphorous) is determined after persulphate digestion of a sample. Total dissolved phosphate (total dissolved phosphorous) is determined by filtering a sample through a 0.45 micron membrane filter followed by persulfate digestion of the filtrate.

PO4-DO-COL-VA Water Dissolved ortho Phosphate by Colour APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". All forms of phosphate are determined by the ascorbic acid colourimetric method. Dissolved ortho-phosphate (dissolved reactive phosphorous) is determined by direct measurement. Total phosphate (total phosphorous) is determined after persulphate digestion of a sample. Total dissolved phosphate (total dissolved phosphorous) is determined by filtering a sample through a 0.45 micron membrane filter followed by persulfate digestion of the filtrate.

PO4-T-COL-VA Water Total Phosphate P by Color APHA 4500-P "Phosphorous"

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". All forms of phosphate are determined by the ascorbic acid colourimetric method. Dissolved ortho-phosphate (dissolved reactive phosphorous) is determined by direct measurement. Total phosphate (total phosphorous) is determined after persulphate digestion of a sample. Total dissolved phosphate (total dissolved phosphorous) is determined by filtering a sample through a 0.45 micron membrane filter followed by persulfate digestion of the filtrate.

PO4-T-COL-VA Water Total Phosphate P by Color APHA 4500-P Phosphorous

Reference Information

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". All forms of phosphate are determined by the ascorbic acid colourimetric method. Dissolved ortho-phosphate (dissolved reactive phosphorous) is determined by direct measurement. Total phosphate (total phosphorous) is determined after persulphate digestion of a sample. Total dissolved phosphate (total dissolved phosphorous) is determined by filtering a sample through a 0.45 micron membrane filter followed by persulfate digestion of the filtrate.

TDS-VA	Water	Total Dissolved Solids by Gravimetric	APHA 2540 C - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TKN-SIE-VA	Water	Total Kjeldahl Nitrogen by SIE	APHA 4500-Norg (TKN)

This analysis is carried out using procedures adapted from APHA Method 4500-Norg "Nitrogen (Organic)". Total kjeldahl nitrogen is determined by sample digestion at 367 celcius with analysis using an ammonia selective electrode.

TSS-VA	Water	Total Suspended Solids by Gravimetric	APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.

TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 "Turbidity"

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** 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
CL	ALS LABORATORY GROUP - CALGARY, ALBERTA, CANADA
VA	ALS LABORATORY GROUP - VANCOUVER, BC, CANADA

Chain of Custody Numbers:

10-022826

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 receieved 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 Laboratory
ANALYTICAL CHEMISTRY & TESTING SERV

Environmental Division

Short Holding Time

Rush Processing

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

10-022826

Page 1 of 1

Report To	Report Format / Distribution	Service Requested: (Rush subject to availability)
Company: Stantec	Standard: ✓ Other (specify):	✓ Regular (Standard Turnaround Times))
Contact: Heather Provost	Select: PDF ✓ Excel ✓ Digital Fax	Priority, Date Req'd: (Surcharges apply)
Address: 4370 Dominion Street Burnaby, BC	Email 1: heather.provost@stantec.com	Emergency (1 Business Day) - 100% Surcharge
Phone: 604-436-3014 Fax: 604-	Email 2:	For Emergency < 1 Day, ASAP or Weekend - Contact ALS

Invoice To	Client / Project Information
Same as Report ? (circle) Yes or (No) (if No, provide details)	Job #: 1235104431-203
Copy of Invoice with Report? (circle) (Yes) or No	PO / AFE:
Company: Avalon Rare Metals	LSD:
Contact: David Swisher + Cindy Hu	
Address: Suite 1901, 130 Adelaide St, Toronto, ON M5H 3P5	Quote #: Q24554
Phone: 416-364-4938 Fax:	ALS Contact: Sampler: CS/SN/DC

Lab Work Order # (lab use only): L931109

Analysis Request (Indicate Filtered or Preserved, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TOC	pH, EC, Turbid, Tot-Alk	TDS, TSS	Anion Scan	T-PO4, DO-PO4	P	P	P	F	F			Number of Containers
	MWL08-128	3-Sep-10	9:30	Water	X	X	X	X	X	X	X	X	X	X			
	MWL08-129	3-Sep-10	9:45	Water	X	X	X	X	X	X	X	X	X	X			
				Tap													

Special Instructions / Regulations / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date:	Time:	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
	10-Sep-10	13:00	RC	14-Sep	10:05	6.3 °C				

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

GENF 18.01 Front

STANTEC CONSULTING LTD.
ATTN: HEATHER PROVOST
4370 DOMINION STREET, 5TH FLOOR
PO BOX 21
BURNABY BC V5G 4L7
Phone: 604-436-3014

Date Received: 15-OCT-10
Report Date: 01-NOV-10 14:34 (MT)
Version: FINAL

Certificate of Analysis

Lab Work Order #: L943658
Project P.O. #: NOT SUBMITTED
Job Reference: 123510431
Legal Site Desc:
C of C Numbers:

Heather Easton
Account Manager

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample ID	L943658-1	L943658-2	L943658-3	L943658-4	L943658-5
Description					
Sampled Date	14-OCT-10	14-OCT-10	14-OCT-10	14-OCT-10	14-OCT-10
Sampled Time	08:45	10:30	11:00	12:00	15:00
Client ID	130	128	DUPLICATE	152	127
Grouping / **Analyte**					
WATER					
Physical Tests Conductivity (uS/cm)	788	505	514	230	414
Hardness (as CaCO3) (mg/L)		301	300	47.3	239
pH (pH)	7.72	7.82	7.87	8.10	8.10
Total Suspended Solids (mg/L)	7.7	90.2	40.2	244	692
Total Dissolved Solids (mg/L)	546	299	294	135	231
Turbidity (NTU)	6.05	41.8	28.5	41.7	323
Anions and Nutrients Alkalinity, Total (as CaCO3) (mg/L)	290	279	282	107	232
Ammonia as N (mg/L)	0.0055	0.474	0.472	0.0055	0.0199
Bromide (Br) (mg/L)	<0.50	<0.050	<0.050	<0.050	<0.050
Chloride (Cl) (mg/L)	66.8	2.24	2.31	7.49	1.11
Fluoride (F) (mg/L)	0.85	1.46	1.47	0.937	0.631
Nitrate (as N) (mg/L)	0.323	<0.0050	<0.0050	<0.0050	<0.0050
Nitrite (as N) (mg/L)	<0.010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen (mg/L)	0.51 DLM	1.11	1.09	1.11	1.12
Ortho Phosphate as P (mg/L)	0.0031	0.0010	0.0017	0.0010	<0.0010
Total Phosphate as P (mg/L)	0.046	0.058	0.043	0.123	0.270
Sulfate (SO4) (mg/L)	18.7	7.75	8.13	3.18	1.76
Organic / Inorganic Carbon Total Organic Carbon (mg/L)	102	14.1	14.5	9.57	13.7
Total Metals Aluminum (Al)-Total (mg/L)		0.844	0.281	2.17	11.7
Antimony (Sb)-Total (mg/L)		0.00010	<0.00010	0.00129	0.00013
Arsenic (As)-Total (mg/L)		0.00614	0.00649	0.00131	0.00229
Barium (Ba)-Total (mg/L)		0.196	0.193	0.0953	0.278
Beryllium (Be)-Total (mg/L)		<0.00050	<0.00050	<0.00050	0.00064
Bismuth (Bi)-Total (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)-Total (mg/L)		0.018	0.018	0.189	0.026
Cadmium (Cd)-Total (mg/L)		0.000179	0.000193	0.000291	0.000088
Calcium (Ca)-Total (mg/L)		50.6	52.0	15.3	45.2
Chromium (Cr)-Total (mg/L)		0.00184	0.00108	0.0101	0.0124
Cobalt (Co)-Total (mg/L)		0.00035	0.00021	0.00110	0.00417
Copper (Cu)-Total (mg/L)		0.00183	0.00094	0.115	0.0995
Iron (Fe)-Total (mg/L)		12.6	9.77	4.92	23.9
Lead (Pb)-Total (mg/L)		0.00129	0.000519	0.00286	0.00790
Lithium (Li)-Total (mg/L)		0.0073	0.0083	0.0224	0.0204
Magnesium (Mg)-Total (mg/L)		37.1	38.3	5.35	37.8
Manganese (Mn)-Total (mg/L)		0.387	0.365	0.141	1.08
Mercury (Hg)-Total (mg/L)		0.000013	<0.000010	0.000014	0.000049

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

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L943658-6				
	Description					
	Sampled Date	14-OCT-10				
	Sampled Time					
	Client ID	TRAVEL BLANK				
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	<2.0				
	Hardness (as CaCO3) (mg/L)	<0.50				
	pH (pH)	5.76				
	Total Suspended Solids (mg/L)	<3.0				
	Total Dissolved Solids (mg/L)	<10				
	Turbidity (NTU)	0.73				
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	<2.0				
	Ammonia as N (mg/L)	<0.0050				
	Bromide (Br) (mg/L)	<0.050				
	Chloride (Cl) (mg/L)	<0.50				
	Fluoride (F) (mg/L)	<0.020				
	Nitrate (as N) (mg/L)	<0.0050				
	Nitrite (as N) (mg/L)	<0.0010				
	Total Kjeldahl Nitrogen (mg/L)	<0.050				
	Ortho Phosphate as P (mg/L)	<0.0010				
	Total Phosphate as P (mg/L)	<0.0020				
	Sulfate (SO4) (mg/L)	<0.50				
Organic / Inorganic Carbon	Total Organic Carbon (mg/L)	0.55				
Total Metals	Aluminum (Al)-Total (mg/L)	0.0129				
	Antimony (Sb)-Total (mg/L)	<0.00010				
	Arsenic (As)-Total (mg/L)	<0.00010				
	Barium (Ba)-Total (mg/L)	0.000124				
	Beryllium (Be)-Total (mg/L)	<0.00050				
	Bismuth (Bi)-Total (mg/L)	<0.00050				
	Boron (B)-Total (mg/L)	<0.010				
	Cadmium (Cd)-Total (mg/L)	<0.000017				
	Calcium (Ca)-Total (mg/L)	<0.050				
	Chromium (Cr)-Total (mg/L)	<0.00050				
	Cobalt (Co)-Total (mg/L)	<0.00010				
	Copper (Cu)-Total (mg/L)	0.00121				
	Iron (Fe)-Total (mg/L)	<0.030				
	Lead (Pb)-Total (mg/L)	0.00119				
	Lithium (Li)-Total (mg/L)	<0.0050				
	Magnesium (Mg)-Total (mg/L)	<0.10				
	Manganese (Mn)-Total (mg/L)	0.000161				
	Mercury (Hg)-Total (mg/L)	<0.000010				

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

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample ID	L943658-1	L943658-2	L943658-3	L943658-4	L943658-5
Description					
Sampled Date	14-OCT-10	14-OCT-10	14-OCT-10	14-OCT-10	14-OCT-10
Sampled Time	08:45	10:30	11:00	12:00	15:00
Client ID	130	128	DUPLICATE	152	127
Grouping / **Analyte**					
WATER					
Total Metals Molybdenum (Mo)-Total (mg/L)		0.0152	0.0161	0.0126	0.00440
Nickel (Ni)-Total (mg/L)		0.00148	0.00080	0.00516	0.0131
Phosphorus (P)-Total (mg/L)		<0.30	<0.30	<0.30	<0.30
Potassium (K)-Total (mg/L)		4.0	4.0	2.9	8.0
Selenium (Se)-Total (mg/L)		<0.0010	<0.0010	0.0012	0.0046
Silicon (Si)-Total (mg/L)		7.78	6.52	6.04	29.0
Silver (Ag)-Total (mg/L)		0.000096	0.000053	0.00132	0.0191
Sodium (Na)-Total (mg/L)		4.5	4.8	36.6	7.4
Strontium (Sr)-Total (mg/L)		0.111	0.110	0.129	0.111
Thallium (Tl)-Total (mg/L)		<0.00010	<0.00010	<0.00010	0.00020
Tin (Sn)-Total (mg/L)		0.00012	0.00013	0.00180	0.00107
Titanium (Ti)-Total (mg/L)		0.017	<0.010	0.048	0.242
Uranium (U)-Total (mg/L)		0.00981	0.0116	0.00350	0.0103
Vanadium (V)-Total (mg/L)		0.0019	0.0012	0.0031	0.0145
Zinc (Zn)-Total (mg/L)		0.0101	0.0062	0.132	0.0412
Dissolved Metals Aluminum (Al)-Dissolved (mg/L)		0.0279	0.0276	0.0132	0.0116
Antimony (Sb)-Dissolved (mg/L)		<0.00010	<0.00010	0.00046	<0.00010
Arsenic (As)-Dissolved (mg/L)		0.00813	0.00856	0.00030	0.00079
Barium (Ba)-Dissolved (mg/L)		0.185	0.187	0.0463	0.117
Beryllium (Be)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050
Bismuth (Bi)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)-Dissolved (mg/L)		0.017	0.017	0.182	0.017
Cadmium (Cd)-Dissolved (mg/L)		0.000187	0.000193	0.000018	<0.000017
Calcium (Ca)-Dissolved (mg/L)		54.8	54.0	12.8	44.2
Chromium (Cr)-Dissolved (mg/L)		<0.0010 DLM	<0.0020 DLM	<0.00050	<0.00050
Cobalt (Co)-Dissolved (mg/L)		0.00017	0.00016	<0.00010	0.00025
Copper (Cu)-Dissolved (mg/L)		<0.00050	<0.00050	0.0144	0.00059
Iron (Fe)-Dissolved (mg/L)		10.1	9.15	0.040	2.27
Lead (Pb)-Dissolved (mg/L)		<0.000050	<0.000050	0.000162	<0.000050
Lithium (Li)-Dissolved (mg/L)		0.0078	0.0080	0.0189	0.0057
Magnesium (Mg)-Dissolved (mg/L)		39.8	40.0	3.74	31.2
Manganese (Mn)-Dissolved (mg/L)		0.368	0.362	0.000752	0.797
Mercury (Hg)-Dissolved (mg/L)		<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved (mg/L)		0.0150	0.0157	0.0119	0.00388
Nickel (Ni)-Dissolved (mg/L)		0.00057	0.00051	0.00124	0.00102
Phosphorus (P)-Dissolved (mg/L)		<0.30	<0.30	<0.30	<0.30
Potassium (K)-Dissolved (mg/L)		4.2	4.0	<2.0	3.6

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

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L943658-6				
	Description					
	Sampled Date	14-OCT-10				
	Sampled Time					
	Client ID	TRAVEL BLANK				
Grouping	**Analyte**					
WATER						
Total Metals	Molybdenum (Mo)-Total (mg/L)	<0.000050				
	Nickel (Ni)-Total (mg/L)	<0.00050				
	Phosphorus (P)-Total (mg/L)	<0.30				
	Potassium (K)-Total (mg/L)	<2.0				
	Selenium (Se)-Total (mg/L)	<0.0010				
	Silicon (Si)-Total (mg/L)	<0.050				
	Silver (Ag)-Total (mg/L)	<0.000010				
	Sodium (Na)-Total (mg/L)	<2.0				
	Strontium (Sr)-Total (mg/L)	<0.00010				
	Thallium (Tl)-Total (mg/L)	<0.00010				
	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	Aluminum (Al)-Dissolved (mg/L)	<0.0030				
	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)	<0.00050				
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050				
	Boron (B)-Dissolved (mg/L)	<0.010				
	Cadmium (Cd)-Dissolved (mg/L)	<0.000017				
	Calcium (Ca)-Dissolved (mg/L)	<0.050				
	Chromium (Cr)-Dissolved (mg/L)	<0.00050				
	Cobalt (Co)-Dissolved (mg/L)	<0.00010				
	Copper (Cu)-Dissolved (mg/L)	<0.00050				
	Iron (Fe)-Dissolved (mg/L)	<0.030				
	Lead (Pb)-Dissolved (mg/L)	0.000057				
	Lithium (Li)-Dissolved (mg/L)	<0.0050				
	Magnesium (Mg)-Dissolved (mg/L)	<0.10				
	Manganese (Mn)-Dissolved (mg/L)	<0.000050				
	Mercury (Hg)-Dissolved (mg/L)	<0.000010				
	Molybdenum (Mo)-Dissolved (mg/L)	<0.000050				
	Nickel (Ni)-Dissolved (mg/L)	<0.00050				
	Phosphorus (P)-Dissolved (mg/L)	<0.30				
	Potassium (K)-Dissolved (mg/L)	<2.0				

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

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample ID	L943658-1	L943658-2	L943658-3	L943658-4	L943658-5
Description					
Sampled Date	14-OCT-10	14-OCT-10	14-OCT-10	14-OCT-10	14-OCT-10
Sampled Time	08:45	10:30	11:00	12:00	15:00
Client ID	130	128	DUPLICATE	152	127
Grouping / Analyte					
WATER					
Dissolved Metals					
Selenium (Se)-Dissolved (mg/L)		<0.0010	<0.0010	<0.0010	<0.0010
Silicon (Si)-Dissolved (mg/L)		6.17	6.12	1.30	5.33
Silver (Ag)-Dissolved (mg/L)		0.000032	0.000029	<0.000010	0.000012
Sodium (Na)-Dissolved (mg/L)		4.9	4.9	36.0	6.8
Strontium (Sr)-Dissolved (mg/L)		0.109	0.110	0.118	0.0900
Thallium (Tl)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010	<0.00010
Tin (Sn)-Dissolved (mg/L)		<0.00010	<0.00010	0.00023	<0.00010
Titanium (Ti)-Dissolved (mg/L)		<0.010	<0.010	<0.010	<0.010
Uranium (U)-Dissolved (mg/L)		0.0104	0.0113	0.00258	0.00688
Vanadium (V)-Dissolved (mg/L)		<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)-Dissolved (mg/L)		<0.0030	<0.0030	0.0246	<0.0030

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

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L943658-6				
	Description					
	Sampled Date	14-OCT-10				
	Sampled Time					
	Client ID	TRAVEL BLANK				
Grouping	**Analyte**					
WATER						
Dissolved Metals	Selenium (Se)-Dissolved (mg/L)	<0.0010				
	Silicon (Si)-Dissolved (mg/L)	<0.050				
	Silver (Ag)-Dissolved (mg/L)	<0.000010				
	Sodium (Na)-Dissolved (mg/L)	<2.0				
	Strontium (Sr)-Dissolved (mg/L)	<0.00010				
	Thallium (Tl)-Dissolved (mg/L)	<0.00010				
	Tin (Sn)-Dissolved (mg/L)	<0.00010				
	Titanium (Ti)-Dissolved (mg/L)	<0.010				
	Uranium (U)-Dissolved (mg/L)	<0.000010				
	Vanadium (V)-Dissolved (mg/L)	<0.0010				
	Zinc (Zn)-Dissolved (mg/L)	<0.0030				

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

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLM	Detection Limit Adjusted For Sample Matrix Effects

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
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.			
ANIONS-BR-IC-VA	Water	Bromide by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
ANIONS-CL-IC-VA	Water	Chloride by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
ANIONS-F-IC-VA	Water	Fluoride by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
ANIONS-NO2-IC-VA	Water	Nitrite by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Specifically, the nitrite detection is by UV absorbance and not conductivity.			
ANIONS-NO3-IC-VA	Water	Nitrate by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Specifically, the nitrate detection is by UV absorance and not conductivity.			
ANIONS-SO4-IC-VA	Water	Sulfate by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
C-TOT-ORG-LOW-CL	Water	Total Organic Carbon	APHA 5310 C-Instrumental
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.			
HARDNESS-CALC-VA	Water	Hardness	APHA 2340B
Hardness is calculated from Calcium and Magnesium concentrations, and is expressed as calcium carbonate equivalents.			
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 (EPA Method 245.7).			
HG-TOT-LOW-CVAFS-VA	Water	Total Mercury in Water by CVAFS(Low)	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 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 (EPA Method 245.7).			
MET-DIS-ICP-VA	Water	Dissolved Metals 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 procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).			
MET-DIS-LOW-MS-VA	Water	Dissolved Metals in Water by ICPMS(Low)	EPA SW-846 3005A/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 involves preliminary sample treatment by filtration (EPA Method 3005A).			

Reference Information

Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

MET-DIS-ULTRA-MS-VA Water Diss. Metals in Water by ICPMS (Ultra) EPA SW-846 3005A/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 involves preliminary sample treatment by filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

MET-TOT-ICP-VA Water Total Metals 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 (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

MET-TOT-LOW-MS-VA Water Total Metals in Water by ICPMS(Low) EPA SW-846 3005A/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 either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

MET-TOT-ULTRA-MS-VA Water Total Metals in Water by ICPMS (Ultra) EPA SW-846 3005A/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 either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

NH3-F-VA Water Ammonia by Fluorescence J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulphuric 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 al.

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.

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.

PO4-DO-COL-VA Water Dissolved ortho Phosphate by Colour APHA 4500-P "Phosphorous"

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". All forms of phosphate are determined by the ascorbic acid colourimetric method. Dissolved ortho-phosphate (dissolved reactive phosphorous) is determined by direct measurement. Total phosphate (total phosphorous) is determined after persulphate digestion of a sample. Total dissolved phosphate (total dissolved phosphorous) is determined by filtering a sample through a 0.45 micron membrane filter followed by persulfate digestion of the filtrate.

PO4-DO-COL-VA Water Dissolved ortho Phosphate by Colour APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". All forms of phosphate are determined by the ascorbic acid colourimetric method. Dissolved ortho-phosphate (dissolved reactive phosphorous) is determined by direct measurement. Total phosphate (total phosphorous) is determined after persulphate digestion of a sample. Total dissolved phosphate (total dissolved phosphorous) is determined by filtering a sample through a 0.45 micron membrane filter followed by persulfate digestion of the filtrate.

PO4-T-COL-VA Water Total Phosphate P by Color APHA 4500-P "Phosphorous"

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". All forms of phosphate are determined by the ascorbic acid colourimetric method. Dissolved ortho-phosphate (dissolved reactive phosphorous) is determined by direct measurement. Total phosphate (total phosphorous) is determined after persulphate digestion of a sample. Total dissolved phosphate (total dissolved phosphorous) is determined by filtering a sample through a 0.45 micron membrane filter followed by persulfate digestion of the filtrate.

PO4-T-COL-VA Water Total Phosphate P by Color APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". All forms of phosphate are determined by the ascorbic acid colourimetric method. Dissolved ortho-phosphate (dissolved reactive phosphorous) is determined by direct measurement. Total phosphate (total phosphorous) is determined after persulphate digestion of a sample. Total dissolved phosphate (total dissolved phosphorous) is determined by filtering a sample through a 0.45 micron membrane filter followed by persulfate digestion of the filtrate.

TDS-VA Water Total Dissolved Solids by Gravimetric APHA 2540 C - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

Reference Information

TKN-SIE-VA	Water	Total Kjeldahl Nitrogen by SIE	APHA 4500-Norg (TKN)

This analysis is carried out using procedures adapted from APHA Method 4500-Norg "Nitrogen (Organic)". Total kjeldahl nitrogen is determined by sample digestion at 367 celcius with analysis using an ammonia selective electrode.

TSS-VA	Water	Total Suspended Solids by Gravimetric	APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.

TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 "Turbidity"

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** 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
CL	ALS LABORATORY GROUP - CALGARY, ALBERTA, CANADA
VA	ALS LABORATORY GROUP - VANCOUVER, BC, CANADA

Chain of Custody Numbers:

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 receieved 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 Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878

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10-036480

Page 1 of 1

Report To		Report Format / Distribution		Service Requested: (Rush subject to availability)	
Company:	STANTEC	Standard: ___ Other (specify):		X	Regular (Standard Turnaround Times))
Contact:		Select: PDF ✓ Excel ✓ Digital ___ Fax ___			Priority, Date Req'd: ___ (Surcharges apply)
Address:	4370 DOMINION St.	Email 1: HEATHER.PROVOST@STANTEC.COM			Emergency (1 Business Day) - 100% Surcharge
	BURNABY BC	Email 2: TOBI.GARDNER@STANTEC.COM			For Emergency < 1 Day, ASAP or Weekend - Contact ALS
Phone:	604 436 3014 Fax: 604 436 3752			Analysis Request	
Invoice To	Same as Report ? (circle) Yes or No (if No, provide details)	Client / Project Information		(Indicate Filtered or Preserved, F/P)	
	Copy of Invoice with Report? (circle) Yes or No	Job #:	123510431		
Company:		PO / AFE:			
Contact:		LSD:			
Address:					
Phone:	Fax:	Quote #:	203.200		
Lab Work Order # (lab use only)	L943658	ALS Contact:	HEATHER BASTON	Sampler:	TOBI GARDNER

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	GENERAL	NUTRIENTS	TOC	TOTAL METALS	DISS. METALS	TKN	Number of Containers
	130	14-OCT-10	08:45		✓	P	P			P	4
	128	14-OCT-10	10:30		✓	P	P	P	P/F	P	6
	DUPLICATE	14-OCT-10	11:00		✓	P	P	P	P/F	P	6
	152	14-OCT-10	12:00		✓	P	P	P	P	P	6
	127	14-OCT-10	15:00		✓	P	P	P	P/F	P	6

Special Instructions / Regulations / Hazardous Details

SAMPLE 152 - DISSOLVED METALS WAS NOT FILTERED - NO METALS FROM SAMPLE 130

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date:	Time:	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
TOBI GARDNER	OCT. 15 2010			15-Oct-10	1450	28 °C				

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION — WHITE - LABORATORY COPY — YELLOW - CLIENT COPY — GENF 18.01 Front

Appendix A.4

Thor Lake Rare Earth Metals Baseline Project Environmental Baseline Report: Volume 4 – Terrain, Soils, and Permafrost 2010

THOR LAKE RARE EARTH METALS BASELINE PROJECT

Environmental Baseline Report: Volume 4 – Terrain, Soils and Permafrost

FINAL INTERIM REPORT

Prepared for:

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Project No.:

123510050 and 123510051

January 15, 2010

Stantec


Stantec

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Dennis O'Leary, BA ..... Senior Review

EXECUTIVE SUMMARY

Avalon Rare Metals Inc (Avalon) is currently undertaking a Prefeasibility Study (PFS) for the development of the Nechalacho Deposit, located on mineral leases it holds at its' Thor Lake site in the Northwest Territories. The deposit is located approximately 100 km southeast of Yellowknife and 4 km north of the Hearne Channel of Great Slave Lake. The Thor Lake site is within the Taiga Shield ecozone, characterized by Precambrian bedrock outcrops with many lakes and wetlands in glacially carved depressions. The site is located within the Akaitcho Territory, an area currently under negotiation of a comprehensive land claim between the federal government and the Akaitcho First Nations, representing First Nations in LutselK'e, Fort Resolution, Ndilo and Dettah. Thor Lake lies within the Mackenzie Valley region of the NWT and is, therefore, subject to the provisions of the *Mackenzie Valley Resource Management Act* (MVRMA) in addition to other federal and territorial legislation of general application.

The Thor Lake site has been subject to mineral exploration by others since the 1970s. Previous exploration focused on beryllium resources in the T-zone and included drilling and bulk sampling. Since acquiring the property in 2006, Avalon has focused on delineating the rare earth resource within the Nechalacho Deposit, which is not part of the T-zone. Preliminary development concepts being considered for the Nechalacho Deposit during the PFS include development of an underground mine, mineral concentration, tailings disposal, waste rock disposal, fuel and concentrate storage, power generation and transportation infrastructure (airstrip, upgraded site roads, wharf on Great Slave Lake). Concentrate would be shipped off-site seasonally for refinement into a marketable rare earth product.

Stantec (formerly Jacques Whitford) initiated environmental baseline studies at the Thor Lake project site in fall 2008. Aquatic monitoring of drilling was undertaken during fall 2007 and winter 2008. This Technical Data Report (TDR) presents and analyzes data collected for the terrain, soils and permafrost disciplines as of fall 2009.

TABLE OF CONTENTS

List of Tables

List of Figures

List of Appendices

List of Tables in Appendices

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1 PROJECT BACKGROUND

1.1 Focus of Baseline Investigation

The main objective of this investigation is to characterize the soils, terrain and permafrost distribution in the vicinity of the proposed Thor Lake project mine and related infrastructure. Detailed information on the surficial geology, landforms diversity, permafrost distribution and associated terrain constraints is paramount in the support of infrastructure planning, facility sitting and routing considerations.

The focus of baseline investigations include

- Identification and distribution of surficial material types
- Identification and distribution of permafrost conditions
- Soil types and their distribution
- Land capability classification of soils
- Soil suitability for reclamation
- Susceptibility to soil acidification from acid emissions
- Baseline metal content of soils
- Descriptions and location of erosion-prone sensitive soils
- The study area's susceptibility to soil compaction.

This report presents the data collected to date with respect to the above topics.

1.2 Study Area and Physiography

The Thor Lake Regional Study Area (RSA), mine lease 3178, is located within NTS 85I/SE, near the northeast shores of the Hearne Channel, Great Slave Lake, Northwest Territories, some. 100 km east/southeast of Yellowknife (Figure 1-1).

The study area falls within the Bear Slave Uplands of the physiographic Kazan Region (Bostock 1970). This region consists of vast areas of massive rocks that form flat, broad, sloping uplands, plateaus and lowlands.

AVALON RARE METALS INC

Scale:	1:2,000,000
Date:	01/12/2009
Drawn By:	KS
Approved By:	NL

Avalon Rare Metals INC.

Site Location

Draft Technical Data Report

Thor Lake Project, Nechalacho Deposit

PREPARED BY Stantec

Figure: 1-1

1.2.1 Quaternary History

The study area was covered by the Laurentide Ice Sheet during the last glaciation, in the Late Wisconsinan. During glacial maximum, about 18 ka ago, the dominant ice flow direction was southwest, flowing from the Keewatin Ice Divide (Dyke and Dredge 1989; Lemmen, *et al.* 1994; Fulton 1995).

The Laurentide Ice Sheet retreated to the northeast of the Project area, leaving the area free of ice between 10,000 and 9,000 years before present (Dyke and Dredge 1989; Dyke, *et al.* 2003). Glacial meltwater impounded along this margin, forming Glacial Lake McConnell (Dyke, *et al.* 2003; Lemmen, *et al.* 1994; Smith 1995). Great Bear Lake (NWT), Great Slave Lake (NWT) and Lake Athabasca (AB/SASK) are remnants of this lake, though it wasn't until around 8,000 years before present that the lakes completely separated to their modern configurations. Glacial Lake McConnell covered approximately 240 000 km^2. Former lake shores of glacial Lake McConnell reached elevations between 245 and 295 metres above sea level (m asl) (Craig 1965). Observation in the Yellowknife area showed material reworked by wave action as far as 70 km inland from the actual location of Great Slave Lake (Kerr and Wilson 2000). This implies that glacial Lake McConnell reached elevations averaging 275 to 285 m asl.

1.2.2 Landforms and Surficial Geology

The bedrock of the region is covered by a thin and discontinuous veneer of glacial till material (Fulton 1995). Great Slave Lake was far more extensive in the past, as part of Glacial Lake McConnell, but very little sediment seems to have been deposited in this lake (Dyke and Dredge 1989; Kerr and Wilson 2000).

The regional landscape and surficial geology in the vicinity of Yellowknife was described by Kerr and Wilson (2000) as a vast terrain of low relief with topographic variations usually ranging between 10 and 30 m. The earth's surface consists mostly of bare rocky outcrops intersected by generally thin accumulation of glacial and glaciolacustrine sediments. The most common surficial deposit consists of till and commonly shows signs of reworking by glacial meltwater and glaciolacustrine processes, resulting in a variety of material facies and textures.

1.2.3 Climate and Permafrost Conditions

The weather station with the oldest historical data is located 100 km to the northwest in the city of Yellowknife (62°27'N, 114°26'W, elevation 206 m), an area characterized by a sub-arctic, semi-arid climate. The annual mean air temperature for the period from 1971 to 2000 was -4.6°C (Environment Canada 2002). The region had approximately 1,835.5 thawing degree-days and approximately 3,475.4 freezing degree-days. Winter (continuous daily mean temperature below 0°C) begins in early-October and ends around late-April, for a mean total of 222 days/year. The annual precipitation is 280.7 mm/year, of which 41 percent (151.8 cm) falls as snow (Environment Canada 2002).

By definition, permafrost refers to a condition when the ground, either loose material or bedrock, remains at or below a temperature of 0°C for a minimum period of two years (NRC, Permafrost

Subcommittee 1988). The Thor Lake Project is located in the extensive discontinuous permafrost zone of Canada (Heginbottom *et al.* 1995; Frozen Ground Data Center, http://nsidc.org/data/ggd318.html) . This zone consists of an area where 50 to 90 percent of the land is characterized by permafrost conditions. Ground ice, which is a direct indicator of permafrost conditions, occurs under three main forms: (1) as coating on grains and as crystals within pores of unconsolidated deposits (pore ice); (2) as thin ice lenses and ice veins (segregated ice, intrusive ice and reticulate ice); and (3) as large bodies of more-or-less pure ice (i.e. ice wedges, massive ice and pingo ice).

In the Yellowknife area, permafrost can be absent or present depending on the geological and physiographic contexts. Where permafrost is present, reported thicknesses vary between 30 to 90 m. Close to Table Mountain (~ 63.6° N, 123.6° W) and Norman Wells (~ 65.3° N, 127° W) reported permafrost thicknesses vary respectively between 40 to 70 m and 15 to 61 m. The reported geothermal gradient for the Yellowknife area is 12°C/km and varies between 48 to 62 °C/km for Norman Wells.

1.2.4 General Soil Patterns

There have been few extensive soil surveys completed for the Thor Lake area. The Canadian Soil Information System (CanSIS) has limited information for the Thor Lake Study Area. The Project area lies north of Great Slave Lake and has extensive areas of bedrock outcrops. Soils in upland areas typically consist of Orthic Gray Luvisols, Orthic or Eluviated Dystric or Eutric Brunisols, and Regosols. Gleyed Regosolic, Cryosolic and Organic soils are found in low-lying, imperfectly to very poorly drained areas.

1.3 Methodology

The baseline program for this study used a combination of research techniques including a review of historical data, a field inventory program and detailed mapping using Stantec's HD-MAPP system.

1.3.1 Literature Review

A literature review of terrain, permafrost and soils conditions around the Thor Lake area was conducted in order to collect valuable background information and in order to identify any data gaps.

Detailed information specific to the Project area is very scarce. There is very few or no large scale bedrock geology, surficial geology or soils maps available for the study area, as per a review of federal and territorial government publications. There is also very limited information related to permafrost and ground temperature within the general Thor Lake Project area.

1.3.2 High Definition Mapping and Applications (HD-MAPP)

Mapping of the surficial geology and soil resources of the Project area was completed by terrain and soil scientists using Stantec's HD-MAPP system. HD-MAPP incorporates both PurVIEW™ and ArcGIS applications, allowing scientists to view medium to small scale aerial photography (e.g.,

1:40,000) in a digital environment at scales as large as 1:1,500. The ability to view imagery at such detailed scales provides a number of significant advantages, including better delineation and classification of key landscape features.

Relatively homogenous terrain units were initially delineated at a scale of 1:5,000 based on surficial sediment type (e.g., till, organic, etc.), surface expression (e.g., hummocky, veneer, fan, etc.), slope, drainage, and geomorphologic processes (e.g., groundwater seepage, mass wasting, permafrost, etc.). Mapping of permafrost related landforms and ground ice distribution was conducted using base data derived from surficial deposits, vegetation and drainage. Soils were generally based on terrain polygons, and further divided into soil units representing a combination of both soil order and parent material texture. Appendix C contains the physical and chemical characteristics of each soil unit identified in the Project area from the preliminary field work conducted in 2008.

Soil unit polygons were delineated at a scale of 1:5,000 based on soil texture and Great Group. These polygons can be used to determine soil spatial extents in the Project area (Figure 2-12)

In this interim report, the following maps will be provided:

- Overview of project area
- Surficial geology
- Location of potential ice rich deposits in the Project area
- Soil and terrain inspection sites, soil unit polygons and dominant soil types.

1.3.3 Field Program

The purpose of the field inventory program was to collect data to verify preliminary terrain and soils mapping and to obtain detailed data for classification. Fieldwork was undertaken over the entire Project area in early October, 2008.

As the Local Study Area (LSA) and the specific locations of the mine and related infrastructure (infrastructure footprint) were not determined at the time of the fieldwork, the area of investigation for terrain, permafrost and soils consists of the general project area surrounding Thor Lake and Long Lake, an area of approximately 1,097 ha.

Most field sites were accessed by foot, with minimum quads and helicopter support. At each site the following general site data were recorded on a standard data sheet:

- GPS coordinates
- Slope position, aspect, gradient, and length
- Sediment type
- Surface expression
- Land use
- Terrain and soil texture
- Percentage of clasts
- Clast roundness and size

- Drainage
- Geomorphic modifying processes.

Additional information relevant to the site was recorded in a notes section. Ground inspection sites were selected while completing mapping using the HD-MAPP system. GPS coordinates for each site were downloaded from the HD-MAPP system into a handheld GPS unit set to NAD83 to allow for efficient sampling. Sixty-three (63) field sites were visited during the 2008 program.

1.3.3.1 Permafrost

Field investigations relative to the permafrost characterization were specifically conducted in the fall, a period when the active layer is fairly deep. An overview helicopter flight was also conducted to observe the Project area and to better identify any permafrost related landforms. Four days of field investigation were dedicated to permafrost observations. The area of investigation was limited to five sites; these sites were previously identified as potential ice rich deposits during the air photo interpretation and subsequently confirmed during the aerial reconnaissance flight.

Specific field methods and operations were conducted in order to confirm terrain mapping and in order to collect site-specific information and samples concerning the local permafrost conditions. Measurements of the active layer thickness were done in various types of materials, including fine-grained soils, coarse grained till, and peat deposits. This was done manually using a graduated steel probe. A series of test pits were dug in order to observe the materials and to study the stratigraphic sequence throughout the Project Area. In order to characterize the thaw-susceptibility of the permafrost, five shallow boreholes were drilled in potentially ice-rich areas. A portable shallow core drill with a carbide and diamond crown (12 cm in diameter) was used. Maximum drilling depth averaged 3.5 m. Core recovery was almost 100 -percent and material was sampled along the entire sequence. Samples within the active layer were taken from the walls of the test pits. A detailed cryostratigraphic description of the test pits and core samples was conducted in the field. Core descriptions were done following the classification of Murton and French (1994) and included dip of the sedimentary strata, cryostructure, type of ice, organic matter decomposition, and type of sediments. The core samples were logged in the field and brought back frozen to the camp where they were kept in a freezer. The frozen samples were analyzed at the Cold regions geomorphology and geotechnical laboratory (University of Montreal). The analyses included gravimetric and volumetric water content, pH, conductivity and grain size distribution (by sieving and hydrometer methods, ASTM D422).

The temperature regime of the active layer and upper permafrost was measured in October 2008 using a thermistor cable installed in a borehole (0- 14.1 m) backfilled with sand. The borehole is located a few tens of meters to the south-west of Thor Lake.

1.3.3.2 Soils

At each soil inspection site, soil profiles were described using criteria established by the Soil Classification Working Group (1998) and according to national standards established by the *Expert*

Committee on Soil Survey (1983). The following information was collected for each horizon when field conditions permitted:

- Depth
- Texture
- Moisture
- Color
- Structure
- Consistence
- Coarse fragment content
- Presence of salts
- Field pH (Bm horizons)
- Calcareousness
- Extent of mottling
- Presence of frozen horizons
- Samples taken for analysis.

Soil profiles were assigned a unit based on their textural group and soil order using the Canadian System of Soil Classification (Soil Classification Working Group, 1998). Representative profiles from each soil series were sampled by horizon to characterize the physical and chemical characteristics of each. Samples were placed in clean plastic bags, labeled and delivered to Exova Canada Inc. in Edmonton. Analyses conducted include:

- Electrical conductivity (saturated paste)
- pH (saturated paste, 1:2 H2O, 0.01 M CaCl2)
- Soluble cations (calcium, magnesium, sodium, and potassium)
- Saturation percentage and sodium adsorption ratio
- Exchangeable calcium, magnesium, sodium, potassium
- Calcium carbonate equivalent or total inorganic carbon
- Total Kjeldahl nitrogen
- Total organic carbon
- Particle size analysis (hydrometer method)
- Bulk density
- Metals Analysis.

1.4 Quality Assurance/Quality Control

Quality control and quality assessments were completed by Stantec's Practice Lead for terrain sciences during the preliminary mapping, field inventory program, final mapping, and classification phases of the work.

1.4.1 Preliminary Mapping

Preliminary terrain linework was reviewed by a senior terrain scientist early in the mapping process to ensure that mapping adhered to standards established for the Project (e.g., 1cm^2 minimum polygon size, etc.). Approximately 40% of all linework was reviewed; any linework that was not acceptable was discussed with the mappers, modified and subsequently reviewed a second time.

1.4.2 Field Inventory Program

The QA assessment for the field program consisted of three activities: field correlation, a field assessment and a review of all field plot cards.

Field correlation was completed on a daily basis with discussions occurring between field team members at the end of each day. These correlation discussions focused on material types, landforms, quaternary history, and geomorphic modifying processes such as permafrost. Field plot cards were reviewed on a nightly basis to ensure the data was properly recorded and met internal data requirements.

1.4.3 Final Mapping and Classification

Final mapping and classification was reviewed to ensure compliance with the mapping standards for the Project. Formal classifications were reviewed and compared to assess their level of congruence. A minimum of 20% of all terrain and soils units (e.g., polygons) were reviewed throughout the final mapping process.

2 RESULTS

Results of the terrain and soils section are based on the 2008 field program.

2.1 Terrain

2.1.1 Surficial Geology and Geomorphology

The landforms and surficial geology within the Project area show strong evidence of glacial and post-glacial activity. The landscape consists of a gently undulating relief that gradually decreases in elevation towards Great Slave Lake. Elevation ranges from 235 m along the shore of Thor Lake, to about 265 m on top of the highest bedrock knobs. Elevations progressively drop to approximately 160 m along the north shore of Great Slave Lake.

Bedrock outcrops are dominant landscape elements throughout the Northwest Territories; within the Thor Lake Project area, bedrock accounts for 43.2 percent of the mapped area (Table 2-1). Several bedrock outcrops show glacial striations, grooves and scratches, all evidence of glacial erosion and ice flow directions. Those abrasion marks are formed by debris-carrying ice and represent some very good indicators of former ice-flow patterns. Several were recorded throughout the Project area and

all were displaying a southwest orientation. A similar ice-flow pattern is reported in the literature for this general area (see Section 1.3.2, Quaternary History). A series of large-scale indicators such glacially smoothed bedrock outcrops, and roche moutonnées were also observed. At the study site, glacially profiled bedrock outcrops are aligned NE-SW which is consistent with the glacial striaes. These low elevation outcrops are separated by longitudinal glacial troughs and glacial overdeepening depressions now occupied by lakes (e.g., Thor Lake).

Slopes were measured throughout the Project area and usually ranged from 5 to 15% with slope lengths ranging from 100 to 500 m. Short slopes between 15 and 30% are present but less common. Steep slopes are rare although a series of bedrock outcrops show some escarpments up to 70% steep with a maximum height of 15 m. Maximum elevation difference between topographic highs and lows average 30 m. Bedrock outcrops show variable degree of weathering in relation with processes such as geological decompression, frost action and thermal expansion.

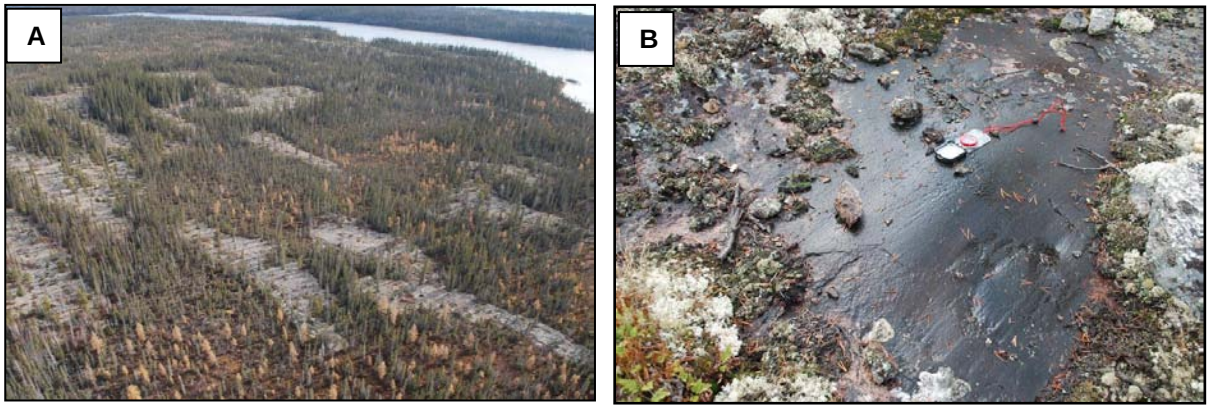

Figure 2-1: Bedrock Outcrops and Ice Flow Indicators

A) Extensive bedrock outcrops located within the Project area. Areas between the outcrops are mostly characterized by washed out tills and thin organic accumulations.

B) Glacially smoothed and striated bedrock surface showing a southwest ice flow (general orientation 230°, photo is from site ST12).

N

BUCK

DRIZZLE

RING

MURKY

CRESSY

FRED

THOR

MEGHAN

THORN

NORTH TARDIFF

WASP

SOUTH TARDIFF

LONG

PORK CHOP

ELBOW

Great Slave Lake

Study Area

A	Anthropogenic	T	Till
F	Fluvial	O	Organic
L	Lacustrine	B	Bedrock

Surficial Expression

b	Blanket	Deposit greater than 1m thick; minor irregularities of the underlying unit (generally bedrock) are masked but the topographic form is still evident
v	Veneer	Deposit less than 1 m thick; minor irregularities of the underlying unit (generally bedrock) are masked but the topographic form is obvious
u	Undulating	Low relief, rolling terrain with no trend or parallelism; bedrock topography is masked
r	Ridge	Narrow, elongate and commonly steep-sided feature that rises above surrounding landscape; bedrock topography is masked (unless a bedrock ridge – Rr). Includes string bogs (Or).
a	Apron	Relatively gentle slope at foot of steeper slope; bedrock topography is masked

Terrain Code

Example: GLACIOLACUSTRINE Veneer

^{10}GL v

Decile — Surficial Material — Surface Expression

Complex Notation:

Where two or more surficial deposits and/or surficial expressions are present, the proportion of each component is given by the decile unit. For example

^{6}Gl$_{b}^{4}$Ob — Means that about 60% of the area is covered by a glaciolacustrine plain and bout 40% is coverd by organic blanket.

^{7}Fb^{2}Fv^{1}Ov — Means that about 70% of the area is covered by a fluvial blanket about 20% is covered by a fluvial veneer and about 10% is covered by organic veneer.

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Thor Lake Project, Nechalacho Deposit

Surficial Geology of Thor Lake Study Area

Area of Detail

AVALON RARE METALS INC.

0 0.25 0.5 1
Kilometres

PREPARED BY Stantec

DRAFT DATE 21/12/2009			SCALE 1:20,000	
REVISION DATE			PROJECT 1036222	FIGURE NO. 2-2
DRAWN KS	CHECKED RH	APPROVED NL	VOL	

Surficial Material Description

Table 2-1 provides a statistical summary of the surficial materials found throughout the Project area; these are described in detail below. Figure 2-2 shows the distribution of the parent materials throughout the Thor Lake Project area. In Figure 2-2, the colors displayed on the map correspond to the dominant parent material only (i.e., Decile 1).

Table 2-1: Surficial Materials within the Thor Lake Project Area

Surficial Material	Total Area (ha)	Percent of Project Area (%)
Bedrock	469.2	43.2
Surficial Deposits		
Glacial Deposits		
Glaciofluvial	3.4	0.3
Till	270.4	24.5
Post-glacial Deposits		
Colluvium	0	0
Fluvial	24.5	2.2
Lacustrine	16.4	1.5
Organic	240.4	21.7
Water Body	72.7	6.6
Anthropogenic	0.1	<1.0
Total	**1097.1**	**100.0**

2.1.1.1 Glacial Deposits

Till Deposits

Till is the dominant surficial deposit found within the Project area accounting for 24.5 percent. It consists of material deposited directly by ice by lodgment, melt out, or post-melt out gravity flow. Till deposits are generally found as discontinuous veneers (<1 m in thickness) and blankets (>1 m in thickness but not masking the underlying bedrock surface) directly overlying the bedrock. The surface topography is generally flat to very gently undulating.

Till facies varies considerably throughout the Project area but generally consist of a poorly compact, stony, matrix supported diamicton (Figure 2-3). Depending on the location and the degree of reworking of the material, the matrix ranges from silty clay to medium sand with minor amount of silt. Clasts range in size from pebbles to boulders and are sub-rounded to angular. Several erratics are found throughout the area, with diameters up to 1.5 m. Clast content is generally high, averaging 30 to 50%, but observation pits and coring have showed till material with clast content below 10%. The material lithology reflects the underlying bedrock type or the bedrock found in up-ice areas of the Project area. Drainage of till deposits range for moderate to poor.

Some till deposits contain lenses and beds of reworked material. In some cases, till facies shows evidence of reworking by glacial meltwaters and wave action (former glacial lake McConnell and present-day Great Slave Lake). Similar observations have been made in the Yellowknife area, where wave-washed bouldery till surface was found up to 100 m (275-280 m a.s.l.) above the present Great Slave Lake level (Kerr and Wilson 2000). These tills are generally coarser, in relation with the fine sediment being removed.

Figure 2-3: Till material (ST21)

Observation pit showing coarse till material with approximately 50% coarse fragments in a silty sand matrix.

2.1.1.2 Glaciofluvial Deposits

Glaciofluvial deposits consist of well-sorted sediment deposited by glacial meltwaters (subaerial or outwash deposits) and also includes material deposited in proglacial lakes in contact with glacier ice (ice-contact deposits) and material deposited at the margins of glaciers. They are very uncommon within the study area (0.3 percent of the study area) and are mostly found as a minor polygon component. No glaciofluvial landforms (e.g., esker, kame, outwash, etc.) were observed within the Project area.

Glaciofluvial materials within the Thor Lake Project area consist of medium- to coarse textured sand with variable amount of gravels and pebbles (Figure 2-4). The clasts are for the most sub-rounded to round, with minor sub-angular. Glaciofluvial sediments are generally massive or vaguely horizontally bedded. Most observed deposits were forming discontinuous veneers, and generally located in topographic lows. Drainage of this type of material was usually good to moderate.

Figure 2-4: Glaciofluvial material (ST25)

Site ST25 showed medium to coarse sand with approximately 30% of subrounded gravel.

Glaciolacustrine Deposits

This type of material is generally well-sorted and consists of heavy clay to silty clay, deposited by suspension into the former glacial lake basin. The sediments are compact, firm and generally massive; although in some areas they are finely laminated (rhythmic beddings). Dropstones released by melting icebergs may be present. Buried organic horizons are not associated with glaciolacustrine sediments due to the limited amount of vegetation that existed in glacial times.

Glaciolacustrine material occupies former topographic depressions. No glaciolacustrine deposits were found exposed at the surface. A shallow borehole drilling revealed the presence of such material at 2.5 meters below the surface. The material consisted of silt and clay (see permafrost section for detailed material description). The bottom of the units was not reached during the drilling.

2.1.1.3 Post-glacial Deposits

Lacustrine Deposits

Lacustrine deposits were mapped over only 1.5 percent of the Project area (most lacustrine deposits were found underlying organic accumulations. Lacustrine sediment consists of massive to poorly laminated silt and clay with minor amount of sand (Figure 2-5). They also include sandy to gravelly beach deposits formed by currents wave action along the Great Slave Lake. Most lacustrine deposits are found in topographic low and bedrock controlled depressions. The thicknesses of lacustrine deposits are highly variable and the material was commonly found underlying organic accumulations.

Figure 2-5: Lacustrine Material Found at Site ST25

Observation pit at site ST25. Material consists mostly of massive silt with minor clay and very fine sand.

Fluvial Deposits

Fluvial sediments are rare throughout the study area accounting for slightly more than one percent of all materials mapped. They consist mainly of moderately well to well sorted, fine sand and silt with a very low amount of sub-rounded to well rounded gravels and pebbles. Fluvial deposits are generally massive, but bedding and lamination with thin buried organic layers are not uncommon. Fluvial material observed in the field was usually less than one meter thick and their drainage ranged from moderate to poor.

Colluvial Deposits

Colluvial deposits are composed of angular to very angular material, deposited by gravity-induced mass movement. They consist mainly of blocky talus, characterized by the absence of fine grained matrix. The thickness of the colluvial deposits found within the Project area is generally thin (less than 2 m). All were characterized as well to rapidly drained. Colluvial deposits are mostly derived from the weathering (gelifraction) of local bedrock and are commonly found mantling the edges of bedrock ridges. The material is generally very coarse and angular, with an average clast size in the 20 to 50 cm range (Figure 2-6). These types of deposits are very rare within the study area, in relation with the relatively flat topography.

Figure 2-6: Blocky Colluvial Deposit

A very coarse colluvial deposit found along a bedrock ridge, east of Thor Lake. Material consists mostly of very angular blocks derived from the local bedrock.

Organic Deposits

Organic accumulations are common throughout the study area and account for 17.9% of the surficial materials. They generally occupy topographic lows, and either rest directly on bedrock or overlie poorly drained surficial deposits such as fine-grained lacustrine or glaciolacustrine material. In lesser occasions, organic material is found overlying fine-grained till deposits. Only organic accumulations greater than 40 cm thick have been mapped as 'organic'. Accumulations less than 40 cm thick have been mapped according to the underlying surficial material.

Organic accumulations form bogs and fens which host varying amounts of grasses, sedges and sphagnum mosses. The average depth of organics is about 80 cm, however some areas only have thin veneers (<50 cm) and others are characterized by deposits over 2 m thick. Drainage of the organic deposit units is considered very poor. More details with regard to the organic peat depths and landform types are found in Section 2.2 (Permafrost)

2.2 Permafrost

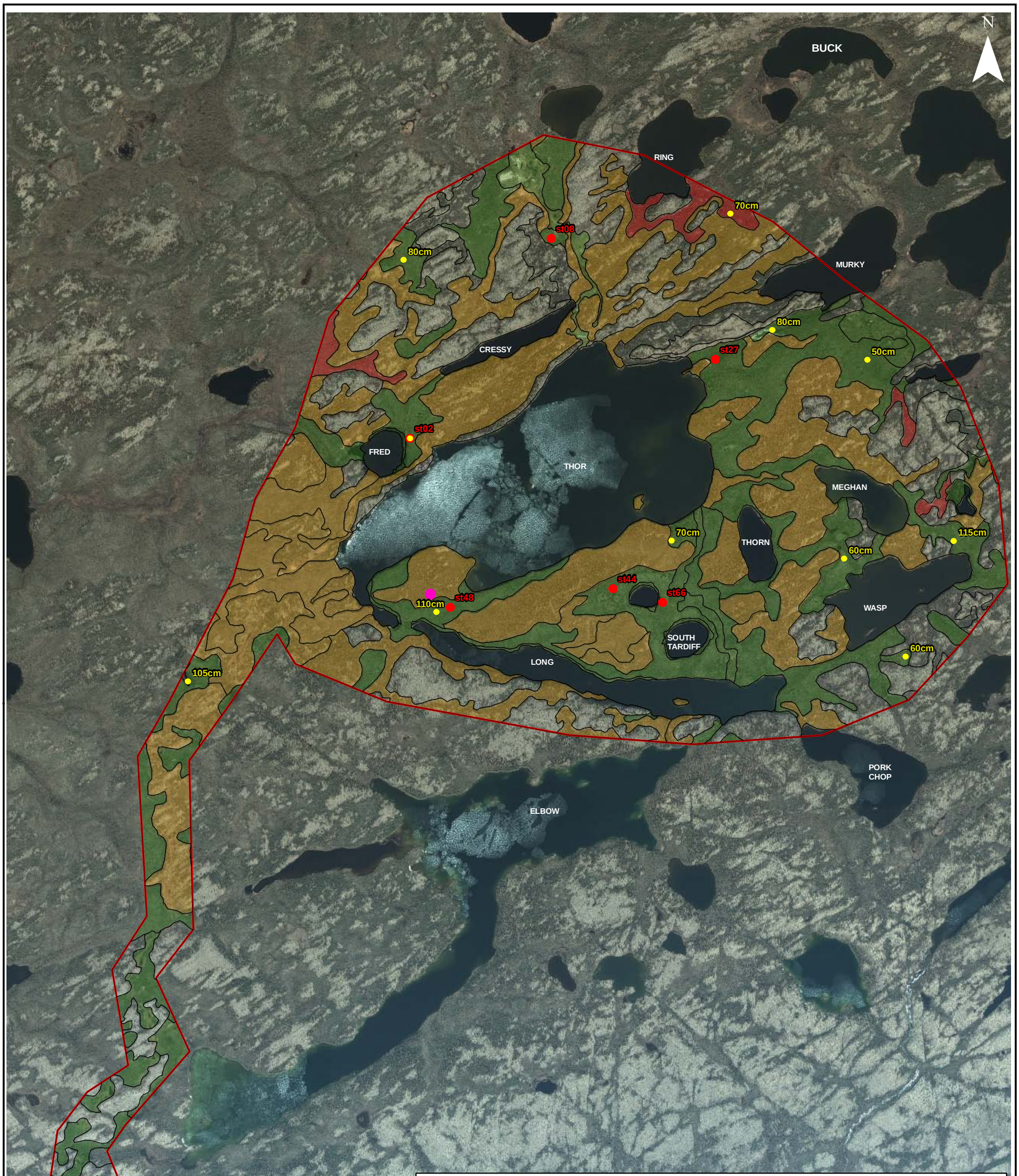
2.2.1 Permafrost Distribution and Landforms

The project site is located in the zone of extensive discontinuous permafrost. In this zone the spatial distribution of the permafrost is highly dependent on local factors. Factors promoting permafrost presence are thin snow cover, northern exposure, presence of a significant organic cover (>dm thick)

and fine-grained sediments (silt, clay). Terrain with southern exposure, coarse-grained sediments (clean sand and gravel, pebbles, boulders), thick snow cover and large/deep lakes (e.g., Thor Lake) are unlikely to support permafrost conditions (Figure 2-7).

At the project site, glacial troughs filled with till (Figure 2-2) having a fine-grained matrix, glaciolacustrine and lacustrine deposits as well as peatlands are very likely affected by ice-bonded permafrost. These deposits represent approximately 50 percent of the Project area. North facing rock outcrops are also possibly affected by permafrost. However, these outcrops do not represent a geotechnical concern as they only contain a limited amount of ice (if any) in fractures and are therefore thaw-stable.

Permafrost landforms in the Project area are essentially represented by the presence of frost-shattered bedrock and frost-heaved sediments forming small uplifted peat plateaus. Permafrost degradation landforms are represented by thaw lakes, thermokarst pits and collapsed fens and bogs. Bathymetric data collected as part of the fisheries baseline assessment and field observations of permafrost degradation along lake shorelines suggest South Tardiff, North Tardiff and Fred lakes are pure thaw lakes. The north-west and south-east portion of Meghan Lake as well as the eastern portion of Thor Lake also likely resulted from the degradation of ice-rich permafrost.



Draft Technical Data Report
Thor Lake Project, Nechalacho Deposit

Permafrost Distribution

AVALON RARE METALS INC.

0 0.25 0.5 1
Kilometres

PREPARED BY
Stantec

DRAFT DATE 14/01/2010			SCALE 1:20,000
REVISION DATE			PROJECT 1036222
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FIGURE NO. 2-7

2.2.2 Permafrost thermal regime and thickness

Table 2-2 and Figure 2-8 show the temperature profile of the active layer and near surface permafrost as measured in a borehole located on the periphery of Thor Lake. In the permafrost, the depth at which there is no discernable change in temperature is termed the "depth of zero annual amplitude" (NRC, Permafrost Subcommittee 1988). Measurements made on October 9 and 21, 2009 indicate that the depth of zero annual amplitude is located a few decimeters below the deepest thermistor bead. The temperature at the depth of zero annual amplitude is used to calculate the permafrost thickness using the following equation:

$$PMF_t = (T_{zaa}/G) + D_{zaa}$$

Where:

PMF_t is the permafrost thickness
T_{zaa} is the temperature at the depth of zero annual amplitude
G is the local geothermal gradient
D_{zaa} is the depth of zero annual amplitude.

The geothermal gradient at Thor Lake is unknown, but Yellowknife measured *G* is 12°C/km (Smith and Burgess 2000). Assuming a similar geothermal gradient at Thor Lake, the permafrost thickness at the location of the thermistor cable can then be estimated to be around 60 m. This is similar to reported permafrost thicknesses for sites with similar elevation at Yellowknife, Table Mountain, Great Bear River and Norman Wells (Smith and Burgess 2000). It should be mentioned that the permafrost thickness at the study site can vary in the order of several meters to tens of meters depending on local factors (e.g., water bodies, soil type, snow cover, exposures).

Table 2-2: Active Layer and Near Surface Permafrost Temperatures as Measured by a Thermistor Cable Located Near Thor Lake (see Figure 2-8)

Depth (mbg)	Reading (°C)	Reading (°C)
	09-Oct-09	21-Oct-09
0.413	-5.93	-4.03
-0.087	0.59	0.03
-0.587	1.04	0.04
-1.087	0.64	0.05
-1.587	0.15	0.03
-2.087	0.05	0.02
-3.087	-0.33	-0.31
-4.087	-0.46	-0.43
-6.587	-0.59	-0.58
-8.087	-0.62	-0.61
-11.087	-0.66	-0.66
-14.087	-0.75	-0.67

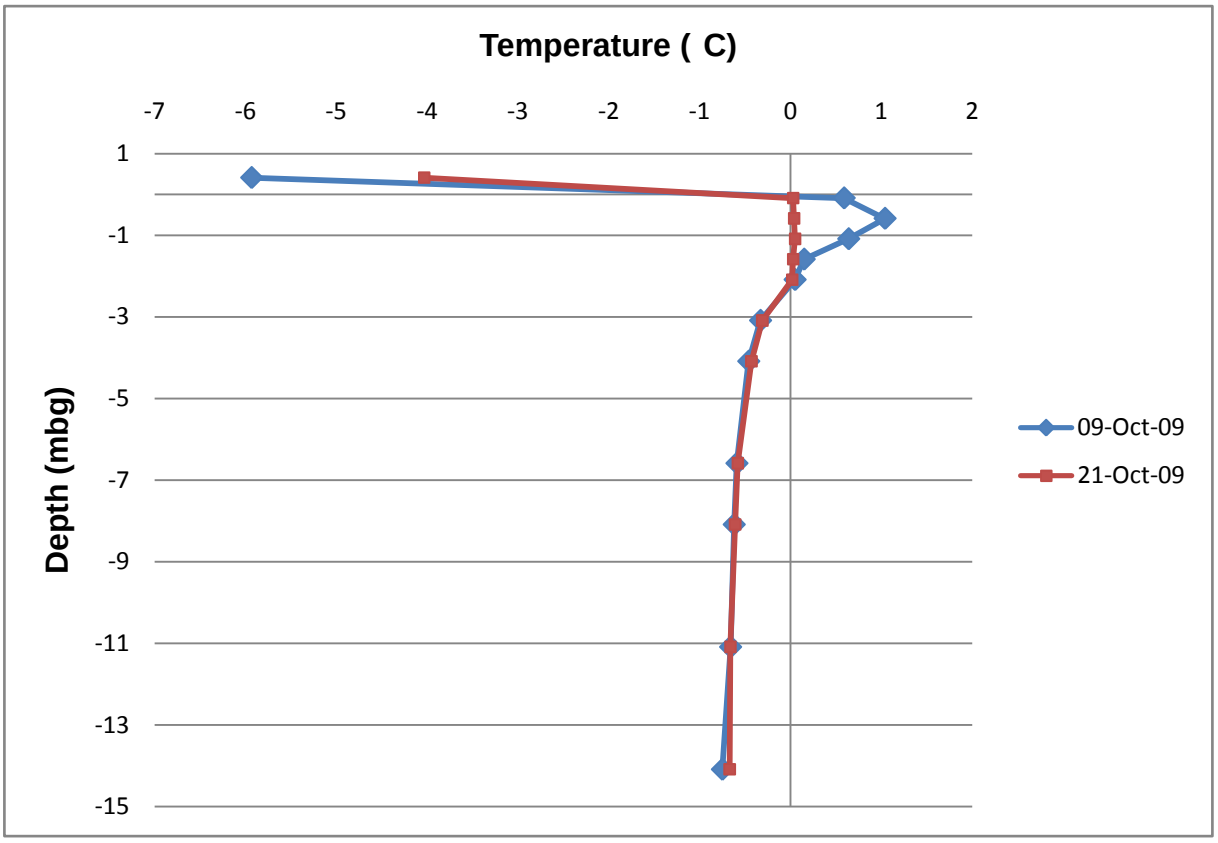

Figure 2-8: Temperature profile of the active layer and near surface permafrost

2.2.3 Active Layer Thickness

Sites with surficial deposits affected by permafrost have an active layer (the zone that freezes and thaws annually) that varies between about 40 and 200 cm. Variations in active layer thickness are related to local terrain factors, the most important being thickness of the organic cover and sediment texture. Sites with organic cover thicker than a few decimeters and underlain by fine-grained sediments (silt, clay, fine-grained till) usually have active layer in the order of 60 to 65 cm on average (n=12). In coarser sediments and in locations with thinner organic cover, the active layer will usually be thicker than 100 cm. In bedrock, the active layer can be a few meters thick.

2.2.4 Upper Permafrost Cryostructure, Ice Content and Thaw-Susceptibility

Five shallow boreholes indicate the near surface permafrost in the Project area is potentially very ice-rich and thus highly thaw-susceptible. From a geotechnical point of view, permafrost with

volumetric ice content over 40% are considered very problematic upon thawing as they initiate major geomorphic and environmental changes such as thaw-settlement, soil consolidation, impeded drainage, excess pore water pressure and mass movement.

2.2.4.1 Peat Accumulation

Significant decimeter to meter thick peat cover was encountered in several locations in the Project Area. These organic accumulations usually support permafrost, the latter usually extending down in the sedimentary deposit or bedrock below. Frozen peat is generally very ice-rich with volumetric ice content over 40% (gravimetric ice content over 100% is very common). Frozen peat is highly thaw-susceptible. Degradation and erosion of frozen peat is also very problematic as peat provides an isolative cover protecting the intrasedimentary permafrost. Removal and destruction of peat cover initiates positive feedback effects which accelerate permafrost degradation.

2.2.4.2 Glaciolacustrine Deposit

Glaciolacustrine silt deposits becoming finer in texture with depth were encountered in boreholes ST44 and ST46 (west of North Tardiff Lake). These deposits are covered by a fine to medium sand blanket a few decimeters thick and peat up to 1.7 m thick. The active layer thickness was 50 cm in borehole ST44 and 80 cm in borehole ST46. Below the active layer the peat has a porous cryostructure and is very ice-rich (60 – 70% volumetric ice content). The sediments have lenticular to reticulate cryostructures and are very ice-rich (40 – 75% volumetric ice content). Glaciolacustrine sediments are considered highly thaw-susceptible. This type of deposit is covered by either peat or various types of sediments and has not been observed directly at the surface. The extent, depth and thickness of glaciolacustrine deposits are unknown but presumably important as the area was covered by glacial Lake McConnell.

2.2.4.3 Lacustrine Deposit

A lacustrine silty sand deposit was encountered in borehole ST48 (south-west of Thor Lake). This deposit is covered by about 70 cm of peat. The active layer is located at the interface between the peat and the mineral sediments. The silts have lenticular to suspended cryostructures and are generally ice-rich (25 – 62% volumetric ice content). Lacustrine deposits are considered highly thaw-susceptible. This type of deposit is covered by either peat or various types of sediments and has not been observed directly at the surface. The extent and thickness of this type of deposit are unknown but presumably smaller than glaciolacustrine deposits as they are related to isolation phases of former glacial Lake McConnell

2.2.4.4 Till with Fine-grained Matrix

A till deposit with a silty matrix was encountered in borehole ST02 (east of Fred Lake). This deposit is covered by peat a few decimeters thick. The active layer thickness was 40 cm and located at the mineral interface. The sediments have reticulate to suspended cryostructures and are very ice-rich (>65% volumetric ice content) in the first meter but the ice content decreased with depth. This type of

deposit is presumably encountered at depth in several glacial troughs in the Project area. Locally this deposit has been washed out by waves of glacial Lake McConnell (see below).

2.2.4.5 Washed-out Till

A washed-out, coarse-grained till deposit was encountered in borehole ST08 (north of Thor Lake). This deposit was overlaid by about 75 cm of peat. The active layer was 55 cm thick. The peat has porous to micro-lenticular cryostructures and was very ice-rich (>480% gravimetric ice content, volumetric ice content not available). The sediment has a porous cryostructure and was ice-poor (<20% gravimetrictric ice content, volumetric ice content not available). Washed-out till deposits are considered thaw-stable.

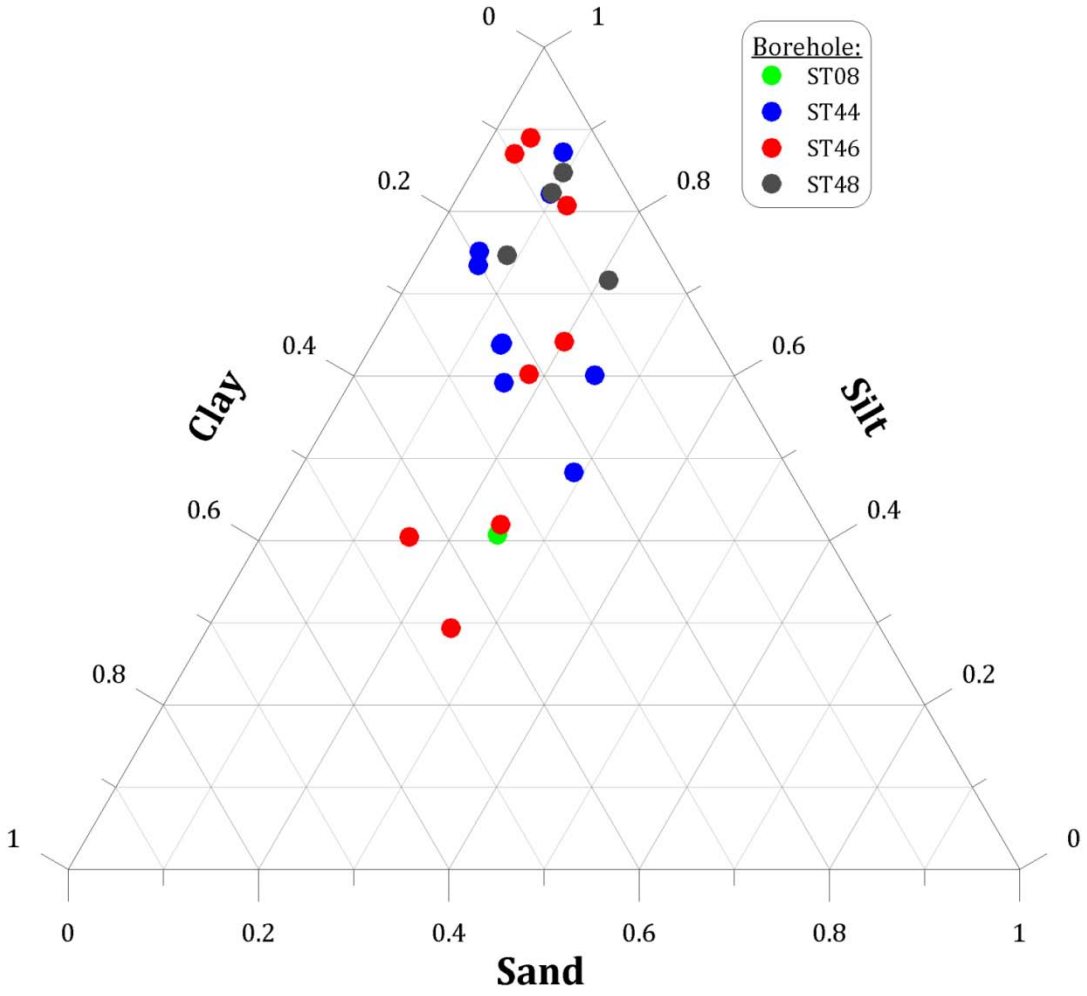

Figure 2-9: Selected sediment samples from the boreholes showing the fine-grained nature of glaciolacustrine (ST44, ST46), lacustrine (ST48) deposits and the coarse-grained nature of washed-out till (ST08) (see Appendix A for additional information)