



January 21, 2016

EDI Project No: 15Y0146

Assessment and Abandoned Mines Branch (AAM) K-149 Department of Energy, Mines and Resources, Yukon Government Room 2C Royal Center, 4114-4<sup>th</sup> Avenue PO 2703, Whitehorse, YT, Y1A 2C6

Attention: Erik Pit, Type II Project Manager

RE: Mount Nansen Water Resources Investigations – Monthly Report: December 2015

**FINAL** 

Trip dates:	December 14-15, 2015
EDI field staff:	Dawn Hansen, Joel MacFabe and Danny Skookum
Weather during trip:	Conditions for the three days included air temperatures from -24 to -15°C, with clear skies to light snow and calm to light wind conditions.

The following monthly report includes a summary of site conditions and data collected during EDI's December 2015 trip to Mount Nansen as part of the 2015/16 Water Resources Investigations. The December 2015 trip represents the second monitoring event of the winter season. See 0 for a summary of data included in this report.

Table 1. Summary of information provided in this monthly report.

Report Section	Description
Site Conditions	Summary of weather and general site conditions
Meteorology	<ul> <li>Statement on station status and identification of any data gaps or QA/QC issues</li> <li>Snow depth sensor QA/QC</li> </ul>
Hydrology	<ul> <li>Discussion of noteworthy hydrology observations for this month</li> <li>Statement of QA/QC for the data collected this month</li> </ul>
Water Quality	<ul> <li>Summary of noteworthy water quality observations for this month</li> <li>Statement on QA/QC sample results for this month</li> </ul>
Program Recommendations	Program recommendations for meteorological, hydrology and water quality programs
Additional Trip Information	<ul> <li>Project Safety Concerns</li> <li>Wildlife sightings</li> <li>Budget and schedule considerations</li> </ul>



Report Section	Description							
List of Attachments	Maps of stations and sites							
	• Site and station photos							
	Data Tables – hydrology and water quality							
	Water quality lab result reports							

### SITE CONDITIONS

The December 2015 site trip represented winter conditions at the Mount Nansen site. Air temperatures were cold, ranging from -24 to -15°C. Weather conditions ranged from clear skies to light snow, with calm to light winds. Ice cover was present across all watercourses and waterbodies, with ice thickness ranging from 1 cm to 70 cm. Water levels were lower than during the October and November 2015 trips. Stations and sites along Pony Creek, Back Creek and Dome Creek remain frozen to bed.

### **METEOROLOGY**

Meteorological data was collected at the ATM-ROAD station throughout the month of December 2015. EDI conducted a preliminary QA/QC review of the December 2015 data. All sensors appear to be functioning as expected, with the possible exception of the longwave radiation sensor. This sensor produced anomalous readings from December 6 to 29, 2015 then returned to what appear to be normal readings. The condition of the sensor will be checked visually by EDI staff during the January 2016 field visit (as this sensor sits outside the meteorological station compound). There was snow on site during the December investigation, which corresponded with a snow sensor measurement of 27.1 cm on December 15, 2015 (Table 2). This indicates that to date, the snow sensor appears to be slightly underestimating snow depth, however there is likely enough spatial variability of the snow distribution and ground surface elevation in the vicinity of the meteorological station that would account for the differences. Meteorological data for the winter season (October 15, 2015 to March 31, 2016) will be summarized and reported on in the March 2016 monthly report, which will include the seasonal analysis.

Table 2. Comparison of snow depth measured at the site with the snow sensor measurement.

Measurement Date/Time	Manual Snow Depth Measurement near Station (cm)	Meteorological Station Snow Sensor Measurement (cm)	Snow Sensor Quality <sup>1</sup>	Difference (cm)
October 13, 2015 1:00 pm	0.0	0.6	181 (Good)	0.6
November 16, 2015 2:20 pm	20.0	18.2	185 (Good)	1.8
December 15, 2015 6:05 pm	29.1	27.1	182 (Good)	2.0

Note:

<sup>&</sup>lt;sup>1</sup>- Quality numbers provide an indication of surface density in snow monitoring applications. Values will increase during snowfall events consisting of low-density snow. Quality Numbers: 0 = Not able to read distance; 152-210 = Good Measurement Quality Numbers; 210-300= Reduced Echo Signal Strength; 300-600 = High measurement uncertainty



### **HYDROLOGY**

Discharge measurements were collected at all stations with suitable conditions during the December 2015 trip. Water levels were lower throughout the Mount Nansen Site than during the November 2015 trip. Hydrology stations at H-PC-DSP, H-BC, H-DC-B, H-DC-R and H-DC-D1b were frozen to substrate. Continuous water level records are available for five stations for the period up to December 14, 2015: H-VC-U, H-VC-DBC, H-VC-UMN, H-VC-R and H-VC-R+290. Data could not be downloaded from the continuous water level logger at H-DC-M WP because of a damaged direct-read cable attached to the logger. This cable will be replaced and the data will be downloaded from the logger during the next field visit if possible. All collected data will remain stored within the internal memory of the loggers therefore there will be no data gaps resulting from this issue.

See attached data tables for a summary of surface water conditions and hydrometric monitoring tasks completed at each station for December 2015 (Attachment 3). Quality control and quality assurance was conducted for all hydrometric data. Noteworthy observations are included below.

### Noteworthy Observations

- The barologger installed along Victoria Creek at ATM-VC5 appears to be malfunctioning. From a preliminary review of the logger, the digital timestamps began drifting after the October 2015 field visit. An additional barologger will be installed at this location during the January 2016 field visit and the condition of the existing barologger will be assessed. Any gaps that exist in the barologger record will be filled using the barometer data from the Mount Nansen meteorological station.
- Discharge measurements were collected with an ADV at all Victoria Creek stations, H-VC-U, H-VC-DBC, H-VC-UMN H-VC-R and H-VC-R+290 with discharge values ranging from 0.082 to 0.100 m<sup>3</sup>/s. These values were lower than the flows observed in November 2015 which ranged from 0.148 to 0.176 m<sup>3</sup>/s.
  - O A preliminary review of the discharge values from the Victoria Creek stations in December 2015 show that the measured discharge at H-VC-DBC (0.100 m³/s) is greater than at the downstream station at H-VC-UMN (0.090 m³/s). Similarly, the discharge at H-VC-UMN is greater than the discharge downstream at H-VC-R (0.096 m³/s). Typically, discharge increases in the downstream direction as the contributing watershed area increases, therefore this decreasing winter flow pattern may indicate that the Victoria Creek reaches are losing surface flow to groundwater. Similar discharge patterns have been previously noted along Victoria Creek in July 2014, May 2015, June 2015, July 2015 and November 2015. A more detailed review of the local hydrology along Victoria Creek will be completed at the end of the winter season when additional low flow data is available.



- Placer mining construction works upstream of the H-PC-DSP site have stopped. No water was
  flowing over or through the embankment of the settling pond. The Pony Creek hydrometric site
  was frozen to bed. Multiple pieces of heavy equipment remain on site. Trenches in the ice
  around some equipment were excavated prior to the site visit.
- Instantaneous volumetric discharge measurements were collected at H-DC-DX+105 and H-DC-M WP with discharges of 0.001 and 0.003 m<sup>3</sup>/s, respectively. At H-DC-M WP all water was flowing through the weir; however the stilling well was encased in frozen sediment and ice. Concerns remain that the sedimentation is producing channel instability, rating curve shifts and continuous stage data errors for this station. Additional excavation may be required in the spring of 2016.
- Overflow ice conditions were present along Dome Creek in the vicinity of H-DC-R, H-DC-B and upstream of H-DC-M WP. The H-DC-B and H-DC-R stations were frozen to bed, no measurements could be collected.

### **WATER QUALITY**

Water quality samples and data were collected at the regularly scheduled sites during the December 2015 trip. A total of 13 normally scheduled sites were visited, with 9 sites sampled. As noted above in the 'Site Conditions' section, the WQ-CH-P-13-01, WQ-DC-B, and WQ-DC-R sites had frozen to substrate for the winter since the November 2015 visit. The regular monthly drinking water sample was collected from the pumphouse well (WQ-PW). All samples were submitted for analysis through ALS Laboratories.

See the attached data tables for a summary of conditions at each site and a record of where samples were collected during each trip (Attachment 3). In-situ and laboratory results summary tables are also attached. Parameters that exceeded the Canadian Council of Ministers of the Environment Freshwater Aquatic Life (CCME-AL) guidelines and/or the Mount Nansen Effluent Quality Standards (EQS) criteria are highlighted. The lab certificates of analysis are also attached in Attachment 4. Many results reflect typical conditions for this time of year at Mount Nansen where water levels have decreased and watercourses are covered in ice. Noteworthy observations and comments on sample QA/QC are included in the subsections below.

### Noteworthy Observations

- The WQ-CH-P-13-01, WQ-DC-B and WQ-DC-R had all frozen to substrate since the last trip.
  The WQ-DC-R and WQ-DC-B had thick ice and overflow conditions, with no flowing water.
  This is typical for the winter season, with these sites remaining frozen through the winter, aside from the WQ-DC-B site that can occasionally flow when ice dredging occurs in the diversion channel.
- The four Victoria Creek samples did not exceed any guidelines or standard criteria during the December 2015 trip this is similar to the November and October 2015 results.



- The total zinc concentration in the December 2015 WQ-SEEP sample was above the CCME-AL guideline with a concentration of 0.112 mg/L. This is a small increase from the November 2015 sample result of 0.103 mg/L. It is likely concentrations will continue to increase as water levels decrease and ions become more concentrated in the water column through the winter. This site also commonly exceeds the guidelines and/or standards for ammonia, arsenic, cadmium, iron, and manganese.
- The WQ-DC-U site downstream of the WQ-DC-B and WQ-SEEP stations exceeded the guidelines and/or standards for ammonia, arsenic, iron, manganese and zinc (which is common in the winter months).

### QA/QC Samples

**Travel Blank Sample** – The travel blank had all parameters below detection limits, except for total chromium. Parameters above detection limits suggest that contamination from transportation and/or storage may have occurred; however, total chromium concentrations for all other samples appear to be within their normal range, thus there are no concerns for sample contamination. The lab is currently investigating potential reasons for the chromium concentration above the detection limit - it may be related to the sample being dated (similar to what occurs occasionally with the ammonia concentrations in some travel blank samples).

Field Blank Sample – all parameters were below detection limits.

**Replicate Sample(s)** – The average relative percent difference (RPD) of the replicate sample set for WQ-DC-DX+105-r was 2%, indicating that sample analysis was adequately precise (RPD<20%). The average RPD for total metals in the replicate sample set was 3% and the average RPD for dissolved metals was 1%. All individual parameters had RPD less than 20% or below detection limits.

### PROGRAM RECOMMENDATIONS

- During each winter trip, collect photographs and snow depths adjacent to the meteorological station compound to confirm snow sensor data.
- Monitor sediment deposition in the H-DC-M WP station weir pond and recommend excavation as required. Also monitor ice build-up at the H-DC-M WP station and WQ-DC-U site.
- Continue to monitor water quality at the WQ-SEEP zinc concentrations have been increasing along with other parameters and it is likely they will continue to do so through the winter. LC50 samples will be collected again in February 2016.
- Conduct concurrent ADV and salt tracer discharge measurement tests at select Victoria Creek stations from January to March 2016, where possible, to continue to validate the salt tracer method.
- Revisit sites/stations that have frozen to substrate in March 2016 (depending on spring weather conditions). It is common for many areas to remain frozen to substrate through April and May. This likely applies to WQ-DC-DX, H/WQ-DC-D1b, WQ-PC-U, WQ-PC-D, H-PC-DSP,



H/WQ-BC, H/WQ-DC-R,H/WQ-DC-B and WQ-CH-P-13-01; as well as the other seeps that have been dry most or all of the 2015 open water season – WQ-ADIT-SEEP, WQ-LW-SEEP-01, WQ-MS-S-08.

• Visually inspect the condition of the longwave radiation sensor at the meteorological sensor on the January 2016 trip – look for any unusual frost/snow build-up and take photos if necessary.

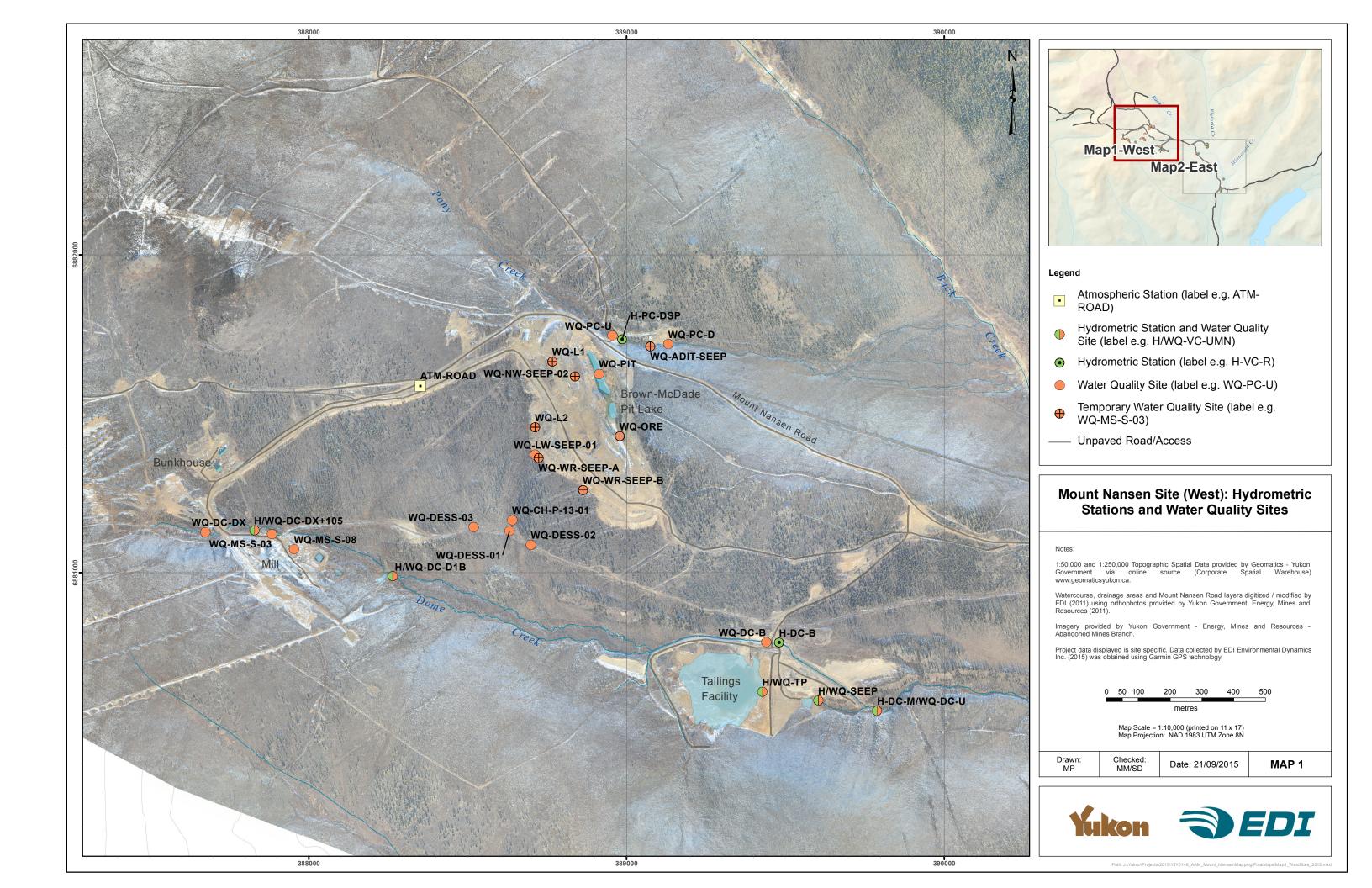
### ADDITIONAL TRIP INFORMATION

Any changes to project scope (i.e.	None. All sampling and monitoring was conducted within scope. The trip took two days versus the typical three days, as the number of sites/stations is reduced in the winter.
additional sites sampled):	The next trip is scheduled for January 12/13, 2015, and will be the third winter season trip.
· · · · · · · · · · · · · · · · · · ·	As discussed below a replacement direct read cable will need to be purchased for the H-DC-M WP station (estimated cost: \$100). There is remaining budget in the contingency fund for the project which could cover this cost.
Any alterations to sample schedule/budget:	None.
Additional	The direct read cable for the logger at the H-DC-M WP station appears to be broken, as data could not be downloaded at this station during the November 2015 or December 2015 trip. A replacement direct read cable has since been purchased and will be installed as soon as possible.
Comments:	The barologger installed at ATM-VC5 may be malfunctioning. Data downloaded during the November and December trips indicate that the timestamps on the logger are drifting. A new barologger will be installed at the station in January 2016 and the condition of the existing barologger will be assessed.
Wildlife Sightings:	None.
Site concerns (safety):	None.

### LIST OF ATTACHMENTS

The following information is attached to this monthly report:

- 1. Maps of Hydrometric Stations and Water Quality Sites
- 2. Site and Station Photos from the trip
- 3. Data Tables
  - a. Hydrology Site Conditions and Tasks Completed & Summary Table of Discharge Measurements.
  - b. Water Quality Site Conditions and Samples Collected & Summary Table of In Situ Parameters and Lab Results
- 4. Copies of Lab Certificate of Analysis (COA) & Yukon Environmental Health Services Bacteriological Results (November 2015).



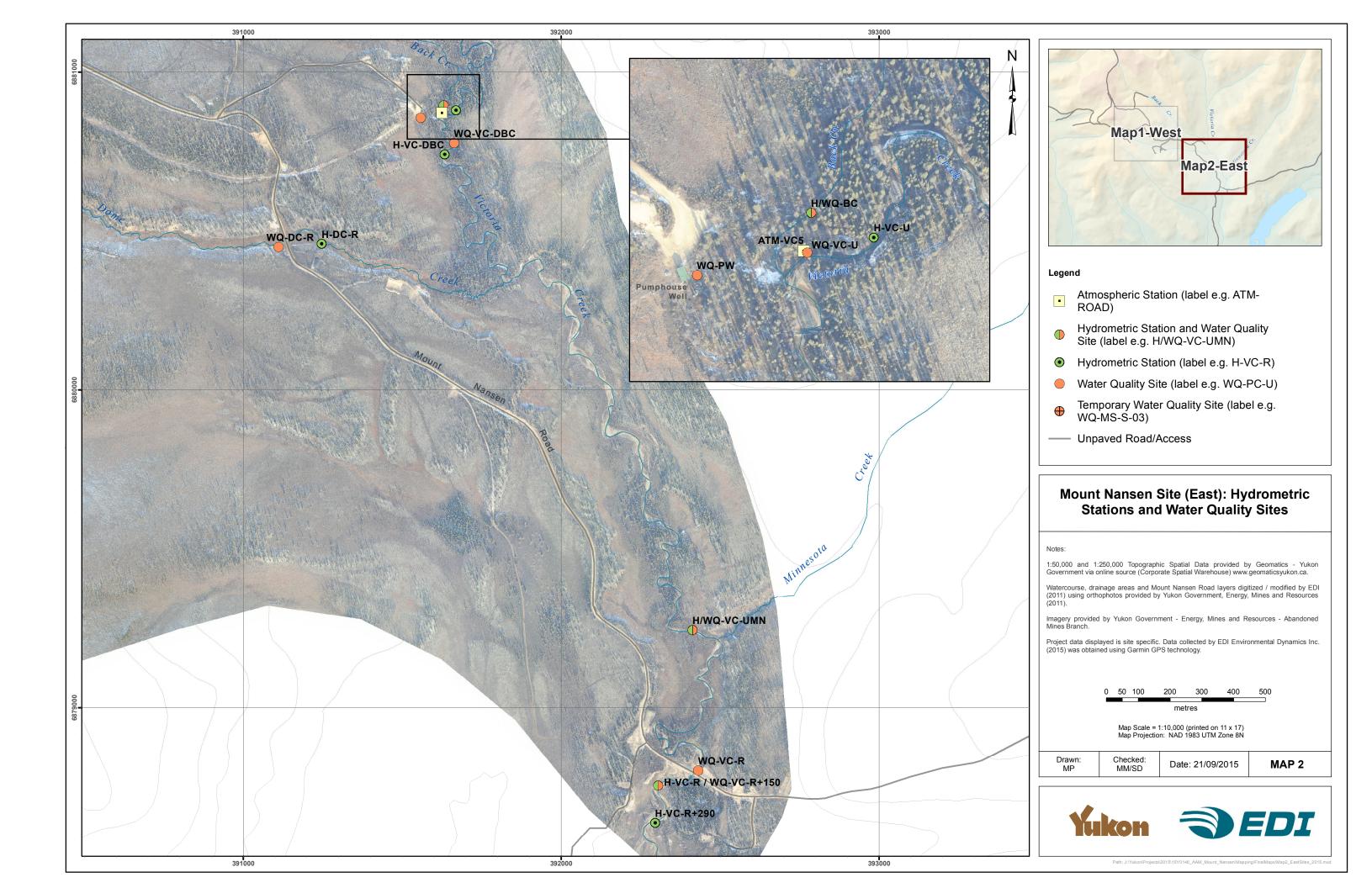






Photo 1. H/WQ-DC-DX+105 – looking upstream.



Photo 2. H/WQ-DC-B – looking upstream. Site frozen to bed.



Photo 3. H/WQ-DC-B – looking downstream. Site frozen to bed.



Photo 4. H-DC-M WP – upstream of station. Looking at overflow ice between H-SEEP and weir pond.



Photo 5. WQ-DC-U looking downstream.



Photo 6. H-DC-R – looking upstream. Site frozen to bed. Overflow ice conditions at site.





Photo 7. H-DC-R – overview. Site frozen to bed. Overflow ice at site.



Photo 8. WQ-DC-R - looking upstream. Site frozen to bed. Overflow ice at site.



Photo 9. WQ-CH-P-13-01 – looking upstream. Site frozen to bed.



Photo 10. H/WQ-SEEP- pipe moved to collect sample.



Photo 11. H/WQ-TP – overview sample site.



Photo 12. H/WQ-BC – looking upstream. Site remains dry.





Photo 13. WQ-VC-U – looking downstream.



Photo 14. H-VC-U – looking upstream.



Photo 15. WQ-VC-DBC – looking upstream.



Photo 16. WQ-VC-DBC – looking upstream.



Photo 17. H/WQ-VC-UMN – looking upstream.



Photo 18. H-VC-UMN – looking downstream.





Photo 19. WQ-VC-R+150 – looking upstream at sampling location near H-VC-R+290.



Photo 20. H-VC-R - looking downstream.



Photo 21. H-VC-R+290 – looking downstream.



Photo 22. H/WQ-PW – overview.



Photo 23. Met station snow depth.



Monthly Report Attachment 3: Data Tables

Measurement ID	Hydrometric Identifier (HID)	Measurement Date	Measurement Time	Discharge Measurement Method	Discharge (m³/s)	Discharge Data Flag	Surveyed Water Elevation (m)	Survey Data Flag	Comments
403	ATM-VC5	15/12/2015		N		х			Logger downloaded at 14:32. Ice observed on the logger and in the bottom of the PVC case due to broken cap. Removed ice from the logger and repaired PVC case. Timestamp dates on logger are offset from known download time. Will investigate time stamps next trip and assess whether logger needs to be repaired.
409	H-DC-DX+105	15/12/2015	10:35	V	0.001				Open leads in some sections, but it is mostly ice covered. Volumetric discharge measurement was completed.
405	H-DC-B	15/12/2015	09:10	N		х		N	Multiple holes augured and chipped through ice along typical measurement reach in channel. Channel frozed to bed below 0.6 to 0.7 m of ice. Denison Environmental Services reported that flow is backing up at the corner upstream of the bridge.
407	H-SEEP	14/12/2015	17:45	v	0.003				Volumetric discharge measurement collected from outlet pipe. Site appears normal. Seepage pond pumphouse at 17:51 flow was 133.698 Litres/minute (0.002 m3/s).
406	H-DC-M WP	14/12/2015	17:15	v	0.003			N	Weir pond covered with ice. All water flows through V-notch weir. Thin layer of ice was cleared to access flow at V-notch. Unable to download data from logger due to suspected problem with direct read cable. Logger continues to log. Overflow ice is building up and moving downstream.
404	H-DC-R	14/12/2015	15:25	N		х			Overflow ice conditions upstream and downstream of the road crossing. Channel is unconfined with substantial overflow present at the hydrology measuement area. Ice thickness varies from 0.4 to 0.7 m. No flow observed downstream of the road. Frozen seep on right downstream bank along valley wall. No measurements collected.
398	H-VC-U	15/12/2015	15:50	ADV-MID	0.084	В		N	Channel covered with ice with variable thickness. ADV cross section completed.
408	H-PW	15/12/2015	15:05	v	0.003				Site appears normal. No substantial ice build up. Volumetric discharge measurement collected.
399	H-VC-DBC	15/12/2015	14:26	ADV-MID	0.100	В		N	ice covers entire channel. Channel conditions typical for this time of year. ADV cross section completed.
400	H-VC-UMN	15/12/2015	12:41	ADV-MID	0.090	В		N	Ice covers entire channel with varying thickness. Ice was sufficiently thick to walk across approximately 50 m downstream of stilling well; upstream of the stilling well the ice was too thin to walk across. ADV cross section completed.
401	H-VC-R	14/12/2015	15:27	ADV-MID	0.096	В		N	ADV cross section completed. Water depth to substrate ratio large resulting in higher than normal measurement uncertainty.
402	H-VC-R+290	14/12/2015	14:11	ADV-MID	0.082	В		N	Conducted ADV measurement downstream of the stilling well. Large section of ice cover removed to reduce backwater effect for measurement. All flow contained in a single channel along the left downstream bank, right bank side of channel frozen to bed.



Discharge Measurement Method Legend

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Measurement Method ID	Measurement Method	Measurement Description
ADV-MID	Mid Section Method - Acoustic Doppler Velocimeter	Cross-sectional velocity using an ADV, mid-section method.
SS	Brine Salt Slug Tracer	Salt dilution gauging using a brine salt slug.
V	Volumetric	Volumetric measurement obtained by filling a graduated contained at a culvert, pipe outlet or weir.
W	Weir	Measurement obtained by a rated structure (v-notch weir).
N	None	No measurement could be obtained.
SD	Dry Salt Slug Tracer	Salt dilution gauging using a dry salt slug.
HWM	High Water Mark - Indirect Method	Indirect method using high water mark in the slope-area calculation for estimating high discharges.
ADCP	Acoustic Doppler Current Profiler	Cross-sectional velocity using an ADCP, mid-section method.
SC	Constant Rate Salt Tracer	Salt dilution gauging using the constant rate method.
CM-MID	Mid Section Method - Current Meter	Cross-sectional velocity using a velocimeter (Swoffer or Pygmy AA)

### Discharge Data Flag Legend

Discharge Data Flag	Discharge Data Flag Description
E	Estimated value
В	Backwater effects (ice related)
F	Instrument malfunction
M	Manual measurement
Α	Automated measurement (logged)
ML	Missing length data
MD	Missing depth data
MW	Missing width data
0	Outside of measurement reporting range
P	Potential Place Mining Interference with Flow
S	Suspect data
x	Poor channel conditions for discharge measurement
MI	Missing Data
SH-L	Data logger Shift
SH-SG	Staff Gauge Shift
UR	Under review

### Survey Data Flag Legend

Survey Flag	Survey Flag Description
S	Suspect data
MI	Missing data
UR	Under review
F	Instrument Malfunction
0	Outside measurement Accuracy (+/-0.003 m)
N	No survey conducted

### Hydrometric Stations

Hydrometric Stations	
Hydrometric ID	Hydrometric Stations
ATM-VC5	Atmospheric Barologger (5) at Victoria Creek
H-BC	Back Creek
H-DC-B	Diversion Channel at Bridge
H-DC-D1B	Dome Creek at D1b
H-DC-DX	Dome Creek at DX
H-DC-DX+105	Dome Creek at DX+105
H-DC-M-WP	Middle Dome Creek at Weir Pond
H-DC-R	Dome Creek at Road
H-PC-DSP	Pony Creek Downstream of Pit
H-SEEP	Seepage Pond Outflow
H-TP	Tailings Pond
H-VC-DBC	Victoria Creek Downstream of Back Creek
H-VC-R	Victoria Creek at Road
H-VC-U	Upper Victoria Creek
H-VC-UMN	Victoria Creek Upstream of Minnesota Creek



Water Quality Site	Sample Collected? (Y/N)	Measurement Date	Comments
WQ-BC	N	15-Dec-15	Sample hole in ice from previous trip still open and site remains dry. Approx 4cm fresh snow in hole.
WQ-CH-P-13-01	N	15-Dec-15	Site is frozen to bed. No sign of water in immediate area to indicate that flow is redirected.
WQ-DC-B	N	15-Dec-15	Augured hole in usual sample location and site was frozen to bed, augured additional holes downstream and channel remains frozen to bed. Cannot hear water or detect water seepage anywhere at the site - considered dry/ frozen for this trip.
WQ-DC-DX+105	N	15-Dec-15	Channel has open leads upstream of typical sample site.
WQ-DC-R	N	14-Dec-15	Chipped down 70 cm and did not find water. Lots of overflow in area. Could not hear water. Overflow has not yet covered the road but it is also present on the downstream side of the crossing.
WQ-DC-U	Y	14-Dec-15	Overflow ice starting to form upstream of weir pond (coming from seepage discharge and diversion channel, no overflow at weir pond or downstream at WQ site.
WQ-PW	Y	15-Dec-15	Conditions normal for time of year. Ice around pipe oulet.
WQ-SEEP	Y	14-Dec-15	Regular samples collected - conditions appear normal. Some ice build up around culvert and pipe outlet.
WQ-TP	Υ	14-Dec-15	The tailings pond has 100% snow and ice cover.
WQ-VC-DBC	Y	15-Dec-15	No open leads in area but visibly thinner ice just up and downstream of water quality site.
WQ-VC-R	N	14-Dec-15	Frozen to bed - thick overflow ice. Samples now collected from winter location at WQ-VC-R+150.
WQ-VC-R+150	Y	14-Dec-15	Ice thickness 10-20cm think. WQ collected at winter sampling location. Over flow conditions observed upstream of culvert at WQ-VC-R.
WQ-VC-U	Y	15-Dec-15	No open leads up or downstream but thinner ice observed both up and downstream. Site conditions seem normal for this time of year.
WQ-VC-UMN	Y	15-Dec-15	Ice has variable thickness from 1-8cm across channel.
QA/QC Samples			
Replicate 1	Y	15-Dec-15	Replicate collected at WQ-DC-DX+105 (sample ID WQ-DC-DX+105-r).
Field Blank	Y	14-Dec-15	Sample bottles filled with deionized water supplied by ALS; samples were filtered and preserved as instructed. Collected at WQ-VC-R+150.
Travel Blank	Y	14-Dec-15	Samples provided by lab and were transported to and from site.



Water Quality										NAC HERRING IN. ETHOMOCA THE							
Summary of Water Quality Results for the December 14	4-15, 2015	Trip.	Mount Nansen	Sample ID/Site ID	WQ-VC-U	WQ-VC-DBC	WQ-VC-UMN	WQ-VC-R+150	WQ-DC-DX+105	WQ-DC-DX+105-r	QA/QC	WQ-TP	WQ-SEEP	WQ-DC-U	WQ-PW **	FIELD BLANK	TRAVEL BLANK
Analyte	Units	CCME-WATER	-F- Effluent Discharge	Date Sampled		12/15/2015 1:50:00 PM	12/15/2015 12:35:00 PM	12/14/2015 1:55:00 PM	12/15/2015 10:05:00 AM	12/15/2015 10:30:00 AM	WQ-DC-DX+105-r Replicate Analysis	12/14/2015 6:15:00 PM	12/14/2015 5:40:00 PM	12/14/2015 4:55:00 PM	12/15/2015 3:00:00 PM	12/14/2015 2:25:00 PM	TRAVEL BLANK
mperature (in-situ)	°c		Standards	Detection Limit	0.1	0.0	0.0	0.0	0.5		-	1.4	0.6	0.1	0.3	-	
cific Conductivity (in-situ)	μS/cm			-	224.7	226.2	248.2	245.4	1172.0			1900	1667.0	1612	345.0		-
(in-situ) colved Oxygen (in-situ )	pH mg/L	6.5 - 9.0	6.0 - 8.5	-	7.36 10.4	7.35 10.22	7.55 10.72	7.11 10.47	7.06	-	-	7.57 6.07	7.17 7.65	7.34	7.6 10.3	-	
bidity (In-situ)	NTU	-	-	-	0.23	0.75	0.48	0.08	1.87		-	3.6	26.90	13.91	0.1	-	-
our, True	CU μS/cm	15	-	5	229	230	255	250	1180	1180	- 0%	1880	1630	1610	<5.0 346	<2.0	<2.0
nductivity rdness (as CaCO3)	mg/L	-	-	0.5	117	118	127	125	699	693	1%	1120	898	898	184	<0.50	<0.50
(lab)	pH	6.5 - 9.0	6.0 - 8.5	0.1	7.65	7.66	7.87	7.71	7.41	7.42	0%	7.82	7.25	7.7	7.93	6.02	5.58
tal Suspended Solids tal Dissolved Solids	mg/L mg/L	-	50	3	<3.0 121	<3.0 121	<3.0 137	<3.0 134	<3.0 821	<3.0 818	<dl 0%</dl 	<3.0 1560	37 1250	22 1210	192	<3.0 <1.0	<3.0 <1.0
kalinity, Bicarbonate (as CaCO3)	mg/L		-	1	93	91	96.2	93.1	263	265	1%	155	251	252	- 192	1	<1.0
kalinity, Carbonate (as CaCO3)	mg/L	-	-	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<dl< td=""><td>&lt;1.0</td><td>&lt;1.0</td><td>&lt;1.0</td><td></td><td>&lt;1.0</td><td>&lt;1.0</td></dl<>	<1.0	<1.0	<1.0		<1.0	<1.0
kalinity, Hydroxide (as CaCO3) kalinity, Total (as CaCO3)	mg/L mg/L	-	-	1	<1.0 93	<1.0 91	<1.0 96.2	<1.0 93.1	<1.0 263	<1.0 265	<dl 1%</dl 	<1.0 155	<1.0 251	<1.0 252	159	<1.0	<1.0 <1.0
nmonia, Total (as N)	mg/L	0.75	-	0.005	<0.0050	<0.0050	<0.0050	<0.0050	0.0167	0.0165	<2xDL	0.469	4.61	3.93	-	<0.0050	<0.0050
loride (CI)	mg/L	120	-	0.5 0.02	<0.50 0.043	<0.50 0.045	<0.50	<0.50 0.046	<1.0	<1.0	<dl< td=""><td>&lt;2.5</td><td>&lt;2.5</td><td>&lt;2.5</td><td>&lt;0.50 0.092</td><td>&lt;0.50 &lt;0.020</td><td>&lt;0.50 &lt;0.020</td></dl<>	<2.5	<2.5	<2.5	<0.50 0.092	<0.50 <0.020	<0.50 <0.020
uoride (F) trate (as N)	mg/L mg/L	0.12	-	0.02	0.043	0.045	0.046 0.173	0.046	0.171 <0.010	0.168 <0.010	2% <dl< td=""><td><b>0.23</b> 0.196</td><td>&lt;0.10 0.867</td><td>&lt;0.10 0.482</td><td>0.092</td><td>&lt;0.020</td><td>&lt;0.020</td></dl<>	<b>0.23</b> 0.196	<0.10 0.867	<0.10 0.482	0.092	<0.020	<0.020
trite (as N)	mg/L	0.06	-	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0020	<0.0020	<dl< td=""><td>&lt;0.0050</td><td>0.0124</td><td>0.0102</td><td>&lt;0.0010</td><td>&lt;0.0010</td><td>&lt;0.0010</td></dl<>	<0.0050	0.0124	0.0102	<0.0010	<0.0010	<0.0010
ulfate (SO4)	mg/L	-	-	0.3	20.9	21.1	30.5	30.6	412	410	0%	1020	710	689	28.4	<0.30	<0.30
ranide, Weak Acid Diss ranide, Total	mg/L mg/L	-	0.1	0.005	<0.0050 <0.0050	<0.0050 <0.0050	<0.0050 <0.0050	<0.0050 <0.0050	<0.0050 <0.0050	<0.0050 <0.0050	<dl <dl< td=""><td>&lt;0.0050 &lt;0.0050</td><td>0.0152 0.0669</td><td>0.018 0.0404</td><td></td><td>&lt;0.0050 &lt;0.0050</td><td>&lt;0.0050 &lt;0.0050</td></dl<></dl 	<0.0050 <0.0050	0.0152 0.0669	0.018 0.0404		<0.0050 <0.0050	<0.0050 <0.0050
yanate	mg/L		-	0.2	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<dl< td=""><td>0.97</td><td>1.08</td><td>&lt;0.20</td><td></td><td>&lt;0.20</td><td>&lt;0.20</td></dl<>	0.97	1.08	<0.20		<0.20	<0.20
niocyanate (SCN) uminum (Al)-Total	mg/L	0.1	-	0.5	<0.50 0.0109	<0.50 0.0095	<0.50 0.0204	<0.50 0.0149	<0.50 0.0038	<0.50 0.0038	<dl &lt;2xDL</dl 	<0.50 0.0225	4.35 0.017	2.54 0.0974	<0.010	<0.50 <0.0030	<0.50 <0.0030
ntimony (Sb)-Total	mg/L mg/L	- 0.1	0.15	0.003	<0.00010	0.0095	0.0204	0.0149	0.0102	0.0105	<2xDL 3%	0.0225	0.017	0.0974	<0.000	<0.0030	<0.0030
senic (As)-Total	mg/L	0.005	-	0.0001	0.00027	0.00029	0.00138	0.00125	0.0412	0.0419	2%	0.146	0.0682	0.0484	0.0004	<0.00010	<0.00010
erium (Ba)-Total eryllium (Be)-Total	mg/L mg/l	-	1.0	0.00005	0.0784 <0.000020	0.0807 <0.000020	0.0752 <0.000020	0.0741 <0.000020	0.0114 <0.000020	0.0121 <0.000020	6% <dl< td=""><td>0.0216 &lt;0.00040</td><td>0.0618 &lt;0.000020</td><td>0.0737 &lt;0.000020</td><td>0.081</td><td>&lt;0.000050 &lt;0.000020</td><td>&lt;0.000050 &lt;0.000020</td></dl<>	0.0216 <0.00040	0.0618 <0.000020	0.0737 <0.000020	0.081	<0.000050 <0.000020	<0.000050 <0.000020
ismuth (Bi)-Total	mg/L mg/L		-	0.00002	<0.000050	0.000020	<0.000020	<0.000050	<0.000020	<0.000020	<dl <dl< td=""><td>&lt;0.00010</td><td>&lt;0.000020</td><td>&lt;0.000020</td><td><u> </u></td><td>&lt;0.000020</td><td>&lt;0.000050</td></dl<></dl 	<0.00010	<0.000020	<0.000020	<u> </u>	<0.000020	<0.000050
oron (B)-Total	mg/L	-	-	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<dl< td=""><td>0.11</td><td>0.059</td><td>0.05</td><td>&lt;0.10</td><td>&lt;0.010</td><td>&lt;0.010</td></dl<>	0.11	0.059	0.05	<0.10	<0.010	<0.010
admium (Cd)-Total (Lab Result)  Cadmium (Cd)-Total (Hardness Adjusted Guideline)	mg/L e) mg/L	0.00009	0.02	0.000005	0.000206 0.000181	0.000022 0.000182	0.000174 0.000193	0.000154 0.000191	0.0021 0.000370	<b>0.00202</b> 0.000370	4%	0.00199 0.000370	0.000648 0.000370	0.000224 0.000370	<0.00020 0.000263	<0.000050 0.000370	<0.000050 0.000370
alcium (Ca)-Total	mg/L	-	-	0.05	29.6	30.8	32.8	32.2	179	183	2%	346	259	249	42.8	<0.050	<0.050
hromium (Cr)-Total	mg/L	0.0089	0.04	0.0001	0.00013	0.00014	0.00011	0.00013	<0.00010	0.0001	<dl< td=""><td>&lt;0.00020</td><td>0.00065</td><td>0.00062</td><td>&lt;0.0020</td><td>&lt;0.00010</td><td>0.00012</td></dl<>	<0.00020	0.00065	0.00062	<0.0020	<0.00010	0.00012
obalt (Co)-Total opper (Cu)-Total (Lab Result)	mg/L mg/L	0.002	0.2	0.0001 0.0005	<0.00010 0.00092	<0.00010	<0.00010 0.00102	<0.00010 0.00103	0.00086 <0.00050	0.00087 <0.00050	1% <dl< td=""><td>0.00083 0.0381</td><td>0.00933 0.00390</td><td>0.00693 0.00186</td><td>&lt;0.0010</td><td>&lt;0.00010 &lt;0.00050</td><td>&lt;0.00010 &lt;0.00050</td></dl<>	0.00083 0.0381	0.00933 0.00390	0.00693 0.00186	<0.0010	<0.00010 <0.00050	<0.00010 <0.00050
Copper (Cu)-Total (Hardness Adjusted Guideline)	mg/L		-	-	0.00270	0.00272	0.00290	0.00286	0.00400	0.00400		0.00400	0.00400	0.00400	0.00400	0.00400	0.00400
on (Fe)-Total	mg/L	0.3	1.0	0.01	0.02 <0.000050	0.021	0.041	0.029	0.381 <0.000050	0.378 <0.00050	1%	0.265 <b>0.00896</b>	15.4	6.91	<0.030	<0.010	<0.010 <0.00050
ead (Pb)-Total (Lab Result)  Lead (Pb)-Total (Hardness Adjusted Guideline)	mg/L mg/L	0.001	0.1	0.00005	0.000050	0.00393	0.000067	0.00423	0.00700	0.00700	<dl< td=""><td>0.00896</td><td>0.000065 0.00700</td><td>0.000158 0.00700</td><td>0.00067</td><td>0.00700</td><td>0.00700</td></dl<>	0.00896	0.000065 0.00700	0.000158 0.00700	0.00067	0.00700	0.00700
thium (Li)-Total	mg/L	-	-	0.001	<0.0010	<0.0010	<0.0010	<0.0010	0.0092	0.0091	1%	0.012	<0.0010	<0.0010		<0.0010	<0.0010
Magnesium (Mg)-Total	mg/L	-	-	0.1	9.6	9.97	10.6	10.6	60.1	61.8	3%	65.1	56.6	63.4	18.7	<0.10	<0.10
langanese (Mn)-Total lercury (Hg)-Total	mg/L mg/L	0.000026	0.5 0.005	0.0001 0.00005	0.0678 <0.000050	0.0698 <0.000050	0.0566 <0.000050	0.0263 <0.000050	<b>1.3</b> <0.000050	1.36 <0.0000050	5% <dl< td=""><td>0.89 0.0000104</td><td>6.87 0.0000054</td><td>5.94 &lt;0.0000050</td><td>&lt;0.0020 &lt;0.00020</td><td>&lt;0.00010 &lt;0.000050</td><td>&lt;0.00010 &lt;0.000050</td></dl<>	0.89 0.0000104	6.87 0.0000054	5.94 <0.0000050	<0.0020 <0.00020	<0.00010 <0.000050	<0.00010 <0.000050
lolybdenum (Mo)-Total	mg/L	0.0073	-	0.00005	0.000402	0.000461	0.00039	0.000404	0.000397	0.000405	2%	0.00179	0.00103	0.000885		<0.000050	<0.000050
lickel (Ni)-Total (Lab Result) Nickel (Ni)-Total (Hardness Adjusted Guideline)	mg/L mg/L	0.025	0.3	0.0005	<0.00050 0.10769	<0.00050 0.10839	<0.00050 0.11462	<0.00050 0.11324	0.00171 0.15000	0.00185 0.15000	<2xDL	0.0021 0.15000	0.00429 0.15000	0.00296 0.15000	0.15000	<0.00050 0.15000	<0.00050 0.15000
hosphorus (P)-Total	mg/L		-	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<dl< td=""><td>&lt;0.050</td><td>&lt;0.050</td><td>&lt;0.050</td><td>0.13000</td><td>&lt;0.050</td><td>&lt;0.050</td></dl<>	<0.050	<0.050	<0.050	0.13000	<0.050	<0.050
otassium (K)-Total	mg/L	-	-	0.1	0.66	0.69	0.76	0.82	3.56	3.65	2%	22.5	6.56	6.14	0.89	<0.10	<0.10
elenium (Se)-Total ilicon (Si)-Total	mg/L mg/L	0.001	-	0.00005	<0.000050 5.85	<0.000050 6.04	<0.000050 6.08	<0.000050 6.08	<0.000050 6.37	<0.000050 6.58	<dl 3%</dl 	<0.00010 4.18	0.000274 7.49	0.000181 7.29	<0.0010	<0.000050 <0.050	<0.000050 <0.050
ilver (Ag)-Total	mg/L	0.0001	0.1	0.00001	<0.000010	<0.000010	<0.00010	<0.00010	<0.00010	<0.000010	<dl< td=""><td>0.000191</td><td>0.000034</td><td>0.00002</td><td></td><td>&lt;0.00010</td><td>&lt;0.00010</td></dl<>	0.000191	0.000034	0.00002		<0.00010	<0.00010
odium (Na)-Total	mg/L		-	0.05	2.52	2.57	2.95	2.85	4.52	4.71	4%	21.3	31.7	29.5	4.7	<0.050	<0.050
trontium (Sr)-Total ulfur (S)-Total	mg/L mg/L	-	-	0.0002	0.323 7.2	0.335 7.49	0.3 10.5	0.314 10.4	0.436 140	0.449 144	3% 3%	0.933	0.785 238	0.794 232		<0.00020 <0.50	<0.00020 <0.50
hallium (TI)-Total	mg/L	0.0008	-	0.00001	<0.000010	<0.00010	<0.000010	<0.000010	0.000094	0.000095	1%	0.000245	0.00001	<0.00010		<0.000010	< 0.000010
in (Sn)-Total	mg/L	-	-	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<dl< td=""><td>&lt;0.00020</td><td>&lt;0.00010</td><td>&lt;0.00010</td><td></td><td>&lt;0.00010</td><td>&lt;0.00010</td></dl<>	<0.00020	<0.00010	<0.00010		<0.00010	<0.00010
itanium (Ti)-Total ranium (U)-Total	mg/L mg/L	0.015	-	0.0003 0.00001	<0.00030 0.000721	<0.00030	0.00047 0.000692	<0.00030 0.000706	<0.00030	<0.00030 0.00446	<dl 1%</dl 	<0.00060 0.00164	<0.0021 0.00193	0.00545 0.00157	0.00169	<0.00030 <0.000010	<0.00030 <0.000010
anadium (V)-Total	mg/L	-	-	0.0005	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<dl< td=""><td>&lt;0.0010</td><td>0.00239</td><td>0.00166</td><td></td><td>&lt;0.00050</td><td>&lt;0.00050</td></dl<>	<0.0010	0.00239	0.00166		<0.00050	<0.00050
inc (Zn)-Total luminum (Al)-Dissolved	mg/L	0.03	0.3	0.003	<0.0030	<0.0030 0.0058	<0.0030 0.0051	<0.0030 0.0055	0.78 <0.0010	<b>0.82</b> <0.0010	5% <dl< td=""><td><b>0.217</b> 0.0045</td><td>0.112 0.0113</td><td>0.043 0.0084</td><td>&lt;0.050</td><td>&lt;0.0030 &lt;0.0010</td><td>&lt;0.0030</td></dl<>	<b>0.217</b> 0.0045	0.112 0.0113	0.043 0.0084	<0.050	<0.0030 <0.0010	<0.0030
ntimony (Sb)-Dissolved	mg/L mg/L	0.1	-	0.001	<0.00010	<0.00010	0.0051	0.0033	0.0102	0.0102	0%	0.0416	0.00113	0.0084		<0.0010	
rsenic (As)-Dissolved	mg/L	0.005	0.15	0.0001	0.00022	0.00024	0.0013	0.00115	0.0194	0.0195	1%	0.107	0.0453	0.0362	-	<0.00010	-
rrium (Ba)-Dissolved rryllium (Be)-Dissolved	mg/L mg/L	-	-	0.00005 0.00002	0.0796 <0.000020	0.0796 <0.000020	0.0758 <0.000020	0.0738 <0.000020	0.0115 <0.000020	0.0113 <0.00020	2% <dl< td=""><td>0.0204 &lt;0.000040</td><td>0.0589 &lt;0.000020</td><td>0.0697 &lt;0.000020</td><td>-</td><td>&lt;0.000050 &lt;0.000020</td><td></td></dl<>	0.0204 <0.000040	0.0589 <0.000020	0.0697 <0.000020	-	<0.000050 <0.000020	
smuth (Bi)-Dissolved	mg/L	-	-	0.00002	<0.000050	<0.000020	<0.000020	<0.000050	<0.000050	<0.000020	<dl< td=""><td>&lt;0.00010</td><td>&lt;0.000020</td><td>&lt;0.000050</td><td>-</td><td>&lt;0.000020</td><td>-</td></dl<>	<0.00010	<0.000020	<0.000050	-	<0.000020	-
ron (B)-Dissolved	mg/L	-	-	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<dl< td=""><td>0.101</td><td>0.054</td><td>0.045</td><td>-</td><td>&lt;0.010</td><td>-</td></dl<>	0.101	0.054	0.045	-	<0.010	-
dmium (Cd)-Dissolved (Lab Result) Cadmium (Cd)-Diss. (Hardness Adjusted Guideline)	mg/L e) mg/L	0.00009	-	0.000005	0.000199 0.000181	0.0000223 0.000182	0.000196 0.000193	0.000097 0.000191	0.000781 0.000370	0.000793 0.000370	2%	0.00178 0.000370	0.000488 0.000370	0.000158 0.000370	0.000263	<0.000050 0.000370	
lcium (Ca)-Dissolved	mg/L	-	-	0.05	30.7	30.9	33.2	32.7	181	179	1%	344	265	255	0.000203	<0.050	
romium (Cr)-Dissolved	mg/L	0.0089	-	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<dl< td=""><td>&lt;0.00020</td><td>0.00047</td><td>0.00031</td><td>-</td><td>&lt;0.00010</td><td>-</td></dl<>	<0.00020	0.00047	0.00031	-	<0.00010	-
pper (Cu)-Dissolved pper (Cu)-Dissolved (Lab Result)	mg/L mg/L	0.002	-	0.0001 0.0002	<0.00010 0.00088	<0.00010	<0.00010 0.00094	<0.00010 0.00093	0.00083 <0.00020	0.00083 <0.00020	0% <dl< td=""><td>0.00076 0.0336</td><td>0.00928 0.00234</td><td>0.00653 0.00117</td><td>-</td><td>&lt;0.00010 &lt;0.00020</td><td></td></dl<>	0.00076 0.0336	0.00928 0.00234	0.00653 0.00117	-	<0.00010 <0.00020	
Copper (Cu)-Diss. (Hardness Adjusted Guideline)	mg/L	-	-	-	0.00270	0.00272	0.00290	0.00286	0.00400	0.00400	-	0.00400	0.00400	0.00400	0.00400	0.00400	
n (Fe)-Dissolved	mg/L	0.3	-	0.01	0.011	<0.010	0.018	0.013	0.23	0.232	1%	0.048	13.7	5.11		<0.010	
d (Pb)-Dissolved (Lab Result)  Lead (Pb)-Diss. (Hardness Adjusted Guideline)	mg/L ) mg/L	0.001	-	0.00005	<0.000050 0.00389	<0.000050 0.00393	<0.00050 0.00431	<0.000050 0.00423	<0.000050 0.00700	<0.00050 0.00700	<dl< td=""><td>0.00167</td><td>&lt;0.000050 0.00700</td><td>&lt;0.000050 0.00700</td><td>0.00700</td><td>&lt;0.000050 0.00700</td><td>-</td></dl<>	0.00167	<0.000050 0.00700	<0.000050 0.00700	0.00700	<0.000050 0.00700	-
ium (Li)-Dissolved	mg/L	-	-	0.001	<0.0010	<0.0010	<0.0010	<0.0010	0.0091	0.0091	0%	0.0107	<0.0010	<0.0010	3.30700	<0.0010	
gnesium (Mg)-Dissolved	mg/L	-	-	0.1	9.8	9.84	10.6	10.6	59.9	59.7	0%	64.3	57.3	63.6	-	<0.10	
rganese (Mn)-Dissolved rcury (Hg)-Dissolved	mg/L mg/L	0.000026	-	0.0001 0.00005	0.0663 <0.000050	0.0674 <0.000050	0.0523 <0.0000050	0.0245 <0.000050	1.28 <0.000050	1.28 <0.0000050	0% <dl< td=""><td>0.854 &lt;0.0000050</td><td>6.86 &lt;0.000050</td><td>5.79 &lt;0.000050</td><td>-</td><td>&lt;0.00010 &lt;0.000050</td><td>-</td></dl<>	0.854 <0.0000050	6.86 <0.000050	5.79 <0.000050	-	<0.00010 <0.000050	-
lybdenum (Mo)-Dissolved	mg/L	0.0073	-	0.00005	0.000401	0.000396	0.000382	0.000377	0.000356	0.000349	2%	0.00169	0.000963	0.000815	-	<0.000050	
kel (Ni)-Dissolved (Lab Result)	mg/L	0.025	-	0.0005	<0.00050	<0.00050	<0.00050	<0.00050	0.00159	0.00163	<2xDL	0.0019	0.00414	0.00276	0.45000	<0.00050	
lickel (NI)-Diss. (Hardness Adjusted Guideline) osphorus (P)-Dissolved	mg/L mg/L	-	-	0.05	0.10769 <0.050	0.10839 <0.050	0.11462 <0.050	0.11324 <0.050	0.15000 <0.050	0.15000 <0.050	<dl< td=""><td>0.15000 &lt;0.050</td><td>0.15000 &lt;0.050</td><td>0.15000 &lt;0.050</td><td>0.15000</td><td>0.15000 &lt;0.050</td><td></td></dl<>	0.15000 <0.050	0.15000 <0.050	0.15000 <0.050	0.15000	0.15000 <0.050	
tassium (K)-Dissolved	mg/L	-	-	0.03	0.66	0.65	0.74	0.79	3.46	3.47	0%	22.1	6.59	6.1	-	<0.10	-
lenium (Se)-Dissolved	mg/L	0.001	-	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<dl< td=""><td>&lt;0.00010</td><td>0.000231</td><td>0.00018</td><td>-</td><td>&lt;0.000050</td><td>-</td></dl<>	<0.00010	0.000231	0.00018	-	<0.000050	-
con (Si)-Dissolved er (Ag)-Dissolved	mg/L	0.0001	-	0.05 0.00001	6.02 <0.000010	6.01 <0.000010	6.09 <0.000010	6.1 <0.000010	6.35 <0.000010	6.33 <0.000010	0% <dl< td=""><td>4.03 0.000053</td><td>7.48 0.00001</td><td>7.21 &lt;0.000010</td><td>-</td><td>&lt;0.050 &lt;0.000010</td><td></td></dl<>	4.03 0.000053	7.48 0.00001	7.21 <0.000010	-	<0.050 <0.000010	
dium (Na)-Dissolved	mg/L mg/L		-	0.0001	2.58	2.55	2.95	2.86	4.56	4.5	1%	20.6	31.9	28.7	<del> </del>	<0.00010	
ontium (Sr)-Dissolved	mg/L	-	-	0.0002	0.319	0.325	0.322	0.306	0.423	0.425	0%	0.899	0.777	0.783	-	<0.00020	-
lfur (S)-Dissolved	mg/L	-	-	0.5	7.2	7.31	10.3	10.4 <0.000010	138	137	1%	328 0.000238	231	228	-	<0.50 <0.00010	
n (Sn)-Dissolved	mg/L mg/L	0.0008	-	0.00001 0.0001	<0.00010 <0.00010	<0.000010 <0.00010	<0.00010 <0.00010	<0.00010 <0.00010	0.000087 <0.00010	0.000088 <0.00010	1% <dl< td=""><td>0.000238 &lt;0.00020</td><td>&lt;0.00010 &lt;0.00010</td><td>&lt;0.00010 &lt;0.00010</td><td>-</td><td>&lt;0.00010 &lt;0.00010</td><td></td></dl<>	0.000238 <0.00020	<0.00010 <0.00010	<0.00010 <0.00010	-	<0.00010 <0.00010	
tanium (Ti)-Dissolved	mg/L	-	-	0.0003	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<dl< td=""><td>&lt;0.00060</td><td>0.00095</td><td>&lt;0.0012</td><td>-</td><td>&lt;0.00030</td><td></td></dl<>	<0.00060	0.00095	<0.0012	-	<0.00030	
ranium (U)-Dissolved	mg/L	0.015	-	0.00001	0.00068	0.000697	0.000713	0.000673	0.0042	0.0042	0%	0.00153	0.0019	0.0015		<0.000010	-

Applied Guidelines: 'Federal CCME Canadian Environmental Quality Guidelines (May 2015), CCME: Freshwater Aquatic Life
'Mount Nansen Effluent Discharge Standards
COLOUR KEY:

Exceeds CCME Guideline

Exceeds MN Effluent Discharge Standards

Exceeds MN Effluent Discharge Standards

Exceeds MN Effluent Discharge Standards

Exceeds Hardness Dependent Calculated Guideline (CCME)

Data flag for Detection Limit Adjustment -> Please refer to the lab COA report and lab excel report for more info

QA/QC Codes: RPD - Relative Percent Difference, CDL - below detection limit, and <2XDL - less than two times the detection limit. Refer to Methodology Document for details.

Notes:

Several sies have frozen to substrate for the winter - WQ-BC, WQ-PC-D, WQ-PC-D, WQ-PC-D, WQ-PC-D1b, WQ-Ch-P-13-01, WQ-DC-Ba, and WQ-DC-B.

\*\* WQ-PW is a drinking water sample and the analysis package has different detection limits than all other samples. The results are also compared to the Guidelines for Canadian Drinking Water Quality (Health Canada, October 2014) versus the CCME or MN Effluent Quality Standards.

QA/QC Travel/Field Blank Analysis - The travel blank had all parameters below detection limit, except for total chromium (confirmed by repeat analysis). The lab is currently investigating potential reasons for the chromium concentration above the detection limit - it may be related to the sample being dated (similar to what occurs occasionally with ammonia). The field blank had all parameters below detection limit.

QA/QC Repulciate Analysis - The average RPD of the replicate sample set for WQ-DC-DX+105-r was 2%, indicating that sample analysis was adequately precise. The average RPD for total metals in the replicate sample set was 3% and the average RPD for dissolved metals was 1%. All individual parameters had RPD <20% or below detection limits.



ENVIRONMENTAL DYNAMICS INC.

ATTN: Meghan Marjanovic

2195 - 2nd Ave

Whitehorse YT Y1A 3T8

Date Received: 16-DEC-15

Report Date: 31-DEC-15 11:01 (MT)

Version: FINAL

Client Phone: 867-393-4882

# Certificate of Analysis

Lab Work Order #: L1715452
Project P.O. #: NOT SUBMITTED

Job Reference: MOUNT NANSEN 15-Y-0146

C of C Numbers: 1, 2

Legal Site Desc:

Can Dang Senior Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700 ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company



L1715452 CONTD.... PAGE 2 of 14

## 31-DEC-15 11:01 (MT)

Version: FINAL

### ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1715452-1 Water 14-DEC-15 14:25 FIELD BLANK	L1715452-2 Water 14-DEC-15 17:40 WQ-SEEP	L1715452-3 Water 14-DEC-15 18:15 WQ-TP	L1715452-4 Water 14-DEC-15 13:55 WQ-VC-R+150	L1715452-5 Water 15-DEC-15 10:30 WQ-DC-DX+105-R
Grouping	Analyte					
WATER						
Physical Tests	Conductivity (uS/cm)	<2.0	1630	1880	250	1180
	Hardness (as CaCO3) (mg/L)	<0.50	898	1120	125	693
	pH (pH)	6.02	7.25	7.82	7.71	7.42
	Total Suspended Solids (mg/L)	<3.0	37.0	<3.0	<3.0	<3.0
	Total Dissolved Solids (mg/L)	<1.0	1250	1560	134	818
Anions and Nutrients	, , , , , , , , , , , , , , , , , , , ,		251	155	93.1	265
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	1.0	251	155	93.1	265
	Ammonia, Total (as N) (mg/L)	<0.0050	4.61	0.469	<0.0050	0.0165
	Chloride (CI) (mg/L)	<0.50	<2.5 DLA	<2.5	<0.50	<1.0 DLA
	Fluoride (F) (mg/L)	<0.020	<0.10 DLA	0.23	0.046	0.168
	Nitrate (as N) (mg/L)	<0.0050	0.867	0.196	0.176	<0.010
	Nitrite (as N) (mg/L)	<0.0010	0.0124	<0.0050	<0.0010	<0.0020
	Sulfate (SO4) (mg/L)	<0.30	710	1020	30.6	410
	Anion Sum (meq/L)	<0.10	19.8	24.3	2.51	13.8
	Cation Sum (meq/L)	<0.10	20.8	24.0	2.65	14.2
	Cation - Anion Balance (%)	-90.9	2.4	-0.7	2.6	1.3
Cyanides	Cyanide, Weak Acid Diss (mg/L)	<0.0050	0.0152	<0.0050	<0.0050	<0.0050
	Cyanide, Total (mg/L)	<0.0050	0.0669	<0.0050	<0.0050	<0.0050
	Cyanate (mg/L)	<0.20	1.08	0.97	<0.20	<0.20
	Thiocyanate (SCN) (mg/L)	<0.50	4.35	<0.50	<0.50	<0.50
<b>Total Metals</b>	Aluminum (AI)-Total (mg/L)	<0.0030	0.0170	0.0225	0.0149	0.0038
	Antimony (Sb)-Total (mg/L)	<0.00010	0.00054	0.0438	0.00036	0.0105
	Arsenic (As)-Total (mg/L)	<0.00010	0.0682	0.146	0.00125	0.0419
	Barium (Ba)-Total (mg/L)	<0.000050	0.0618	0.0216	0.0741	0.0121
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000040	<0.000020	<0.000020
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.00010	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	<0.010	0.059	0.110	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.000050	0.000648	0.00199	0.0000154	0.00202
	Calcium (Ca)-Total (mg/L)	<0.050	259	346	32.2	183
	Chromium (Cr)-Total (mg/L)	<0.00010	0.00065	<0.00020	0.00013	0.00010
	Cobalt (Co)-Total (mg/L)	<0.00010	0.00933	0.00083	<0.00010	0.00087
	Copper (Cu)-Total (mg/L)	<0.00050	0.00390	0.0381	0.00103	<0.00050
	Iron (Fe)-Total (mg/L)	<0.010	15.4	0.265	0.029	0.378
	Lead (Pb)-Total (mg/L)	<0.000050	0.000065	0.00896	<0.000050	<0.000050
	Lithium (Li)-Total (mg/L)	<0.0010	<0.0010	0.0120	<0.0010	0.0091

<sup>\*</sup> Please refer to the Reference Information section for an explanation of any qualifiers detected.

L1715452 CONTD.... PAGE 3 of 14

31-DEC-15 11:01 (MT) Version: FINAL

### ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID  Grouping Analyte		L1715452-6 Water 15-DEC-15 10:05 WQ-DC-DX+105	L1715452-7 Water 15-DEC-15 13:50 WQ-VC-DBC	L1715452-8 Water 15-DEC-15 14:20 WQ-VC-U	L1715452-9 Water 14-DEC-15 14:25 TRAVEL BLANK	L1715452-10 Water 14-DEC-15 16:55 WQ-DC-V
Grouping	Analyte					
WATER						
Physical Tests	Conductivity (uS/cm)	1180	230	229	<2.0	1610
	Hardness (as CaCO3) (mg/L)	699	118	117	<0.50	898
	pH (pH)	7.41	7.66	7.65	5.58	7.70
	Total Suspended Solids (mg/L)	<3.0	<3.0	<3.0	<3.0	22.0
	Total Dissolved Solids (mg/L)	821	121	121	<1.0	1210
Anions and Alkalinity, Bicarbonate (as CaCO3) (mg/L) Nutrients		263	91.0	93.0	<1.0	252
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity, Hydroxide (as CaCO3) (mg/L) Alkalinity, Total (as CaCO3) (mg/L)		<1.0	<1.0	<1.0	<1.0	<1.0
		263	91.0	93.0	<1.0	252
	Ammonia, Total (as N) (mg/L)		<0.0050	<0.0050	<0.0050	3.93
Chloride (Cl) (mg/L)  Fluoride (F) (mg/L)		<1.0 DLA	<0.50	<0.50	<0.50	<2.5
		0.171	0.045	0.043	<0.020	<0.10
	Nitrate (as N) (mg/L)	<0.010	0.186	0.187	<0.0050	0.482
	Nitrite (as N) (mg/L)	<0.0020	<0.0010	<0.0010	<0.0010	0.0102
	Sulfate (SO4) (mg/L)	412	21.1	20.9	<0.30	689
	Anion Sum (meq/L)	13.8	2.27	2.31	<0.10	19.4
	Cation Sum (meq/L)	14.3	2.48	2.47	<0.10	20.1
	Cation - Anion Balance (%)	1.8	4.4	3.4	0.0	1.8
Cyanides	Cyanide, Weak Acid Diss (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	0.0180
	Cyanide, Total (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	0.0404
	Cyanate (mg/L)	<0.20	<0.20	<0.20	<0.20	<0.20
	Thiocyanate (SCN) (mg/L)	<0.50	<0.50	<0.50	<0.50	2.54
Total Metals	Aluminum (Al)-Total (mg/L)	0.0038	0.0095	0.0109	<0.0030	0.0974
	Antimony (Sb)-Total (mg/L)	0.0102	0.00011	<0.00010	<0.00010	0.00038
	Arsenic (As)-Total (mg/L)	0.0412	0.00029	0.00027	<0.00010	0.0484
	Barium (Ba)-Total (mg/L)	0.0114	0.0807	0.0784	<0.000050	0.0737
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Total (mg/L)	<0.000050	0.000056	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	0.050
	Cadmium (Cd)-Total (mg/L)	0.00210	0.0000220	0.0000206	<0.0000050	0.000224
	Calcium (Ca)-Total (mg/L)	179	30.8	29.6	<0.050	249
	Chromium (Cr)-Total (mg/L)	<0.00010	0.00014	0.00013	0.00012	0.00062
	Cobalt (Co)-Total (mg/L)	0.00086	<0.00010	<0.00010	<0.00010	0.00693
	Copper (Cu)-Total (mg/L)	<0.00050	0.00098	0.00092	<0.00050	0.00186
	Iron (Fe)-Total (mg/L)	0.381	0.021	0.020	<0.010	6.91
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	0.000158
	Lithium (Li)-Total (mg/L)	0.0092	<0.0010	<0.0010	<0.0010	<0.0010

<sup>\*</sup> Please refer to the Reference Information section for an explanation of any qualifiers detected.

L1715452 CONTD.... PAGE 4 of 14 31-DEC-15 11:01 (MT)

### ALS ENVIRONMENTAL ANALYTICAL REPORT

**FINAL** Version: L1715452-11 Sample ID Description Water 15-DEC-15 Sampled Date Sampled Time 12:35 WQ-VC-UMN Client ID Grouping **Analyte WATER Physical Tests** Conductivity (uS/cm) 255 Hardness (as CaCO3) (mg/L) 127 pH (pH) 7.87 Total Suspended Solids (mg/L) <3.0 Total Dissolved Solids (mg/L) 137 Anions and Alkalinity, Bicarbonate (as CaCO3) (mg/L) 96.2 **Nutrients** Alkalinity, Carbonate (as CaCO3) (mg/L) <1.0 Alkalinity, Hydroxide (as CaCO3) (mg/L) <1.0 Alkalinity, Total (as CaCO3) (mg/L) 96.2 Ammonia, Total (as N) (mg/L) < 0.0050 Chloride (CI) (mg/L) < 0.50 Fluoride (F) (mg/L) 0.046 Nitrate (as N) (mg/L) 0.173 Nitrite (as N) (mg/L) < 0.0010 Sulfate (SO4) (mg/L) 30.5 Anion Sum (meq/L) 2.57 Cation Sum (meq/L) 2.68 Cation - Anion Balance (%) 2.1 Cyanide, Weak Acid Diss (mg/L) Cyanides < 0.0050 Cyanide, Total (mg/L) < 0.0050 Cyanate (mg/L) < 0.20 Thiocyanate (SCN) (mg/L) < 0.50 **Total Metals** Aluminum (Al)-Total (mg/L) 0.0204 Antimony (Sb)-Total (mg/L) 0.00027 Arsenic (As)-Total (mg/L) 0.00138 Barium (Ba)-Total (mg/L) 0.0752 Beryllium (Be)-Total (mg/L) < 0.000020 Bismuth (Bi)-Total (mg/L) < 0.000050 Boron (B)-Total (mg/L) < 0.010 Cadmium (Cd)-Total (mg/L) 0.0000174 Calcium (Ca)-Total (mg/L) 32.8 Chromium (Cr)-Total (mg/L) 0.00011 Cobalt (Co)-Total (mg/L) < 0.00010 Copper (Cu)-Total (mg/L) 0.00102 Iron (Fe)-Total (mg/L)

0.041

0.000067

< 0.0010

Lead (Pb)-Total (mg/L)

Lithium (Li)-Total (mg/L)

<sup>\*</sup> Please refer to the Reference Information section for an explanation of any qualifiers detected.

L1715452 CONTD.... PAGE 5 of 14

Version: FINAL

### PAGE 5 of 14 31-DEC-15 11:01 (MT)

### ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1715452-1 Water 14-DEC-15 14:25 FIELD BLANK	L1715452-2 Water 14-DEC-15 17:40 WQ-SEEP	L1715452-3 Water 14-DEC-15 18:15 WQ-TP	L1715452-4 Water 14-DEC-15 13:55 WQ-VC-R+150	L1715452-5 Water 15-DEC-15 10:30 WQ-DC-DX+105-R
Grouping	Analyte					
WATER						
Total Metals	Magnesium (Mg)-Total (mg/L)	<0.10	56.6	65.1	10.6	61.8
	Manganese (Mn)-Total (mg/L)	<0.00010	6.87	0.890	0.0263	1.36
	Mercury (Hg)-Total (mg/L)	<0.0000050	0.0000054	0.0000104	<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	<0.000050	0.00103	0.00179	0.000404	0.000405
	Nickel (Ni)-Total (mg/L)	<0.00050	0.00429	0.0021	<0.00050	0.00185
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	<0.10	6.56	22.5	0.82	3.65
	Selenium (Se)-Total (mg/L)	<0.00050	0.000274	<0.00010	<0.000050	<0.000050
	Silicon (Si)-Total (mg/L)	<0.050	7.49	4.18	6.08	6.58
	Silver (Ag)-Total (mg/L)	<0.00010	0.000034	0.000191	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	<0.050	31.7	21.3	2.85	4.71
	Strontium (Sr)-Total (mg/L)	<0.00020	0.785	0.933	0.314	0.449
	Sulfur (S)-Total (mg/L)	<0.50	238	340	10.4	144
	Thallium (TI)-Total (mg/L)	<0.00010	0.000010	0.000245	<0.000010	0.000095
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00020	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	<0.00030	<0.0021	<0.00060	<0.00030	<0.00030
	Uranium (U)-Total (mg/L)	<0.00010	0.00193	0.00164	0.000706	0.00446
	Vanadium (V)-Total (mg/L)	<0.00050	0.00239	<0.0010	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)	<0.0030	0.112	0.217	<0.0030	0.820
	Zirconium (Zr)-Total (mg/L)	<0.00030	0.00067	<0.00060	<0.00030	<0.00030
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	<0.0010	0.0113	0.0045	0.0055	<0.0010
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	0.00051	0.0416	0.00033	0.0102
	Arsenic (As)-Dissolved (mg/L)	<0.00010	0.0453	0.107	0.00115	0.0195
	Barium (Ba)-Dissolved (mg/L)	<0.000050	0.0589	0.0204	0.0738	0.0113
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.00040	<0.000020	<0.000020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.00010	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010	0.054	0.101	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.000050	0.000488	0.00178	0.0000097	0.000793
	Calcium (Ca)-Dissolved (mg/L)	<0.050	265	344	32.7	179
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	0.00047	<0.00020	<0.00010	<0.00010
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	0.00928	0.00076	<0.00010	0.00083
	Copper (Cu)-Dissolved (mg/L)	<0.00020	0.00234	0.0336	0.00093	<0.00020
	Iron (Fe)-Dissolved (mg/L)	<0.010	13.7	0.048	0.013	0.232
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	0.00167	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	<0.0010	<0.0010	0.0107	<0.0010	0.0091

<sup>\*</sup> Please refer to the Reference Information section for an explanation of any qualifiers detected.

L1715452 CONTD.... PAGE 6 of 14 31-DEC-15 11:01 (MT)

Version: FINAL

### ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1715452-6 Water 15-DEC-15 10:05 WQ-DC-DX+105	L1715452-7 Water 15-DEC-15 13:50 WQ-VC-DBC	L1715452-8 Water 15-DEC-15 14:20 WQ-VC-U	L1715452-9 Water 14-DEC-15 14:25 TRAVEL BLANK	L1715452-10 Water 14-DEC-15 16:55 WQ-DC-V
Grouping	Analyte					
WATER						
Total Metals	Magnesium (Mg)-Total (mg/L)	60.1	9.97	9.60	<0.10	63.4
	Manganese (Mn)-Total (mg/L)	1.30	0.0698	0.0678	<0.00010	5.94
	Mercury (Hg)-Total (mg/L)	<0.000050	<0.0000050	<0.000050	<0.0000050	<0.000050
	Molybdenum (Mo)-Total (mg/L)	0.000397	0.000461	0.000402	<0.000050	0.000885
	Nickel (Ni)-Total (mg/L)	0.00171	<0.00050	<0.00050	<0.00050	0.00296
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	3.56	0.69	0.66	<0.10	6.14
	Selenium (Se)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	0.000181
	Silicon (Si)-Total (mg/L)	6.37	6.04	5.85	<0.050	7.29
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	0.000020
	Sodium (Na)-Total (mg/L)	4.52	2.57	2.52	<0.050	29.5
	Strontium (Sr)-Total (mg/L)	0.436	0.335	0.323	<0.00020	0.794
	Sulfur (S)-Total (mg/L)	140	7.49	7.20	<0.50	232
	Thallium (TI)-Total (mg/L)	0.000094	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	0.00545
	Uranium (U)-Total (mg/L)	0.00440	0.000743	0.000721	<0.000010	0.00157
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	0.00166
	Zinc (Zn)-Total (mg/L)	0.780	<0.0030	<0.0030	<0.0030	0.0430
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	0.00036
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD		FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD		FIELD
	Aluminum (AI)-Dissolved (mg/L)	<0.0010	0.0058	0.0060		0.0084
	Antimony (Sb)-Dissolved (mg/L)	0.0102	<0.00010	<0.00010		0.00034
	Arsenic (As)-Dissolved (mg/L)	0.0194	0.00024	0.00022		0.0362
	Barium (Ba)-Dissolved (mg/L)	0.0115	0.0796	0.0796		0.0697
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020		<0.000020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050		<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010		0.045
	Cadmium (Cd)-Dissolved (mg/L)	0.000781	0.0000223	0.0000199		0.000158
	Calcium (Ca)-Dissolved (mg/L)	181	30.9	30.7		255
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		0.00031
	Cobalt (Co)-Dissolved (mg/L)	0.00083	<0.00010	<0.00010		0.00653
	Copper (Cu)-Dissolved (mg/L)	<0.00020	0.00083	0.00088		0.00117
	Iron (Fe)-Dissolved (mg/L)	0.230	<0.010	0.011		5.11
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050		<0.000050
	Lithium (Li)-Dissolved (mg/L)	0.0091	<0.0010	<0.0010		<0.0010

<sup>\*</sup> Please refer to the Reference Information section for an explanation of any qualifiers detected.

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### ALS ENVIRONMENTAL ANALYTICAL REPORT

L1715452-11 Sample ID Description Water 15-DEC-15 Sampled Date Sampled Time 12:35 WQ-VC-UMN **Client ID** Grouping **Analyte WATER Total Metals** Magnesium (Mg)-Total (mg/L) 10.6 Manganese (Mn)-Total (mg/L) 0.0566 Mercury (Hg)-Total (mg/L) < 0.0000050 Molybdenum (Mo)-Total (mg/L) 0.000390 Nickel (Ni)-Total (mg/L) < 0.00050 Phosphorus (P)-Total (mg/L) < 0.050 Potassium (K)-Total (mg/L) 0.76 Selenium (Se)-Total (mg/L) < 0.000050 Silicon (Si)-Total (mg/L) 6.08 Silver (Ag)-Total (mg/L) < 0.000010 Sodium (Na)-Total (mg/L) 2.95 Strontium (Sr)-Total (mg/L) 0.300 Sulfur (S)-Total (mg/L) 10.5 Thallium (TI)-Total (mg/L) < 0.000010 Tin (Sn)-Total (mg/L) < 0.00010 Titanium (Ti)-Total (mg/L) 0.00047 Uranium (U)-Total (mg/L) 0.000692 Vanadium (V)-Total (mg/L) < 0.00050 Zinc (Zn)-Total (mg/L) < 0.0030 Zirconium (Zr)-Total (mg/L) < 0.00030 **Dissolved Metals** Dissolved Mercury Filtration Location **FIELD** Dissolved Metals Filtration Location **FIELD** Aluminum (Al)-Dissolved (mg/L) 0.0051 Antimony (Sb)-Dissolved (mg/L) 0.00028 Arsenic (As)-Dissolved (mg/L) 0.00130 Barium (Ba)-Dissolved (mg/L) 0.0758 Beryllium (Be)-Dissolved (mg/L) < 0.000020 Bismuth (Bi)-Dissolved (mg/L) < 0.000050 Boron (B)-Dissolved (mg/L) < 0.010 Cadmium (Cd)-Dissolved (mg/L) 0.0000196 Calcium (Ca)-Dissolved (mg/L) 33.2 Chromium (Cr)-Dissolved (mg/L) < 0.00010 Cobalt (Co)-Dissolved (mg/L) < 0.00010 Copper (Cu)-Dissolved (mg/L) 0.00094 Iron (Fe)-Dissolved (mg/L) 0.018 Lead (Pb)-Dissolved (mg/L) < 0.000050 Lithium (Li)-Dissolved (mg/L) < 0.0010

<sup>\*</sup> Please refer to the Reference Information section for an explanation of any qualifiers detected.

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### ALS ENVIRONMENTAL ANALYTICAL REPORT

L1715452-2 L1715452-3 L1715452-4 L1715452-5 Sample ID L1715452-1 Description Water Water Water Water Water 14-DEC-15 Sampled Date 14-DEC-15 14-DEC-15 14-DEC-15 15-DEC-15 Sampled Time 14:25 17:40 18:15 13:55 10:30 FIELD BLANK WQ-SEEP WQ-TP WQ-VC-R+150 WQ-DC-DX+105-R **Client ID** Grouping **Analyte WATER Dissolved Metals** Magnesium (Mg)-Dissolved (mg/L) <0.10 57.3 64.3 10.6 59.7 Manganese (Mn)-Dissolved (mg/L) < 0.00010 6.86 0.854 0.0245 1.28 Mercury (Hg)-Dissolved (mg/L) < 0.0000050 < 0.0000050 < 0.0000050 < 0.0000050 < 0.0000050 Molybdenum (Mo)-Dissolved (mg/L) < 0.000050 0.000963 0.00169 0.000377 0.000349 Nickel (Ni)-Dissolved (mg/L) 0.00414 0.0019 < 0.00050 0.00163 < 0.00050 Phosphorus (P)-Dissolved (mg/L) < 0.050 < 0.050 < 0.050 < 0.050 < 0.050 Potassium (K)-Dissolved (mg/L) < 0.10 6.59 0.79 3.47 22.1 Selenium (Se)-Dissolved (mg/L) < 0.00010 < 0.000050 0.000231 < 0.000050 < 0.000050 Silicon (Si)-Dissolved (mg/L) < 0.050 7.48 4.03 6.10 6.33 Silver (Ag)-Dissolved (mg/L) 0.000010 0.000053 < 0.000010 < 0.000010 < 0.000010 Sodium (Na)-Dissolved (mg/L) 20.6 < 0.050 31.9 2.86 4.50 Strontium (Sr)-Dissolved (mg/L) < 0.00020 0.777 0.899 0.306 0.425 Sulfur (S)-Dissolved (mg/L) < 0.50 328 10.4 137 231 Thallium (TI)-Dissolved (mg/L) < 0.000010 < 0.000010 0.000238 < 0.000010 0.000088 Tin (Sn)-Dissolved (mg/L) < 0.00010 <0.00010 < 0.00020 < 0.00010 < 0.00010 Titanium (Ti)-Dissolved (mg/L) < 0.00030 0.00095 <0.00060 < 0.00030 < 0.00030 Uranium (U)-Dissolved (mg/L) < 0.000010 0.00190 0.00153 0.000673 0.00420 Vanadium (V)-Dissolved (mg/L) <0.0010 < 0.00050 0.00156 < 0.00050 < 0.00050 Zinc (Zn)-Dissolved (mg/L) < 0.0010 0.109 0.205 0.0013 0.767 Zirconium (Zr)-Dissolved (mg/L) <0.00060 < 0.00030 0.00063 < 0.00030 < 0.00030

<sup>\*</sup> Please refer to the Reference Information section for an explanation of any qualifiers detected.

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### ALS ENVIRONMENTAL ANALYTICAL REPORT

			L1715452-7 Water 15-DEC-15 13:50 WQ-VC-DBC	L1715452-8 Water 15-DEC-15 14:20 WQ-VC-U	L1715452-9 Water 14-DEC-15 14:25 TRAVEL BLANK	L1715452-10 Water 14-DEC-15 16:55 WQ-DC-V
Grouping	Analyte					
WATER						
Dissolved Metals	Magnesium (Mg)-Dissolved (mg/L)	59.9	9.84	9.80		63.6
	Manganese (Mn)-Dissolved (mg/L)	1.28	0.0674	0.0663		5.79
	Mercury (Hg)-Dissolved (mg/L)	<0.000050	<0.0000050	<0.0000050		<0.000050
	Molybdenum (Mo)-Dissolved (mg/L)	0.000356	0.000396	0.000401		0.000815
	Nickel (Ni)-Dissolved (mg/L)	0.00159	<0.00050	<0.00050		0.00276
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050		<0.050
	Potassium (K)-Dissolved (mg/L)	3.46	0.65	0.66		6.10
	Selenium (Se)-Dissolved (mg/L)	<0.00050	<0.000050	<0.000050		0.000180
	Silicon (Si)-Dissolved (mg/L)	6.35	6.01	6.02		7.21
	Silver (Ag)-Dissolved (mg/L)	<0.00010	<0.000010	<0.000010		<0.000010
	Sodium (Na)-Dissolved (mg/L)	4.56	2.55	2.58		28.7
	Strontium (Sr)-Dissolved (mg/L)	0.423	0.325	0.319		0.783
	Sulfur (S)-Dissolved (mg/L)	138	7.31	7.20		228
	Thallium (TI)-Dissolved (mg/L)	0.000087	<0.000010	<0.000010		<0.000010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030		<0.0012
	Uranium (U)-Dissolved (mg/L)	0.00420	0.000697	0.000680		0.00150
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050		0.00089
	Zinc (Zn)-Dissolved (mg/L)	0.770	<0.0010	0.0016		0.0401
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030		0.00038

<sup>\*</sup> Please refer to the Reference Information section for an explanation of any qualifiers detected.

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### ALS ENVIRONMENTAL ANALYTICAL REPORT

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	Sample ID Description Sampled Date Sampled Time Client ID	L1715452-11 Water 15-DEC-15 12:35 WQ-VC-UMN		
Grouping	Analyte			
WATER				
Dissolved Metals	Magnesium (Mg)-Dissolved (mg/L)	10.6		
	Manganese (Mn)-Dissolved (mg/L)	0.0523		
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050		
	Molybdenum (Mo)-Dissolved (mg/L)	0.000382		
	Nickel (Ni)-Dissolved (mg/L)	<0.00050		
	Phosphorus (P)-Dissolved (mg/L)	<0.050		
	Potassium (K)-Dissolved (mg/L)	0.74		
	Selenium (Se)-Dissolved (mg/L)	<0.000050		
	Silicon (Si)-Dissolved (mg/L)	6.09		
	Silver (Ag)-Dissolved (mg/L)	<0.000010		
	Sodium (Na)-Dissolved (mg/L)	2.95		
	Strontium (Sr)-Dissolved (mg/L)	0.322		
	Sulfur (S)-Dissolved (mg/L)	10.3		
	Thallium (TI)-Dissolved (mg/L)	<0.000010		
	Tin (Sn)-Dissolved (mg/L)	<0.00010		
	Titanium (Ti)-Dissolved (mg/L)	<0.00030		
	Uranium (U)-Dissolved (mg/L)	0.000713		
	Vanadium (V)-Dissolved (mg/L)	<0.00050		
	Zinc (Zn)-Dissolved (mg/L)	0.0019		
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030		

<sup>\*</sup> Please refer to the Reference Information section for an explanation of any qualifiers detected.

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### **Reference Information**

### QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Antimony (Sb)-Dissolved	DLA	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8
Duplicate	Bismuth (Bi)-Dissolved	DLA	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8
Duplicate	Chromium (Cr)-Dissolved	DLA	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8
Duplicate	Selenium (Se)-Dissolved	DLA	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8
Duplicate	Silver (Ag)-Dissolved	DLA	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8
Duplicate	Thallium (TI)-Dissolved	DLA	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8
Duplicate	Tin (Sn)-Dissolved	DLA	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8
Duplicate	Titanium (Ti)-Dissolved	DLA	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8
Duplicate	Vanadium (V)-Dissolved	DLA	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8
Duplicate	Zirconium (Zr)-Dissolved	DLA	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Uranium (U)-Dissolved	MS-B	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Uranium (U)-Dissolved	MS-B	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Zinc (Zn)-Dissolved	MS-B	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Aluminum (AI)-Total	MS-B	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Cadmium (Cd)-Total	MS-B	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Copper (Cu)-Total	MS-B	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Manganese (Mn)-Total	MS-B	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Sodium (Na)-Total	MS-B	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Strontium (Sr)-Total	MS-B	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Zinc (Zn)-Total	MS-B	L1715452-1, -10, -11, -2, -3, -4, -5, -6, -7, -8, -9

### Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution
DLM	Detection Limit Adjusted due to sample matrix effects.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RRV	Reported Result Verified By Repeat Analysis

### **Test Method References:**

ALS Test Code	Matrix	Test Description	Method Reference**
AI K-TITR-VA	Water	Alkalinity Species by 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.

Diss. Be (low) in Water by CRC ICPMS APHA 3030B/6020A (mod) Water

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

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Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

BE-T-L-CCMS-VA Water Total Be (Low) in Water by CRC ICPMS EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

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

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

CN-CNO-WT Water Cyanate APHA 4500-CN-L

This analysis is carried out using procedures adapted from APHA method 4500-CN "Cyanide". Cyanate is determined by the Cyanate hydrolysis

method using an ammonia selective electrode

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

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

colourimetric method.

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

This analysis is carried out using procedures adapted from ISO Method 14403:2002 "Determination of Total Cyanide using Flow Analysis (FIA and CFA)". Total or strong acid dissociable (SAD) cyanide is determined by in-line UV digestion along with sample distillation and final determination by colourimetric analysis. Method Limitation: This method is susceptible to interference from thiocyanate (SCN). If SCN is present in the sample, there could be a positive interference with this method, but it would be less than 1% and could be as low as zero.

CN-WAD-CFA-VA Water Weak Acid Diss. Cyanide in water by CFA APHA 4500-CN CYANIDE

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

EC-PCT-VA Water Conductivity (Automated) APHA 2510 Auto. Conduc.

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

electrode.

F-IC-N-WR Water Fluoride in Water by IC EPA 300.1 (mod)

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

HARDNESS-CALC-VA Water Hardness APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents.

Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-D-CVAA-VA Water Diss. Mercury in Water by CVAAS or CVAFS APHA 3030B/EPA 1631E (mod)

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction

with stannous chloride, and analyzed by CVAAS or CVAFS.

HG-T-CVAA-VA Water Total Mercury in Water by CVAAS or CVAFS EPA 1631E (mod)

Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

IONBALANCE-VA Water Ion Balance Calculation APHA 1030E

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

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

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

MET-D-CCMS-VA Water Dissolved Metals in Water by CRC ICPMS APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-DIS-LOW-ICP-VA Water Dissolved Metals in Water by ICPOES EPA 3005A/6010B

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

MET-T-CCMS-VA Water Total Metals in Water by CRC ICPMS EPA 200.2/6020A (mod)

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Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-TOT-LOW-ICP-VA

Water

Total Metals in Water by ICPOES

EPA 3005A/6010B

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

NH3-F-VA

Water

Ammonia in Water by Fluorescence

APHA 4500 NH3-NITROGEN (AMMONIA)

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

NH3-F-VA

Water

Ammonia in Water by Fluorescence

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

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

NO2-L-IC-N-WR

Water

Nitrite in Water by IC (Low Level)

EPA 300.1 (mod)

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

NO3-L-IC-N-WR

Water

Nitrate in Water by IC (Low Level)

EPA 300.1 (mod)

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

PH-PCT-VA

Water

pH by Meter (Automated)

APHA 4500-H "pH Value"

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

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

PH-PCT-VA

Water

pH by Meter (Automated)

APHA 4500-H pH Value

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

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

S-DIS-ICP-VA

Water

Dissolved Sulfur in Water by ICPOES

EPA SW-846 3005A/6010B

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

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

S-TOT-ICP-VA

Water

Total Sulfur in Water by ICPOES

EPA SW-846 3005A/6010B

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

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

SO4-IC-N-WR

Water

Sulfate in Water by IC

EPA 300.1 (mod)

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

TDS-CALC-VA

Water

TDS (Calculated)

APHA 1030E (20TH EDITION)

This analysis is carried out using procedures adapted from APHA 1030E "Checking Correctness of Analyses".

TSS-MAN-WR

Water

Total Suspended Solids by Gravimetric

APHA 2540 D

L1715452 CONTD....

PAGE 14 of 14

31-DEC-15 11:01 (MT)

Version: FINAL

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

\*\* 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:

<b>Laboratory Definition Code</b>	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, 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.

2

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

mg/L - milligrams per litre.

< - Less than.

1

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

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

# ALS Environmental www.alsglobal.com

# Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1715452-COFC

COC Number: 14 -

Page	of	

Report To			Report Format / Distribution			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)														
Company:	EDI		Select Report Format: PDF DEXCEL DEDD (DIGITAL)			R  Regular (Standard TAT if received by 3 pm - business days)														
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	Whitehorse, YT Y1A 3T8		Select Distribution:			E2 Same day or weekend emergency - contact ALS to confirm TAT and surcharge														
Phone:	867-393-4882		Email 1 or Fax	mmarjanovic@edy	namics.com	_	Specify Date Required for E2,E or P:													
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# S) Environmental

# Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

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Phone:	867-393-4882		Email 1 or Fax	mmarjanovic@edy	namics.com		Spec	ify Dat	te Req	ulred (	or E2,I	or P		Π						
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ENVIRONMENTAL DYNAMICS INC.

ATTN: Meghan Marjanovic

2195 - 2nd Ave

Whitehorse YT Y1A 3T8

Date Received: 16-DEC-15

Report Date: 30-DEC-15 10:56 (MT)

Version: FINAL

Client Phone: 867-393-4882

# Certificate of Analysis

Lab Work Order #: L1715436
Project P.O. #: NOT SUBMITTED

Job Reference: MOUNT NANSEN 15-Y-0146

C of C Numbers: 1

Legal Site Desc:

Can Dang Senior Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700 ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company



L1715436 CONTD.... PAGE 2 of 4

30-DEC-15 10:56 (MT) Version: FINAL

### ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1715436-1 Water 15-DEC-15 15:00 WQ-PW		
Grouping	Analyte			
WATER			+	
Physical Tests	Colour, True (CU)	<5.0		
,	Conductivity (uS/cm)	346		
	Hardness (as CaCO3) (mg/L)	184		
	pH (pH)	7.93		
	Total Dissolved Solids (mg/L)	192		
	Turbidity (NTU)	0.14		
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	159		
	Chloride (CI) (mg/L)	<0.50		
	Fluoride (F) (mg/L)	0.092		
	Nitrate (as N) (mg/L)	0.135		
	Nitrite (as N) (mg/L)	<0.0010		
	Sulfate (SO4) (mg/L)	28.4		
	Anion Sum (meq/L)	3.79		
	Cation Sum (meq/L)	3.90		
	Cation - Anion Balance (%)	1.5		
Total Metals	Aluminum (Al)-Total (mg/L)	<0.010		
	Antimony (Sb)-Total (mg/L)	<0.00050		
	Arsenic (As)-Total (mg/L)	0.00040		
	Barium (Ba)-Total (mg/L)	0.081		
	Boron (B)-Total (mg/L)	<0.10		
	Cadmium (Cd)-Total (mg/L)	<0.00020		
	Calcium (Ca)-Total (mg/L)	42.8		
	Chromium (Cr)-Total (mg/L)	<0.0020		
	Copper (Cu)-Total (mg/L)	<0.0020		
	Iron (Fe)-Total (mg/L)	<0.030		
	Lead (Pb)-Total (mg/L)	0.00067		
	Magnesium (Mg)-Total (mg/L)	18.7		
	Manganese (Mn)-Total (mg/L)	<0.0020		
	Mercury (Hg)-Total (mg/L)	<0.0020		
	Potassium (K)-Total (mg/L)			
	Selenium (Se)-Total (mg/L)	0.89		
	Sodium (Na)-Total (mg/L)	<0.0010		
	Uranium (U)-Total (mg/L)	4.7		
	Zinc (Zn)-Total (mg/L)	0.00169		
	o (_i)   o.a. (iiig/_)	<0.050		

<sup>\*</sup> Please refer to the Reference Information section for an explanation of any qualifiers detected.

# L1715436 CONTD.... PAGE 3 of 4

30-DEC-15 10:56 (MT)

### **Reference Information**

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Calcium (Ca)-Total	MS-B	L1715436-1
Matrix Spike	Zinc (Zn)-Total	MS-B	L1715436-1
Matrix Spike	Aluminum (AI)-Total	MS-B	L1715436-1
Matrix Spike	Cadmium (Cd)-Total	MS-B	L1715436-1
Matrix Spike	Copper (Cu)-Total	MS-B	L1715436-1
Matrix Spike	Manganese (Mn)-Total	MS-B	L1715436-1

### **Qualifiers for Individual Parameters Listed:**

Qualifier Description

MS-B Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

### **Test Method References:**

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

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

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

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

COLOUR-TRUE-VA Water Colour (True) by Spectrometer BCMOE Colour Single Wavelength

This analysis is carried out using procedures adapted from British Columbia Environmental Manual "Colour- Single Wavelength." Colour (True Colour) is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using the platinum-cobalt colourimetric method.

Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.

Conduitent medicarement of bampie prine recommended.

EC-MAN-WR Water Conductivity by Meter APHA 2510 (B)

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

F-IC-N-WR Water Fluoride in Water by IC EPA 300.1 (mod)

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

HARDNESS-CALC-VA Water Hardness APHA 2340B

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

HG-TOT-CVAFS-VA Water Total Hg in Water by CVAFS LOR=50ppt EPA 1631E (mod)

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

IONBALANCE-VA Water Ion Balance Calculation APHA 1030E

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

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

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

MET-T-CCMS-VA Water Total Metals in Water by CRC ICPMS EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

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).

L1715436 CONTD....

PAGE 4 of 4

30-DEC-15 10:56 (MT)

Version: FINAL

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

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

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

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

PH-MAN-WR Water pH by Meter APHA 4500-H+

pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally  $20 - 5^{\circ}$ C). For

high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.

SO4-IC-N-WR Water Sulfate in Water by IC EPA 300.1 (mod)

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

TDS-CALC-VA Water TDS (Calculated) APHA 1030E (20TH EDITION)

This analysis is carried out using procedures adapted from APHA 1030E "Checking Correctness of Analyses".

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

VA ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

### **Chain of Custody Numbers:**

1

### **GLOSSARY OF REPORT TERMS**

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

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

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

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

mg/L - milligrams per litre.

< - Less than.

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

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATÉD, ALL SAMPLES WERE RÉCEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

# ALS Environmental

www.alsglobal.com

# Chain of Custody (COC) / Analytical Request Form

Canada Toli Free: 1 800 668 9878

L1715436-COFC

COC Number:	14 -	

Page \_\_\_\_of \_\_\_\_

Report To				Report Format	/ Distribution		Select Service Level Below (Rush Turneround Time (TAT) is not available for all tests)						ts)					
Company:	EDI		Select Report Format:  PDF  EXCEL  EDD (DIGITAL)					R  Regular (Standard TAT If received by 3 pm - business days)										
Contact:	Meghan Marjanovic	Quality Control (QC) Report with Report				P Priority (2-4 bus, days if received by 3pm) 50% surcharge - contact ALS to confirm TAT							AT					
Address:	2195 - 2nd Avenue		Criteria on Report - provide details below if box checked				E     Emergency (1-2 bils, days if received by 3pm) 100% surcharge - contact ALS to confirm TAT								rm TAT			
	Whitehorse, YT Y1A 3T8		Select Distributi	ion: EM	AIL MAIL	□ FAX	E2	Same	day or w	reekend e	mergency	- contac	t ALS to	confirm 1	AT and :	surcharg	е	
Phone:	867-393-4882		Email 1 or Fax	mmarjanovic@edy	<u>mamics.com</u>		Spec	ify Date	Require	d for E2	E or P:					_		
			Email 2	Emilie.Hamm@go	v.yk.ca													
			Email 3	erik.pit@gov.yk.ca							Aı	nalysis	Requ	est				
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Company:	EDI		Email 1 or Fax	sjenner@edynami	cs.com													
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	Project Information		Oi	l and Gas Require	d Fields (client (	use)			ĺ								- 1	<u>a</u>
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LSD:			Location:				¥									1	ı	Number of Containers
ALS Lab Wo	rk Order # ((lab use only)		ALS Contact:	Sean Sluggett	Sampler: D	4,24, <i>0</i> 5	FULL-TOT-DW-WR								;			Z
ALS Sample # (lab use only)	Sample Identification (This description will a		-	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	FULL-T						İ				ı	
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Drinking	Water (DW) Samples <sup>1</sup> (client use)	Special In	structions / Spec	Ify Criteria to add o	n report (client Us	se)	Froze	n <b>Ya</b>	ST SAI	MPLE C	ONDITIO	ON AS	RECE bserva	iVED (	Yes	only)	No÷⊁	
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	SHIPMENT RELEASE (client use)	227	INITIAL S	HIPMENT RECEP	TION (lab use on					FINAL S	HIPMEI	IT RE	CEPTI	ON (lab	use or	ily} ਾਤ	TARA	T 40V/1 /
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REFER TO BACK	Y PAGE FOR ALS LOCATIONS AND SAMPLIN	IG INFORMATION		WHI	TE - LABORATOR	RY COPY YEL	LOW -	CLIENT	COPY	71			NA.	PN-0326+ +09	romW04 Jerns	ery 2014		



# Health and Social Services Santé et Affaires sociales Environmental Health Services Environmental Health Services Service d'hygiène du millieu #2 Hospital Road, Whitehorse, Yukon Y1A 3H8 #2 Hospita

2 Hospital Road, Whitehorse (Yukon) Y1A 3H8 Tél.: 867-667-8391 Téléc.: 867-667-8322 Sans frais au Yukon: 1-800-661-0408, poste 8391

Report Authorized By Report autorisé par Distribution: Distribution: Distribution: Distribution: Sample Number: VG(466469NC3 Rev.03/2013  Numéro de l'échantillon  Position Position Position Position Position Position Vellow - Lab Copy Pink - Cilient Copy Rose - Cilient Rose - Cilient Sample Number: 62255	Results (See Reverse Side for Interpretation) per 100 IIII Résultats (Voir au verso l'Interprétation des résultats)  Total Colliformes totaux    Present / Présence   Absent / Absence   Comments / Commentaires	For Laboratory Use Only A Long By  Receipt of Sample Reception de l'échantillon Date Satisfaisant Incubation Date Satisfaisant Precisez Procession Date Satisfaisant Precisez Precisez Incubation Date Pryliminos AAMMAAA Heure Dam By Incubateur Analyse terminée Date Pryliminos Date Pryliminos Par Satisfaisant Precisez Precisez Incubateur Analyse terminée Date Pryliminos AAMMAAA Heure Dam By Par Satisfaisant Precisez P	Dug Well Pults creuse  Water Holding Tank Heservoir deau  Water Chlorinated? L'eau contient-elle du chlore? Other (explain) Ves Ves Ves Von Cher Treatment Systems (e.g., UV, softener, filter) Other Treatment Systems (e.g., UV, softener, filter) Autre dispositif de traitement (ex.: désinfection aux rayons UV, adoucissaur d'au, filtre)  Autre dispositif de traitement (ex.: désinfection aux rayons UV, adoucissaur d'au, filtre)  Depth of Well Profondeur du pults	MIDD · AAMMALA  Previous Sample Nur Previous S	Agent Sampling Location · Lieu de la prise d'échantillon  Municipal Address Adresse municipale M. Non K.  Adresse municipale M. Non K.  Quad Legal Description Lot  Legal Description Lot  Legal Description Lot  Designation officielle Lot  Designation (e.g., Location, Business / Building Name)  Other Information (e.g., Location, Business / Building Name)  Other Information (e.g., Location, Business / Building Name)  Autres renseignements (ex. : emplacement, nom de l'entreprise, nom de l'édifice)	Person McG ne ressource McG address 2 195 postale 2 195 ation, Municipal or Bu e la Première nation,
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