December 22, 2015

Assessment and Abandoned Mines
Department of Energy, Mines, and Resources
Government of Yukon
Box 2703, K-419
Whitehorse, YT Y1A 2C6

Attention: Erik Pit, Project Manager

Re: Clinton Creek Environmental Monitoring and Fish Salvage

1. INTRODUCTION

During the late summer of 2015 the Government of Yukon, Assessment and Abandoned Mines (AAM) repaired drop structures at the Clinton Creek Site (herein referred to as the Site), an abandoned mine site located approximately 75 km northwest of Dawson, Yukon (100 km by road). At the Site, drop structures had been previously installed to stabilize Clinton Creek at the outlet of Hudgeon Lake, where gradual waste rock movement has created steep stream gradients and unstable slopes. A flood event in recent years damaged the lowermost (4th) drop structure, which was the focal point of repair works.

Ecological Logistics & Research Ltd. (ELR) was retained by AAM during the summer of 2015 to provide environmental monitoring and fish salvage services during the drop structure repairs. This letter report summarizes the activities performed by ELR and provides the data collected during the fish salvage and environmental monitoring process. The letter report does not provide an interpretation or analysis of the monitoring data.

2. SCOPE OF WORK

ELR's scope of environmental monitoring and fish salvage services associated with Clinton Creek drop structure repairs included:

- Attending meetings with AAM, AAM's representatives, and the project contractor, as required.
- Obtaining and providing closure data for a Scientific Collection Permit from Fisheries and Oceans Canada (DFO).
- Working with AAM's on-site environmental monitor to establish monitoring sites and review monitoring protocols.
- Providing fish salvage services on site during construction works as required.
- Performing environmental monitoring and providing related advice, as needed.

Fish salvage activities were performed according to the *Fish Salvage Plan For the Clinton Creek Drop Structure Repair*, prepared by Minnow Environmental Inc. (Minnow 2015a), and modified to site conditions as required. Environmental monitoring activities were performed according to the *Construction Monitoring*

Standard Operating Procedures For the Clinton Creek Drop Structure Repair, prepared by Minnow Environmental Inc. (Minnow 2015b), and modified to site conditions as required.

2.1 Environmental Monitoring Activities and Results

ELR staff made three visits to the site to perform environmental monitoring and fish salvage activities, and also conducted other activities according to the scope of work during and after the completion of construction activities. A summary of environmental monitoring activities are provided below.

2.1.1 August 9-11 Site Visit

ELR staff (Chris Jastrebski and Michelle McKay) were at the Site from August 9-11, 2015 during the pre-construction period, when site access upgrades were being completed, including road upgrades/grading, the installation of a culvert crossing at the location of the lower access road crossing of Clinton Creek (generally a ford crossing), and general planning for the construction works. Leading up to and during this site visit, ELR:

- Arranged for and provided to AAM all analytical laboratory sampling supplies for the weekly water quality sampling program.
- Supplied a field turbidity meter to AAM which was to be used on site for the duration of the construction project.
- Provided hard copies of field monitoring forms and laboratory chain of custody (COC) forms.
- Worked with AAM staff (Luca Poloni and Patricia Randell) to ground-truth monitoring locations and to perform the first environmental monitoring events.
- Discussed environmental monitoring, fish salvage, and mitigation strategies to be employed during the construction project.

2.1.2 September 2-3 Site Visit

ELR staff (Chris Jastrebski and Michelle McKay) were at the Site on September 2 and 3, 2015 during the implementation of the flow diversion and dewatering of the drop structures immediately prior to the drop structure repairs. At this time, all site access upgrades had been performed and the diversion pumping infrastructure had been installed (4 pumps and HDPE pipes leading from Hudgeon Lake to downstream of drop structure 4). During this site visit ELR:

- Worked with AAM staff (Wayne Emery) to discuss the status of the environmental monitoring program, and to provide advice related to the rate at which the drop structure area should be dewatered (i.e., the rate of berm construction across the outlet of Hudgeon Lake).
- Reviewed the turbidity measurement and water sampling processes with AAM staff to ensure compliance with monitoring protocols.
- Provided training on turbidity meter calibration for AAM, and confirmed the correct operation of the field turbidity meter being used on site.

2.1.3 September 23 Construction Discussion

ELR staff (Chris Jastrebski) were contacted by Patricia Randell of AAM on September 23, 2015 to discuss a diversion pumping blockage on September 22, 2015 that had temporarily reduced flows below the required minimum for the stream. ELR was asked to provide advice on whether follow-up monitoring and reporting were relevant or required. ELR staff confirmed with Minnow Environmental staff that no follow up monitoring (for conditions or potential fish mortality) were relevant as flows had been re-established, and confirmed that a summary of the event should be provided to DFO for the purposes of maintaining a transparent reporting process. No further discussions or requests of ELR occurred.

2.1.4 September 30 Water Sample Collection

ELR staff (Aaron Nicholson and Chris Harwood [Hemmera]) on site for a water quality and hydrology sampling program were asked to collect a final (post construction) set of water quality samples from the five on-site locations. These samples were collected between September 30 and October 2, 2015, and delivered to the analytical laboratory in Whitehorse.

2.1.5 Analytical Water Sample Handling and Analysis

Throughout the construction project, ELR received weekly laboratory analytical samples from AAM staff either shipped via Air North or delivered directly to ELR by AAM staff. For each sample shipment, ELR reviewed the COC, submitted the samples to the laboratory (ALS Global), and conducted ongoing liaison with the laboratory through to the receipt of data. Throughout the duration of construction, ELR received and submitted for analysis eight shipments of samples (Table 1).

Table 1: Summary of Laboratory Analytical Samples Collected During the Drop Structure Repair Project

Date	Event	Laboratory Analytical Parameters Requested			
		pH	Total Suspended Solids (TSS)	Total Metals	Asbestos (Sites HL, CCI, CC2 only)
August 10	Pre-Construction	•	•	•	•
August 16	Weekly Sample During Construction	•	•	•	
August 26	Weekly Sample During Construction	•	•	•	
August 31	Weekly Sample During Construction	•	•	•	
September 8	Weekly Sample During Construction	•	•	•	
September 15	Weekly Sample During Construction	•	•	•	
September 22	Weekly Sample During Construction	•	•	•	
September 30	Post-Construction	•	•	•	•

After receipt of laboratory data, the results were reviewed and entered into ELR's EQWin water quality database along with field *in-situ* parameter data (pH in pH units; conductivity in µs/cm) that was collected and provided by AAM. The database was used to flag exceedences of Canadian Council of Ministers on the Environment (CCME) *Water Quality Guidelines for Protection of Aquatic Life* (CCME-FAL), where applicable (CCME 2014). A summary of the monitoring data including flagged exceedences of CCME-

FAL guidelines is provided in Appendix 1, while the laboratory certificates of analysis are provided in Appendix 2.

ELR was also provided the results of turbidity monitoring from the project, which were combined and are included as Appendix 3 of this memo. A review of the data was completed to identify exceedences of the project monitoring threshold of 50 NTU, to summarize where additional follow-up monitoring was completed in relation exceedences of more than 4 hours (Minnow 2015b). Throughout the construction period of August 10, 2015 to September 26, 2015, a single exceedance was noted (CC1, August 27, 2015 at 09:18; 60.1 NTU), which dropped to within limits within 10 minutes (CC1, August 27, 2015 at 09:28; 12.9 NTU). Based on these *in-situ* results, no additional monitoring as defined by Minnow (2105b) was required.

3. FISH SALVAGE ACTIVITIES AND RESULTS

ELR staff conducted two fish salvage events at the Site in conjunction with instream works. All salvage activities were conducted under scientific collection permit XR 249 2015 (Appendix 4).

3.1 Culvert Installation August 9-10, 2015

ELR staff visited the Site on August 9 and 10, 2015 to perform fish salvage for the installation of culverts at the downstream ford crossing location. ELR installed block nets upstream and downstream of the work area to isolate an instream work area to be salvaged; the upstream and downstream limits were established by AAM and the construction contractor (P S Sidhu Trucking). ELR prepared nets and supporting posts on August 9, 2015 in order to start salvage work early on August 10, 2015.

ELR conducted salvage using a backpack electrofisher (Smith Root LR-24) starting at 8:40 on August 10, 2015. Seven electrofishing passes of the isolated area were conducted between 8:40 and 13:00, totaling 4,204 seconds of electrofishing effort, during which time fish continued to be consistently captured at a low rate. Although block nets had been securely installed (no fish entering), the isolation area included a deep run and deep pool area where fish were concentrated and where the backpack electrofisher was less effective, therefore the fishing effectiveness was low. After further discussion with AAM and the contractor, it was agreed that the isolated area was to be reduced to only the area needed for culvert installation. Following the installation of an additional block net to reduce the isolation area, six passes totaling 2,027 seconds of effort were required to clear fish from the area. Salvage of the culvert area was completed at approximately 14:00 on August 10, 2015. A summary of the electofishing efforts employed fish catches from this salvage event is provided in Table 2. In total, 37 fish were removed from the instream work area.

Table 2: Backpack Electrofishing Effort Summary for Culvert Installation at Clinton Creek

Watercourse	Date	Electrofisher Effort and Settings					Catch			
		Effort (seconds)	Voltage (V)	Duty Cycle	Frequency (Hz)	Power (w)	Arctic Grayling	Slimy Sculpin	Longnose Sucker	Juvenile Chinook Salmon
Clinton Creek	10-Aug-15	723	250	12	45	45-50		4		
	10-Aug-15	984	250	12	45	45-50	1	3		
	10-Aug-15	799	275	12	75	40-60	4	3	3	1
	10-Aug-15	672	275	12	75	40-60	1	1	1	
	10-Aug-15	603	275	12	75	40-60	2	1		
	10-Aug-15	423	275	12	75	40-60	2	1		
	10-Aug-15	546	275	12	75	40-60	3			
	10-Aug-15	468	275	12	75	40-60	4			
	10-Aug-15	180	275	12	75	40-60	2			
	10-Aug-15	367	275	12	75	40-60				
	10-Aug-15	210	275	12	75	40-60				
	10-Aug-15	256	275	12	75	40-60				
Total Effort		**6,231**					**19**	**13**	**4**	**1**

3.2 Diversion Implementation September 2-3, 2015

ELR staff visited the Site on September 2 and 3, 2015 to perform fish salvage during the implementation of the diversion (and dewatering of the drop structures). On the morning of September 2, ELR assessed the instream work area, which extended from the base of the 4th drop structure to roughly 10 m downstream of the extent of construction. Prior to the implementation of the pumping diversion, it was determined that flows were too high through the work area to conduct salvage safely and effectively, and that flow to the drop structure area should be reduced prior to salvage work. Accordingly, AAM initiated the contractor to begin closing off the outlet to Hudgeon Lake, and a berm closure was completed between 8:30 and 13:00 of that day. Due to the amount of water stored in the upper three drop structures, water levels at drop structure 4 were very slow to respond (be reduced), and it wasn't until the early afternoon of September 2 that fish salvage could begin.

ELR installed a block net at the downstream extent of the fish salvage area below drop structure 4, and began salvage activities at roughly 13:30 on September 2 using a combination of electrofishing and seine netting. After an initial electrofishing pass, it was apparent that there was an extremely high concentration of fish in the upper pool area immediately below the drop structure. Accordingly, ELR employed a seine net to remove large numbers of easily catchable fish from the pool area, then resumed electrofishing. In total, 11 seine net pulls and 10 electrofishing passes (totaling 3,557 seconds) were conducted on September 2, with work ending at 19:00. Water levels were relatively stable overnight and ELR resumed fish salvage at 8:00 on September 3, performing another 9 passes totaling 4,469 seconds of effort. During salvage work on the second day, the contractor installed an instream berm to help isolate flow from the work area, and also installed a small pump to directly dewater the work area and concentrate any remaining fish, assisting in the progress of the salvage. The salvage was completed at approximately 12:30 on September 3, 2015, with a total of 500 fish having been removed from the

work area. A summary of the electofishing efforts employed and fish catches from this salvage event is provided in Table 3, and a summary of seine netting efforts and catches is provided in Table 4.

Table 3: Backpack Electrofishing Effort Summary for Drop Structure 4 Dewatering

Watercourse	Date	Electrofisher Effort and Settings					Catch			
		Effort (seconds)	Voltage (V)	Duty Cycle	Frequency (Hz)	Power (w)	Arctic Grayling	Slimy Sculpin	Longnose Sucker	Juvenile Chinook Salmon
Clinton Creek	2-Sep-15	129	275	12	75	40-60	6	1		1
	2-Sep-15	356					8	13	1	
	2-Sep-15	432					17	15	3	4
	2-Sep-15	148					3	3	2	1
	2-Sep-15	140					1	1		
	2-Sep-15	110								
	2-Sep-15	295					13	9		1
	2-Sep-15	301					16	22		
	2-Sep-15	760					18	23	2	2
	2-Sep-15	886					12	25	2	
	3-Sep-15	1265					16	11		
	3-Sep-15	956					1	5		
	3-Sep-15	276					1	2		
	3-Sep-15	601						6	2	
	3-Sep-15	397						5		
	3-Sep-15	182						2	1	
	3-Sep-15	363					2	11		1
	3-Sep-15	277						1		
	3-Sep-15	152						1		
Total Effort		**8,026**					**114**	**156**	**13**	**10**

Table 4: Seine Netting Effort Summary During Salvage for Drop Structure 4 Dewatering

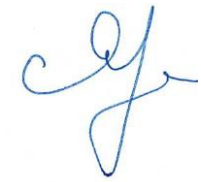
Watercourse	Date	Seine Pull Number	Catch			
			Arctic Grayling	Slimy Sculpin	Longnose Sucker	Juvenile Chinook Salmon
Clinton Creek	2-Sep-15	1	17			
	2-Sep-15	2-3	21			1
	2-Sep-15	3-4	30	1		2
	2-Sep-15	6	59			
	2-Sep-15	7-8	6	1		
	2-Sep-15	9	45			
	2-Sep-15	10-11	24			
Total Effort			**202**	**2**		**3**

4. CLOSURE

Ecological Logistics & Research Ltd. (ELR) has prepared this memo to summarize environmental monitoring and fish salvage activities performed at the Clinton Creek Site in conjunction with drop structure repairs. This memo is intended for use by the Government of Yukon, Assessment and Abandoned Mines and its agents, and is not to be used or relied upon for other purposes.

We trust this this memo meets the project needs at this time, and we welcome any further inquiries related to the project that you may have.

Sincerely,



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References

Canadian Council of Ministers of the Environment (CCME). 2014. Canadian Water Quality Guidelines for the Protection of Aquatic Life. Accessed online at http://st-ts.ccme.ca/, March 2014.

Minnow Environmental Inc. (Minnow). 2015a. Fish Salvage Plan for the Clinton Creek Drop Structure Repair. Prepared for Yukon Government, Assessment and Abandoned Mines.

Minnow Environmental Inc. (Minnow). 2015b. Construction Monitoring Standard Operating Procedures for the Clinton Creek Drop Structure Repair. Prepared for Yukon Government, Assessment and Abandoned Mines.

PHOTOGRAPHS

Photo 1: View of the isolated and salvaged area at the Clinton Creek ford crossing location, showing the reduced isolation area. Photo taken August 10, 2015.

Photo 2: View of the isolated and salvaged area at the Clinton Creek ford crossing location during culvert installation. Note the original extent of isolation (upper left net in background) and the revised smaller area (closer net in upper left). Photo taken August 10, 2015.

Photo 3: View of the instream work area below drop structure 4 prior to the implementation of the diversion. As noted, the water levels and flow were too great to safely salvage fish. Photo taken September 2, 2015.

Photo 4: View of the instream work area below drop structure 4 following the full closure of the Hudgeon Lake outlet (all water flowing through diversion). Fish salvage was underway at the time of the photo. Photo taken September 2, 2015.

Photo 5: View of the instream work area below drop structure 4 on September 3, 2015, after all drop structures had dewatered for 24 hours. Salvage had been completed at the time of this photograph.

Appendix I – Summary of Water Quality Monitoring Data

		Site Location	Clinton Creek - CC1								Clinton Creek - CC2								Clinton Creek - CC3							
		Sample ID	CC1	CC1	CC1	CC1	CC1	CC1	CC1	CC1	CC2	CC2	CC2	CC2	CC2	CC2	CC2	CC2	CC3	CC3	CC3	CC3	CC3	CC3	CC3	CC3
		Date Sampled	10/08/2015	16/08/2015	26/08/2015	31/08/2015	08/09/2015	15/09/2015	22/09/2015	30/09/2015	10/08/2015	16/08/2015	26/08/2015	31/08/2015	08/09/2015	15/09/2015	22/09/2015	30/09/2015	10/08/2015	16/08/2015	26/08/2015	31/08/2015	08/09/2015	15/09/2015	22/09/2015	30/09/2015
		ALS Work Number	L1657162	L1662011	L1665125	L1668448	L1672207	L1675053	L1678817	L1683409	L1657162	L1662011	L1665125	L1668448	L1672207	L1675053	L1678817	L1683409	L1657162	L1662011	L1665125	L1668448	L1672207	L1675053	L1678817	L1683409
Parameter	**Units**	CCME-FAL [1, 2, 3, 4]																								
Lab pH	pH units	6.5-9.0 [5]	8.23	8.11	8.09	7.98	8.01	8.22	8.11	8.24	8.09	7.89	8.05	7.91	7.90	8.23	7.99	8.22	8.11	7.91	8.06	7.92	7.94	8.28	8.01	8.23
Field pH	pH units	6.5-9.0 [5]	8.14	8.22	8.1	8.24	8.21	8.27	8.33	6.46	7.82	7.79	7.96	8.1	8.05	8.06	8.08	7.63	7.9	7.99	7.95	8.1	8.1	8.19	8.15	6.91
Field Conductivity	uS/cm	-	493	509	471	425	453	458	5.03	348.8	718	641	557	509	617	648	7.5	494.3	703	632	527	493	656	631	7.13	438.5
Total Suspended Solids	mg/L	-	<3.0	4.0	4.0	3.3	<3.0	3.3	<3.0	<3.0	<3.0	4.0	<3.0	<3.0	<3.0	4.0	<3.0	<3.0	<3.0	5.3	31.3	3.3	4.0	8.0	<3.0	10.7
Total Hardness (as CaCO3)	mg/L	-	281	274	261	248	278	289	295	337	412	360	308	301	391	396	454	471	407	351	288	288	428	381	443	426
Total Metals																										
Aluminum (Al)	mg/L	Varies [6]	0.0388	0.0392	0.123	0.184	0.0924	0.0607	0.0490	0.0525	0.0263	0.0320	0.133	0.167	0.0961	0.0407	0.0321	0.0347	0.0385	0.109	0.628	0.194	0.145	0.134	0.0638	0.315
Aluminum CCME-FAL	mg/L	-	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.005000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*
Antimony (Sb)	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00053	<0.00050	0.00057	<0.00050	<0.00050	<0.00050	0.00051	<0.00050	0.00057	<0.00050
Arsenic (As)	mg/L	0.005	0.00090	0.00085	0.00083	0.00102	0.00085	0.00078	0.00079	0.00086	0.00125	0.00106	0.00109	0.00120	0.00117	0.00106	0.00125	0.00120	0.00128	0.00112	0.00133	0.00117	0.00138	0.00108	0.00131	0.00122
Barium (Ba)	mg/L	-	0.053	0.054	0.059	0.063	0.060	0.061	0.058	0.063	0.050	0.054	0.056	0.059	0.057	0.054	0.054	0.058	0.052	0.057	0.072	0.059	0.062	0.058	0.055	0.066
Beryllium (Be)	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Boron (B)	mg/L	1.5	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium (Cd)	mg/L	Varies [7]	0.0000293	0.0000322	0.0000381	0.0000490	0.0000424	0.0000470	0.0000419	0.0000347	0.0000567	0.0000405	0.0000467	0.0000529	0.0000532	0.0000493	0.0000652	0.0000541	0.0000473	0.0000437	0.0000892	0.0000480	0.0000488	0.0000460	0.0000565	0.0000548
Cadmium CCME-FAL	mg/L	-	*0.00037*	*0.000366*	*0.000351*	*0.000337*	*0.000370*	*0.00037*	*0.00037*	*0.00037*	*0.00037*	*0.00037*	*0.00037*	*0.00037*	*0.00037*	*0.00037*	*0.00037*	*0.00037*	*0.00037*	*0.00037*	*0.00037*	*0.00037*	*0.00037*	*0.00037*	*0.00037*	*0.00037*
Calcium (Ca)	mg/L	-	61.4	59.8	58.0	55.9	60.5	65.1	65.8	74.2	78.7	71.0	64.6	64.0	74.4	78.1	86.0	89.6	76.2	67.9	57.7	60.2	78.0	73.8	82.7	79.6
Chromium (Cr)	mg/L	-	<0.0010	<0.0010	0.0010	0.0012	<0.0010	<0.0010	<0.0010	0.0013	<0.0010	<0.0010	0.0014	0.0012	0.0012	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	0.0024	0.0013	0.0012	<0.0010	<0.0010	0.0015
Cobalt (Co)	mg/L	-	<0.00030	<0.00030	0.00037	0.00048	0.00040	0.00037	0.00037	0.00042	0.00070	0.00051	0.00055	0.00056	0.00066	0.00065	0.00081	0.00074	0.00060	0.00049	0.00081	0.00054	0.00074	0.00058	0.00077	0.00069
Copper (Cu)	mg/L	Varies [8]	0.0028	0.0027	<0.0035	0.0034	0.0030	0.0031	0.0027	0.0028	0.0022	0.0027	<0.0035	0.0031	0.0027	0.0024	0.0021	0.0022	0.0021	0.0027	<0.0045	0.0033	0.0025	0.0024	0.0022	0.0028
Copper CCME-FAL	mg/L	-	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*
Iron (Fe)	mg/L	0.3	0.181	0.193	0.439	0.538	0.336	0.259	0.273	0.327	0.301	0.266	0.452	0.528	0.436	0.312	0.370	0.397	0.299	0.412	1.22	0.585	0.558	0.488	0.406	0.867
Lead (Pb)	mg/L	Varies [9]	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00074	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Lead CCME-FAL	mg/L	-	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*
Lithium (Li)	mg/L	-	0.0034	0.0028	0.0032	0.0028	0.0033	0.0030	0.0035	0.0033	0.0087	0.0060	0.0045	0.0045	0.0080	0.0075	0.0113	0.0090	0.0079	0.0050	0.0041	0.0043	0.0080	0.0062	0.0101	0.0062
Magnesium (Mg)	mg/L	-	30.9	30.3	28.1	26.4	30.9	30.7	31.7	36.7	52.4	44.3	35.7	34.2	49.7	48.8	58.2	60.1	52.7	44.0	35.0	33.5	56.7	47.7	57.5	55.2
Manganese (Mn)	mg/L	-	0.0695	0.0844	0.0994	0.126	0.157	0.167	0.181	0.181	0.106	0.0945	0.121	0.122	0.153	0.153	0.179	0.170	0.0960	0.0933	0.121	0.115	0.144	0.138	0.173	0.149
Mercury (Hg)	mg/L	0.000026	0.0000109	<0.0000050	0.0000069	0.0000079	0.0000072	0.0000085	<0.0000050	0.0000101	0.0000079	<0.0000050	<0.0000050	0.0000078	0.0000076	0.0000082	<0.0000050	0.0000087	0.0000080	0.0000057	0.0000152	0.0000074	0.0000058	0.0000081	<0.0000050	0.0000100
Molybdenum (Mo)	mg/L	0.073	0.0015	0.0014	0.0013	0.0012	0.0012	0.0014	0.0013	0.0014	0.0019	0.0016	0.0014	0.0014	0.0015	0.0016	0.0017	0.0017	0.0018	0.0016	0.0014	0.0013	0.0016	0.0014	0.0016	0.0014
Nickel (Ni)	mg/L	Varies [10]	0.0062	0.0049	0.0044	0.0053	0.0050	0.0050	0.0051	0.0063	0.0163	0.0113	0.0096	0.0088	0.0125	0.0129	0.0174	0.0148	0.0152	0.0107	0.0099	0.0085	0.0136	0.0111	0.0168	0.0115
Nickel CCME-FAL	mg/L	-	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*
Potassium (K)	mg/L	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Selenium (Se)	mg/L	0.001	0.00120	0.00123	0.00123	0.00123	0.00135	0.00154	0.00163	0.00174	0.00121	0.00126	0.00133	0.00163	0.00145	0.00144	0.00157	0.00162	0.00115	0.00118	0.00131	0.00151	0.00137	0.00125	0.00141	0.00136
Silver (Ag)	mg/L	0.0001	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	0.000052	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	0.000028	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Sodium (Na)	mg/L	-	2.7	2.7	2.4	2.5	2.7	3.0	3.0	3.1	4.3	3.5	2.8	2.8	3.7	4.0	4.5	4.4	4.3	3.6	3.0	2.9	4.4	4.2	4.5	4.3
Thallium (Tl)	mg/L	0.0008	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Tin (Sn)	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Titanium (Ti)	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.020	<0.010	<0.010	<0.010	<0.010	0.014
Uranium (U)	mg/L	0.015	0.00202	0.00199	0.00167	0.00167	0.00171	0.00211	0.00209	0.00231	0.00218	0.00207	0.00180	0.00179	0.00197	0.00208	0.00236	0.00252	0.00236	0.00221	0.00190	0.00180	0.00238	0.00242	0.00255	0.00285
Vanadium (V)	mg/L	-	<0.00050	<0.00050	0.00067	0.00112	0.00094	0.00057	0.00069	<0.00050	<0.00050	<0.00050	0.00081	0.00106	0.00099	<0.00050	0.00065	<0.00050	<0.00050	0.00069	0.00207	0.00115	0.00124	0.00084	0.00084	0.00128
Zinc (Zn)	mg/L	0.03	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0057	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050

		Site Location	Hudgeon Lake - HL					Hudgeon Lake - HLB			Wolverine Creek - WC							
		Sample ID	HL	HL	HL	HL	HL	HLB	HLB	HLB	WC	WC	WC	WC	WC	WC	WC	WC
		Date Sampled	10/08/2015	16/08/2015	26/08/2015	31/08/2015	02/10/2015	08/09/2015	15/09/2015	22/09/2015	10/08/2015	16/08/2015	26/08/2015	31/08/2015	08/09/2015	15/09/2015	22/09/2015	30/09/2015
		ALS Work Number	L1657162	L1662011	L1665125	L1668448	L1683409	L1672207	L1675053	L1678817	L1657162	L1662011	L1665125	L1668448	L1672207	L1675053	L1678817	L1683409
Parameter	**Units**	CCME-FAL[1, 2, 3, 4]																
Lab pH	pH units	6.5-9.0 [5]	8.12	7.92	7.81	7.69	8.10	7.81	8.06	7.81	8.19	7.93	7.98	7.93	8.03	8.16	8.14	8.19
Field pH	pH units	6.5-9.0 [5]	7.97	8	7.7	7.78	7.9	7.81	7.9	7.91	8.12	8.14	7.99	8.19	8.29	8.36	8.4	7.89
Field Conductivity	uS/cm	-	487	505	465	423	333.3	449	459	5.01	661	598	4.62	430	570	5.91	6.51	377.4
Total Suspended Solids	mg/L	-	<3.0	3.3	<3.0	<3.0	<3.0	<3.0	6.0	<3.0	<3.0	14.0	69.3	16.0	9.3	15.3	5.3	25.3
Total Hardness (as CaCO3)	mg/L	-	278	287	261	235	322	277	276	288	384	309	262	243	344	353	379	379
Total Metals																		
Aluminum (Al)	mg/L	Varies [6]	0.0451	0.0575	0.129	0.186	0.0440	0.115	0.0583	0.0518	0.104	0.403	1.81	0.563	0.221	0.347	0.196	0.711
Aluminum CCME-FAL	mg/L	-	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*
Antimony (Sb)	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00079	0.00055	0.00052	<0.00050	0.00054	<0.00050	0.00073	<0.00050
Arsenic (As)	mg/L	0.005	0.00084	0.00086	0.00085	0.00101	0.00071	0.00091	0.00079	0.00080	0.00116	0.00116	0.00224	0.00130	0.00108	0.00105	0.00121	0.00138
Barium (Ba)	mg/L	-	0.055	0.060	0.059	0.059	0.061	0.061	0.059	0.057	0.060	0.064	0.119	0.066	0.059	0.067	0.061	0.077
Beryllium (Be)	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Boron (B)	mg/L	1.5	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium (Cd)	mg/L	Varies [7]	0.0000397	0.0000295	0.0000424	0.0000523	0.0000493	0.0000478	0.0000395	0.0000391	0.0000255	0.0000317	0.000209	0.0000389	0.0000247	0.0000337	0.0000203	0.0000462
Cadmium CCME-FAL	mg/L	-	*0.000370*	*0.00037*	*0.000351*	*0.000322*	*0.00037*	*0.000369*	*0.000368*	*0.00037*	*0.00037*	*0.00037*	*0.000353*	*0.000331*	*0.00037*	*0.00037*	*0.00037*	*0.00037*
Calcium (Ca)	mg/L	-	61.1	62.2	57.9	53.1	70.9	60.2	62.5	64.6	68.8	56.4	48.6	45.4	62.1	68.0	68.1	69.9
Chromium (Cr)	mg/L	-	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	0.0021	0.0065	0.0024	0.0013	0.0015	0.0012	0.0023
Cobalt (Co)	mg/L	-	0.00036	0.00038	0.00041	0.00048	0.00047	0.00047	0.00041	0.00045	<0.00030	0.00047	0.00170	0.00062	0.00038	0.00051	0.00035	0.00070
Copper (Cu)	mg/L	Varies [8]	0.0030	0.0029	<0.0035	0.0034	0.0028	0.0034	0.0030	0.0028	0.0023	0.0031	0.0082	0.0037	0.0024	0.0027	0.0022	0.0035
Copper CCME-FAL	mg/L	-	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*
Iron (Fe)	mg/L	0.3	0.224	0.283	0.409	0.514	0.294	0.351	0.265	0.279	0.397	0.880	3.47	1.08	0.590	0.802	0.574	1.54
Lead (Pb)	mg/L	Varies [9]	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00225	0.00050	<0.00050	<0.00050	<0.00050	0.00071
Lead CCME-FAL	mg/L	-	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*
Lithium (Li)	mg/L	-	0.0033	0.0030	0.0032	0.0029	0.0030	0.0034	0.0030	0.0034	0.0045	0.0031	0.0040	0.0029	0.0040	0.0035	0.0046	0.0034
Magnesium (Mg)	mg/L	-	30.6	32.0	28.2	24.9	35.3	30.7	29.2	30.6	51.6	40.8	34.2	31.5	45.9	44.6	50.8	49.7
Manganese (Mn)	mg/L	-	0.120	0.124	0.126	0.134	0.276	0.207	0.203	0.249	0.0702	0.0879	0.143	0.0915	0.0993	0.117	0.100	0.127
Mercury (Hg)	mg/L	0.000026	0.0000107	<0.0000050	0.0000062	0.0000089	0.0000091	0.0000067	0.0000079	0.0000056	0.0000104	0.0000106	0.0000150	0.0000110	0.0000054	0.0000093	<0.0000050	0.0000113
Molybdenum (Mo)	mg/L	0.073	0.0015	0.0015	0.0012	0.0012	0.0013	0.0012	0.0012	0.0013	0.0014	0.0012	0.0014	0.0011	0.0012	0.0012	0.0012	0.0012
Nickel (Ni)	mg/L	Varies [10]	0.0043	0.0050	0.0044	0.0047	0.0048	0.0049	0.0044	0.0048	0.0093	0.0082	0.0127	0.0078	0.0072	0.0068	0.0093	0.0072
Nickel CCME-FAL	mg/L	-	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*
Potassium (K)	mg/L	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Selenium (Se)	mg/L	0.001	0.00130	0.00121	0.00118	0.00118	0.00162	0.00141	0.00134	0.00162	0.00103	0.000871	0.00105	0.000974	0.00109	0.00100	0.00104	0.00110
Silver (Ag)	mg/L	0.0001	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	0.000076	0.000023	<0.000020	<0.000020	<0.000020	<0.000020
Sodium (Na)	mg/L	-	2.7	3.0	2.5	2.4	3.0	2.7	2.9	2.9	4.3	3.7	3.4	3.3	4.1	4.6	4.5	4.3
Thallium (Tl)	mg/L	0.0008	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Tin (Sn)	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Titanium (Ti)	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.015	0.039	0.016	0.010	0.015	0.011	0.025
Uranium (U)	mg/L	0.015	0.00209	0.00208	0.00164	0.00163	0.00214	0.00175	0.00189	0.00203	0.00345	0.00275	0.00208	0.00187	0.00268	0.00308	0.00313	0.00344
Vanadium (V)	mg/L	-	<0.00050	0.00052	0.00079	0.00106	<0.00050	0.00104	0.00061	0.00075	0.00086	0.00170	0.00559	0.00234	0.00154	0.00162	0.00127	0.00248
Zinc (Zn)	mg/L	0.03	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0163	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050

(1) CCME guideline exceedences shaded with dark grey. Light grey shading denotes reportable detection limit in exceedence of CCME Guideline. Where guideline value is dependent on hardness or pH, reported values have been compared against a guideline value calculated for each site based on the relevant value, and the guideline value has been noted as "varies".

(2) - = No standard or not analyzed

(3) CCME = Canadian Council of Ministers of the Environment, Canadian Environmental Quality Guidelines, 1999, updated to November 2014

(4) CCME FAL = Chapter 4, Canadian Water Quality Guidelines for the Protection of Aquatic Life, Freshwater, updated to November 2014

(5) CCME FAL stipulates pH not < 6.5 and not > 9

(6) Aluminum varies with pH as follows for CCME FAL:

0.005	if	pH<6.5
0.1	if	pH>=6.5

when field pH is not available, lab pH is used. When field and lab pH are both not available, the most stringent guideline has been used.

(7) Cadmium varies with Hardness in mg/L as follows for CCME FAL:

0.00	if	H<17
0.00004 - 0.00037	if	H>=17 and H<=280 as follows;
		CWQG (µg/L) = 10{0.83(log[hardness]) – 2.46 }
0.00	if	H>280

(8) Copper varies with Hardness in mg/L as follows for CCME FAL:

0.002	if	H<82
0.002 - 0.004	if	H>=82 and H<=180 as follows;
		CWQG (µg/L) = 0.2 * e{0.8545[ln(hardness)]-1.465}
0.004	if	H>180

(9) Lead varies with Hardness in mg/L as follows for CCME FAL:

0.001	if	H<60
.001 - 0.00	if	H>=60 and H<=180 as follows;
		CWQG (µg/L)= e{1.273[ln(hardness)]-4.705}
0.007	if	H>180

(10) Nickel varies with Hardness in mg/L as follows for CCME FAL:

0.025	if	H<60
025 - 0.15	if	H>=60 and H<=180 as follows;
		CWQG (µg/L) = e{0.76[ln(hardness)]+1.06}
0.15	if	H>180

Italics text indicates the parameter-specific standard (calculated) for a particular sample.

Appendix 2 – Laboratory Certificates of Analysis

ECOLOGICAL LOGISTICS & RESEARCH LTD.
ATTN: Chris Jastrebski
204 - 105 Titanium Way
Whitehorse YT Y1A 0E7

Date Received: 13-AUG-15
Report Date: 27-AUG-15 11:09 (MT)
Version: FINAL

Client Phone: 867-668-6386

Certificate of Analysis

Lab Work Order #: L1657162

Project P.O. #: NOT SUBMITTED
Job Reference: 15-210
C of C Numbers: 1
Legal Site Desc:

Comments: Please note ALS identified samples L1657162-1 to -3 was sublet to ALS Cincinnati for Asbestos in water testing.

Jamie Lo, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1657162-1	L1657162-2	L1657162-3	L1657162-4	L1657162-5
Description	Water	Water	Water	Water	Water
Sampled Date	10-AUG-15	10-AUG-15	10-AUG-15	10-AUG-15	10-AUG-15
Sampled Time	09:37	09:09	08:26	08:00	08:10
Client ID	HL	CC1	CC2	CC3	WC
Grouping / **Analyte**					
WATER					
Physical Tests Hardness (as CaCO3) (mg/L)	278	281	412	407	384
pH (pH)	8.12	8.23	8.09	8.11	8.19
Total Suspended Solids (mg/L)	<3.0	<3.0	<3.0	<3.0	<3.0
Total Metals Aluminum (Al)-Total (mg/L)	0.0451	0.0388	0.0263	0.0385	0.104
Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	0.00050	0.00057	0.00079
Arsenic (As)-Total (mg/L)	0.00084	0.00090	0.00125	0.00128	0.00116
Barium (Ba)-Total (mg/L)	0.055	0.053	0.050	0.052	0.060
Beryllium (Be)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Boron (B)-Total (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium (Cd)-Total (mg/L)	0.0000397	0.0000293	0.0000567	0.0000473	0.0000255
Calcium (Ca)-Total (mg/L)	61.1	61.4	78.7	76.2	68.8
Chromium (Cr)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	0.0011
Cobalt (Co)-Total (mg/L)	0.00036	<0.00030	0.00070	0.00060	<0.00030
Copper (Cu)-Total (mg/L)	0.0030	0.0028	0.0022	0.0021	0.0023
Iron (Fe)-Total (mg/L)	0.224	0.181	0.301	0.299	0.397
Lead (Pb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Lithium (Li)-Total (mg/L)	0.0033	0.0034	0.0087	0.0079	0.0045
Magnesium (Mg)-Total (mg/L)	30.6	30.9	52.4	52.7	51.6
Manganese (Mn)-Total (mg/L)	0.120	0.0695	0.106	0.0960	0.0702
Mercury (Hg)-Total (mg/L)	0.0000107	0.0000109	0.0000079	0.0000080	0.0000104
Molybdenum (Mo)-Total (mg/L)	0.0015	0.0015	0.0019	0.0018	0.0014
Nickel (Ni)-Total (mg/L)	0.0043	0.0062	0.0163	0.0152	0.0093
Potassium (K)-Total (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
Selenium (Se)-Total (mg/L)	0.00130	0.00120	0.00121	0.00115	0.00103
Silver (Ag)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Sodium (Na)-Total (mg/L)	2.7	2.7	4.3	4.3	4.3
Thallium (Tl)-Total (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Tin (Sn)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Titanium (Ti)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)-Total (mg/L)	0.00209	0.00202	0.00218	0.00236	0.00345
Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	0.00086
Zinc (Zn)-Total (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050

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

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Calcium (Ca)-Total	MS-B	L1657162-1, -2, -3, -4, -5
Matrix Spike	Magnesium (Mg)-Total	MS-B	L1657162-1, -2, -3, -4, -5

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**
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-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.

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).

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.

TSS-MAN-WR	Water	Total Suspended Solids by Gravimetric	APHA 2540 D

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:

Laboratory Definition Code	Laboratory Location

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

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

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Submitted To: Reporting
ALS Whitehorse
12-151 Industrial Rd
Whitehorse, YT Y1A2V3

REFERENCE DATA

Asbestos in Water by TEM

Sample Type:	Drinking Water
Method Reference:	EPA Method 100.2
Client Sample No.:	L1657162-1/HL through L1657162-3/CC2
Sample Location:	L1657162; ELR: Clinton Creek
PO No.:	L1657162
ALS Work Order No.:	1508549
ALS Sample No.:	1508549-01 through 1508549-03

The samples indicated in this report were analyzed by Transmission Electron Microscopy (TEM) for asbestos using EPA Method 100.2 "Detection of Asbestos Structures >10μm in Length in Drinking Water" dated June 1994. Sample collection is performed outside the laboratory and is the responsibility of the client. If sample collection or submission deviates from any method requirement, interpretation of the results under strict EPA guidelines cannot be made.

Upon arrival at the laboratory, each sample was ultrasonically treated in its original container for 15 minutes to suspend the solids. Aliquots of this suspension were filtered onto 0.22μm pore size MCE filters. Whenever possible, a sufficient volume of sample is filtered to yield a reporting limit (RL) of <0.20 MFL equivalent to counting of one confirmed asbestos fiber. However, the actual volumes filtered are based on the clarity of the sample. Portions of the filtered sample are coated with carbon and mounted on TEM grids for examination.

Analysis is performed on an FEI Tecnai Spirit G2 Twin TEM with EDAX Genesis System. Results apply only to portions of samples analyzed and are tabulated on the following page(s). Samples are disposed after sufficient filtration. Filtered portions are disposed after 1 year, and grids are archived for a minimum of 3 years.

Pamela Johnson
Analyst

Shawn Smythe
Project Manager

NELAC accredited through New York ELAP (LAB #11371)

CLIENT: ALS Whitehorse
SAMPLE LOCATION: L1657162; ELR: Clinton Creek

SAMPLE PREP DATA

Date Received:	8/18/2015
Date Filtered:	8/18/2015
Time Filtered:	10:30
Filter Type:	MCE, 0.22 µm
Filter Size:	47 mm
Collection Area:	1075 mm^2

ANALYSIS DATA

Date and Time Analyzed:	8/25/2015 & 14:00
Magnification:	13,500x
Calibration Constant:	1 cm = 0.74 µm
EDXA Resolution:	<170.0 eV
Accelerating Voltage:	100 keV
Camera Constant:	129.25 mm-Å

SAMPLE IDENTIFICATION			
Client Sample No.:	L1657162-1/HL	L1657162-2/CC1	L1657162-3/CC2
ALS Sample No.:	1508549-01	1508549-02	1508549-03
Date Sampled:	8/10/2015	8/10/2015	8/10/2015
Time Sampled:	9:37	9:09	8:26
Volume Filtered (L):	0.050	0.050	0.050
No. Grid Openings Analyzed:	10	4	4
Average Grid Opening Area:	0.0108	0.0108	0.0108
RL (MFL):	0.20	0.50	0.50
Asbestos Fibers ≥10 microns			
Chrysotile:	7	19	12
Amosite:	0	0	0
Crocidolite:	0	0	0
Act-Tremolite†:	0	0	0
Anthophyllite:	0	0	0
Total Asbestos ≥10 microns			
Count:	**7**	**19**	**12**
Concentration (MFL):	**1.39**	**9.46**	**5.97**

†Act-Tremolite concentrations include: Actinolite, as well as the Libby Amphiboles; Tremolite, Winchite, and Richterite.
RL= Reporting Limit MFL= Millions of Fibers per Liter

NOTE: All samples were received past the 48 hour hold time and contained many Chrysotile asbestos fibers that were too short to be counted by this method.

Pamela Johnson
Analyst

Shawn Smythe
Project Manager

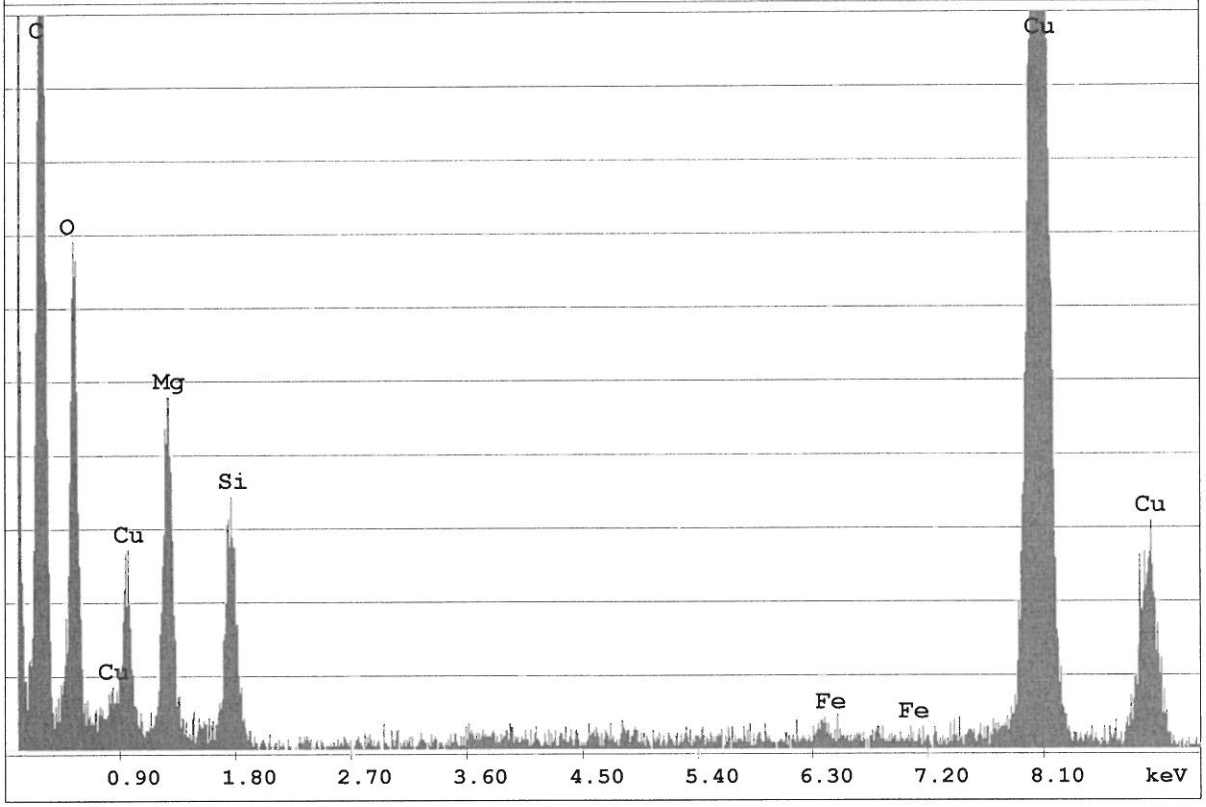
NELAC accredited through New York ELAP (LAB #11371)

Z:\TEM\EDXA SPECTRA\2015 Sample Data\WATER\1508549 ALS Yukon\1508549 01 Chrysotile.spc

Label:1508549 01 a1 Chrysotile

kV:100.0 X Tilt:13.0 Y Tilt:0.0 Det: STD

Res:134 Amp.T:51.20 FS:235 Lsec:14 25-Aug-2015 14:24:06

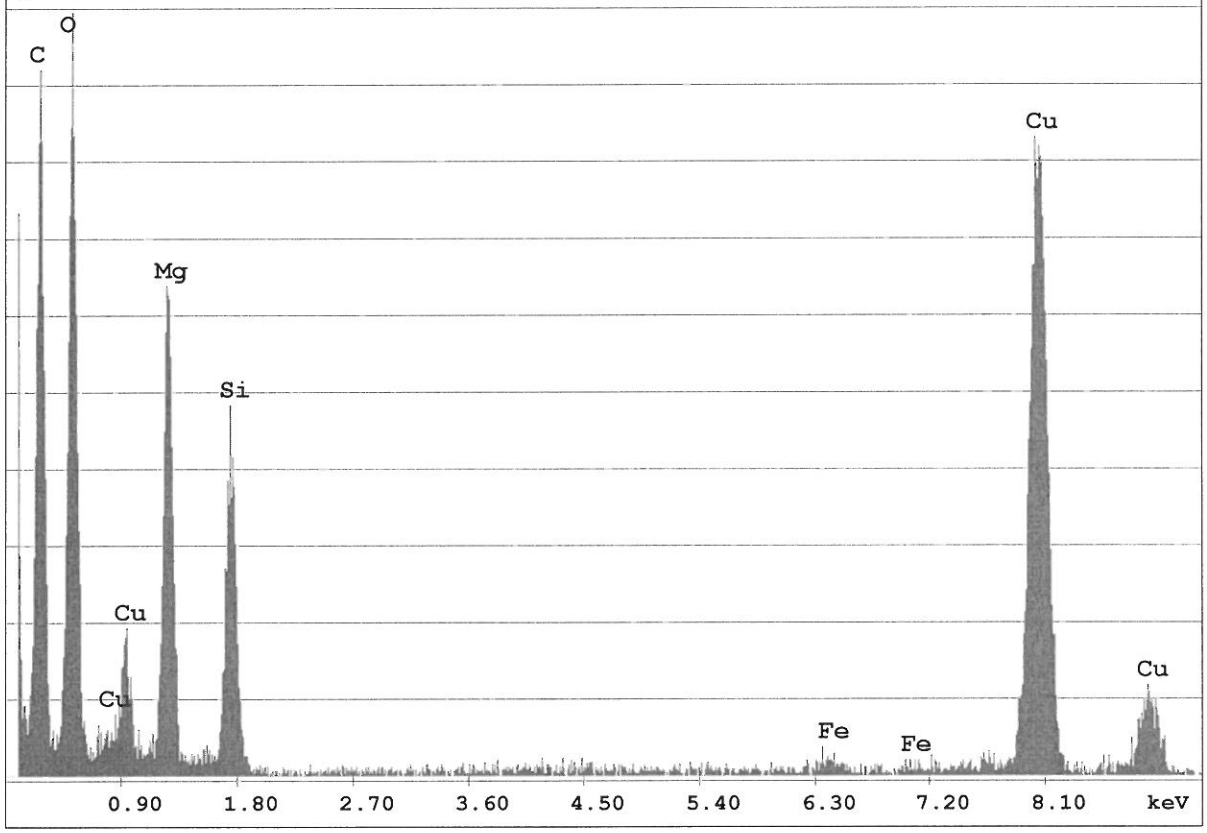


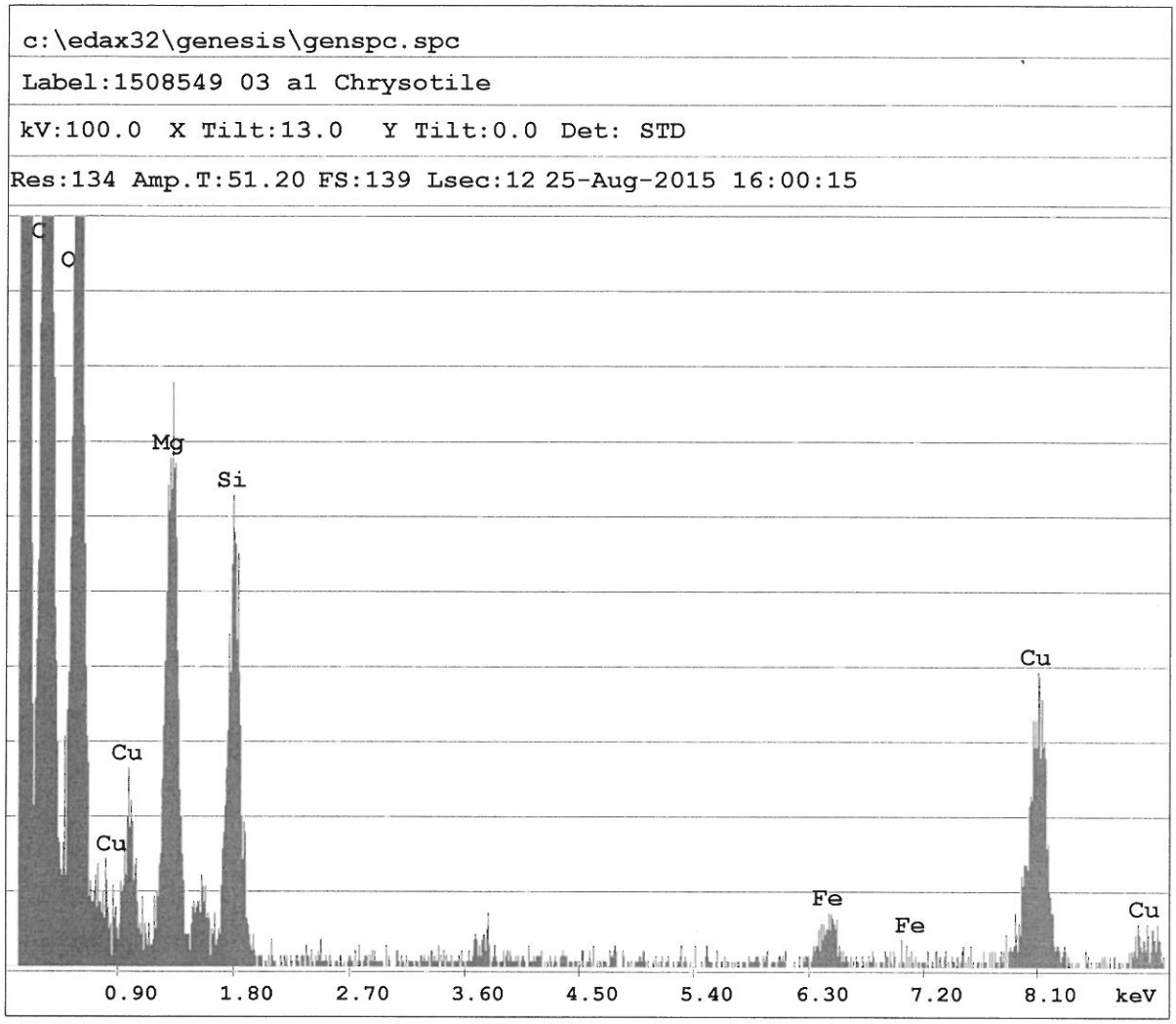
c:\edax32\genesis\genspc.spc

Label:1508549 02 a1 Chrysotile

kV:100.0 X Tilt:13.0 Y Tilt:0.0 Det: STD

Res:134 Amp.T:51.20 FS:347 Lsec:14 25-Aug-2015 15:30:18




c:\edax32\genesis\genspc.spc
Label:1508549 03 a1 Chrysotile
kV:100.0 X Tilt:13.0 Y Tilt:0.0 Det: STD
Res:134 Amp.T:51.20 FS:139 Lsec:12 25-Aug-2015 16:00:15
C
O
Mg
Si
Cu
Cu
Fe
Fe
Cu
Cu
0.90
1.80
2.70
3.60
4.50
5.40
6.30
7.20
8.10
keV

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L1657162-COFC

COC Number: 14 -

Page 1 of 1

Report To		Report Format / Distribution		Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
Company:	Ecological Logistics & Research Ltd.	Select Report Format:	☑PDF ☑EXCEL ☑EDD (DIGITAL)	R ☑Regular (Standard TAT if received by 3 pm - business days)
Contact:	Chris Jastrebski	Quality Control (QC) Report with Report	☑ Yes ☐ No	P ☐Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
Address:	204-105 Titanium Way Whitehorse, YT Y1A 0E7	☐Criteria on Report - provide details below if box checked Select Distribution:	☑EMAIL ☐MAIL ☐FAX	E ☐Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 ☐Same day or weekend emergency - contact ALS to confirm TAT and surcharge
Phone:	867.668.6386	Email 1 or Fax	chris@elr.ca	Specify Date Required for E2,E or P:
		Email 2	kmartens@minnow.ca	

Invoice To	Same as Report To ☑ Yes ☐ No	Invoice Distribution	
	Copy of Invoice with Report ☐ Yes ☑ No	Select Invoice Distribution:	☑EMAIL ☐MAIL ☐FAX
Company:	Ecological Logistics & Research Ltd.	Email 1 or Fax	chris@elr.ca
Contact:	Chris Jastrebski	Email 2	Patricia.Randell@gov.yk.ca

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:	Q52337	Approver ID:	Cost Center:
Job #:	15-210	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact:	Sampler:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TSS	Total Metals and Mercury (P)	Asbestos	pH	Number of Containers
	HL	10-Aug-15	9:37	Water	R	R	R	R	4
	CC1	10-Aug-15	9:09	Water	R	R	R	R	4
	CC2	10-Aug-15	8:26	Water	R	R	R	R	4
	CC3	10-Aug-15	8:00	Water	R	R		R	3
	WC	10-Aug-15	8:10	Water	R	R		R	3

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? ☐ Yes ☑ No Are samples for human drinking water use? ☐ Yes ☑ No	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐	No ☐
Ice packs	Yes ☐	No ☐	Custody seal intact	Yes ☐ No ☐
Cooling Initiated	☐			

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
4.5					

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
	Aug 13/15	9:30		13 Aug 15	09:40			

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

NA-FM-0326e v09 Front/04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

ECOLOGICAL LOGISTICS & RESEARCH LTD.
ATTN: Chris Jastrebski
204 - 105 Titanium Way
Whitehorse YT Y1A 0E7

Date Received: 24-AUG-15
Report Date: 01-SEP-15 15:34 (MT)
Version: FINAL

Client Phone: 867-668-6386

Certificate of Analysis

Lab Work Order #: L1662011

Project P.O. #: NOT SUBMITTED
Job Reference: 15-210
C of C Numbers: 1
Legal Site Desc:

Jamie Lo, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1662011-1	L1662011-2	L1662011-3	L1662011-4	L1662011-5
Description	Water	Water	Water	Water	Water
Sampled Date	16-AUG-15	16-AUG-15	16-AUG-15	16-AUG-15	16-AUG-15
Sampled Time	09:30	09:10	08:50	08:15	08:30
Client ID	HL	CC1	CC2	CC3	WC
Grouping / **Analyte**					
WATER					
Physical Tests					
Hardness (as CaCO3) (mg/L)	287	274	360	351	309
pH (pH)	7.92	8.11	7.89	7.91	7.93
Total Suspended Solids (mg/L)	3.3	4.0	4.0	5.3	14.0
Total Metals					
Aluminum (Al)-Total (mg/L)	0.0575	0.0392	0.0320	0.109	0.403
Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	0.00055
Arsenic (As)-Total (mg/L)	0.00086	0.00085	0.00106	0.00112	0.00116
Barium (Ba)-Total (mg/L)	0.060	0.054	0.054	0.057	0.064
Beryllium (Be)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Boron (B)-Total (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium (Cd)-Total (mg/L)	0.0000295	0.0000322	0.0000405	0.0000437	0.0000317
Calcium (Ca)-Total (mg/L)	62.2	59.8	71.0	67.9	56.4
Chromium (Cr)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	0.0021
Cobalt (Co)-Total (mg/L)	0.00038	<0.00030	0.00051	0.00049	0.00047
Copper (Cu)-Total (mg/L)	0.0029	0.0027	0.0027	0.0027	0.0031
Iron (Fe)-Total (mg/L)	0.283	0.193	0.266	0.412	0.880
Lead (Pb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Lithium (Li)-Total (mg/L)	0.0030	0.0028	0.0060	0.0050	0.0031
Magnesium (Mg)-Total (mg/L)	32.0	30.3	44.3	44.0	40.8
Manganese (Mn)-Total (mg/L)	0.124	0.0844	0.0945	0.0933	0.0879
Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	0.0000057	0.0000106
Molybdenum (Mo)-Total (mg/L)	0.0015	0.0014	0.0016	0.0016	0.0012
Nickel (Ni)-Total (mg/L)	0.0050	0.0049	0.0113	0.0107	0.0082
Potassium (K)-Total (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
Selenium (Se)-Total (mg/L)	0.00121	0.00123	0.00126	0.00118	0.000871
Silver (Ag)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Sodium (Na)-Total (mg/L)	3.0	2.7	3.5	3.6	3.7
Thallium (Tl)-Total (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Tin (Sn)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Titanium (Ti)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	0.015
Uranium (U)-Total (mg/L)	0.00208	0.00199	0.00207	0.00221	0.00275
Vanadium (V)-Total (mg/L)	0.00052	<0.00050	<0.00050	0.00069	0.00170
Zinc (Zn)-Total (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050

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

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Lead (Pb)-Total	MS-B	L1662011-1, -2, -3, -4, -5
Matrix Spike	Manganese (Mn)-Total	MS-B	L1662011-1, -2, -3, -4, -5

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**
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-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.

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).

PH-MAN-WR	Water	pH by Meter	APHA 4500-H (B)

"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."

TSS-MAN-WR	Water	Total Suspended Solids by Gravimetric	APHA 2540 D

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:

Laboratory Definition Code	Laboratory Location

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 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.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L1662011-COFC

COC Number: 14 -

Page 1 of 1

Report To		Report Format / Distribution	Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
Company:	Ecological Logistics & Research Ltd.	Select Report Format: ☑ PDF ☑ EXCEL ☑ EDD (DIGITAL)	R ☑ Regular (Standard TAT if received by 3 pm - business days)
Contact:	Chris Jastrebski	Quality Control (QC) Report with Report ☑ Yes ☐ No	P ☐ Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
Address:	204-105 Titanium Way Whitehorse, YT Y1A 0E7	☐ Criteria on Report - provide details below if box checked	E ☐ Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT
Phone:	867.668.6386	Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	E2 ☐ Same day or weekend emergency - contact ALS to confirm TAT and surcharge
		Email 1 or Fax chris@elr.ca, patricia.randell@gov.yk.ca	Specify Date Required for E2,E or P:
		Email 2 kmartens@minnow.ca	

Invoice To	Same as Report To ☑ Yes ☐ No	Invoice Distribution	Analysis Request
	Copy of Invoice with Report ☐ Yes ☑ No	Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below
Company:	Ecological Logistics & Research Ltd.	Email 1 or Fax chris@elr.ca patricia.randell@gov.yk.ca	
Contact:	Chris Jastrebski	Email 2	

Project Information		[redacted] Oil and Gas Required Fields (client use)	
ALS Quote #:	Q52337	Approver ID: [redacted]	Cost Center:
Job #:	15-210	GL Account: [redacted]	Routing Code:
PO / AFE:		Activity Code: [redacted]	
LSD:		Location: [redacted]	

ALS Lab Work Order # (lab use only)		ALS Contact:	Sampler: Luca Poloni

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TSS	Total Metals and Mercury	Asbestos	pH	Number of Containers
	HL	16/08/15	9:30 AM	Water	R	R		R	3
	CC1	16/08/15	9:10 AM	Water	R	R		R	3
	CC2	16/08/15	8:50 AM	Water	R	R		R	3
	CC3	16/08/15	8:15 AM	Water	R	R		R	3
	WC	16/08/15	8:30 AM	Water	R	R		R	3

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? ☐ Yes ☑ No	
Are samples for human drinking water use? ☐ Yes ☑ No	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐	No ☐
Ice packs	Yes ☐	No ☐	Custody seal intact	Yes ☐	No ☐
Cooling Initiated	☐			

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
5.0			3.9	5.4	5.4

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Luca Poloni	Date: Aug 21	Time:	Received by: [signature]	Date: 1045	Time: 24Aug 15	Received by: Shafee	Date: Aug 25	Time: 1430

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-[illegible]-0326a v09 Front04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

Michelle McKay Aug 24/15 10:45

ECOLOGICAL LOGISTICS & RESEARCH LTD.
ATTN: Chris Jastrebski
204 - 105 Titanium Way
Whitehorse YT Y1A 0E7

Date Received: 28-AUG-15
Report Date: 09-SEP-15 11:31 (MT)
Version: FINAL

Client Phone: 867-668-6386

Certificate of Analysis

Lab Work Order #: L1665125

Project P.O. #: NOT SUBMITTED
Job Reference: 15-210
C of C Numbers: 1
Legal Site Desc:

Jamie Lo, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1665125-1 Water 26-AUG-15 09:51 HL	L1665125-2 Water 26-AUG-15 09:19 CC1	L1665125-3 Water 26-AUG-15 08:56 CC2	L1665125-4 Water 26-AUG-15 08:28 CC3	L1665125-5 Water 26-AUG-15 08:37 WC
WATER						
Physical Tests	Hardness (as CaCO3) (mg/L)	261	261	308	288	262
	pH (pH)	7.81	8.09	8.05	8.06	7.98
	Total Suspended Solids (mg/L)	<3.0	4.0	<3.0	31.3	69.3
Total Metals	Aluminum (Al)-Total (mg/L)	0.129	0.123	0.133	0.628	1.81
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	0.00052
	Arsenic (As)-Total (mg/L)	0.00085	0.00083	0.00109	0.00133	0.00224
	Barium (Ba)-Total (mg/L)	0.059	0.059	0.056	0.072	0.119
	Beryllium (Be)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Boron (B)-Total (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10
	Cadmium (Cd)-Total (mg/L)	0.0000424	0.0000381	0.0000467	0.0000892	0.000209
	Calcium (Ca)-Total (mg/L)	57.9	58.0	64.6	57.7	48.6
	Chromium (Cr)-Total (mg/L)	<0.0010	0.0010	0.0014	0.0024	0.0065
	Cobalt (Co)-Total (mg/L)	0.00041	0.00037	0.00055	0.00081	0.00170
	Copper (Cu)-Total (mg/L)	<0.0035 DLB	<0.0035 DLB	<0.0035 DLB	<0.0045 DLB	0.0082
	Iron (Fe)-Total (mg/L)	0.409	0.439	0.452	1.22	3.47
	Lead (Pb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	0.00074	0.00225
	Lithium (Li)-Total (mg/L)	0.0032	0.0032	0.0045	0.0041	0.0040
	Magnesium (Mg)-Total (mg/L)	28.2	28.1	35.7	35.0	34.2
	Manganese (Mn)-Total (mg/L)	0.126	0.0994	0.121	0.121	0.143
	Mercury (Hg)-Total (mg/L)	0.0000062	0.0000069	<0.0000050	0.0000152	0.0000150
	Molybdenum (Mo)-Total (mg/L)	0.0012	0.0013	0.0014	0.0014	0.0014
	Nickel (Ni)-Total (mg/L)	0.0044	0.0044	0.0096	0.0099	0.0127
	Potassium (K)-Total (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Selenium (Se)-Total (mg/L)	0.00118	0.00123	0.00133	0.00131	0.00105
	Silver (Ag)-Total (mg/L)	<0.000020	<0.000020	<0.000020	0.000028	0.000076
	Sodium (Na)-Total (mg/L)	2.5	2.4	2.8	3.0	3.4
	Thallium (Tl)-Total (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
	Tin (Sn)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Titanium (Ti)-Total (mg/L)	<0.010	<0.010	<0.010	0.020	0.039
	Uranium (U)-Total (mg/L)	0.00164	0.00167	0.00180	0.00190	0.00208
	Vanadium (V)-Total (mg/L)	0.00079	0.00067	0.00081	0.00207	0.00559
	Zinc (Zn)-Total (mg/L)	<0.0050	<0.0050	<0.0050	0.0057	0.0163

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

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Copper (Cu)-Total	DLB	L1665125-1, -2, -3, -4, -5
Method Blank	Copper (Cu)-Total	MB-LOR	L1665125-1, -2, -3, -4, -5
Matrix Spike	Manganese (Mn)-Total	MS-B	L1665125-1, -2, -3, -4, -5

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLB	Detection Limit was raised due to detection of analyte at comparable level in Method Blank.
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.
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**
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-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.

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).

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

TSS-MAN-WR	Water	Total Suspended Solids by Gravimetric	APHA 2540 D

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:

Laboratory Definition Code	Laboratory Location

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 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.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L1665125-COFC

COC Number: 14 -

Page 1 of 1

Report To		Report Format / Distribution	Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
Company:	Ecological Logistics & Research Ltd.	Select Report Format: ☑ PDF ☑ EXCEL ☑ EDD (DIGITAL)	R ☑ Regular (Standard TAT if received by 3 pm - business days)
Contact:	Chris Jastrebski	Quality Control (QC) Report with Report ☑ Yes ☐ No	P ☐ Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
Address:	204-105 Titanium Way Whitehorse, YT Y1A 0E7	☐ Criteria on Report - provide details below if box checked	E ☐ Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT
Phone:	867.668.6386	Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	E2 ☐ Same day or weekend emergency - contact ALS to confirm TAT and surcharge
		Email 1 or Fax chris@elr.ca	Specify Date Required for E2,E or P:
		Email 2 kmartens@minnow.ca patricia.randell@gov.yk.ca	

Invoice To		Invoice Distribution	Analysis Request
	Same as Report To ☑ Yes ☐ No	Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below
	Copy of Invoice with Report ☐ Yes ☑ No	Email 1 or Fax chris@elr.ca	
Company:	Ecological Logistics & Research Ltd.	Email 2	
Contact:	Chris Jastrebski		

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:	Q52337	Approver ID:	Cost Center:
Job #:	15-210	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact:	Sampler:

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TSS	Total Metals and Mercury	Asbestos	pH	P	Number of Containers
	HL	26/08/15	09:51	Water	R	R		R		3
	CC1	26/08/15	09:19	Water	R	R		R		3
	CC2	26/08/15	08:56	Water	R	R		R		3
	CC3	26/08/15	08:29	Water	R	R		R		3
	WC	26/08/15	08:37	Water	R	R		R		3

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? ☐ Yes ☑ No	
Are samples for human drinking water use? ☐ Yes ☑ No	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐		SIF Observations	Yes ☐	No ☐
Ice packs	Yes ☑	No ☐	Custody seal intact	Yes ☐	No ☐
Cooling Initiated	☑				

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
3.5					

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Chris Jastrebski	Aug 28th 15	07:00		28-Aug	4:45			

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

ALS-FM-0025e v29 Front/04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

ECOLOGICAL LOGISTICS & RESEARCH LTD.
ATTN: Chris Jastrebski
204 - 105 Titanium Way
Whitehorse YT Y1A 0E7

Date Received: 04-SEP-15
Report Date: 16-SEP-15 16:33 (MT)
Version: FINAL

Client Phone: 867-668-6386

Certificate of Analysis

Lab Work Order #: L1668448

Project P.O. #: NOT SUBMITTED
Job Reference: 15-210
C of C Numbers: 1
Legal Site Desc:

Jamie Lo, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1668448-1	L1668448-2	L1668448-3	L1668448-4	L1668448-5
Description	Water	Water	Water	Water	Water
Sampled Date	31-AUG-15	31-AUG-15	31-AUG-15	31-AUG-15	31-AUG-15
Sampled Time	10:37	09:51	09:31	09:15	08:55
Client ID	HL	CC1	CC2	CC3	WC
Grouping / **Analyte**					
WATER					
Physical Tests					
Hardness (as CaCO3) (mg/L)	235	248	301	288	243
pH (pH)	7.69	7.98	7.91	7.92	7.93
Total Suspended Solids (mg/L)	<3.0	3.3	<3.0	3.3	16.0
Total Metals					
Aluminum (Al)-Total (mg/L)	0.186	0.184	0.167	0.194	0.563
Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Arsenic (As)-Total (mg/L)	0.00101	0.00102	0.00120	0.00117	0.00130
Barium (Ba)-Total (mg/L)	0.059	0.063	0.059	0.059	0.066
Beryllium (Be)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Boron (B)-Total (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium (Cd)-Total (mg/L)	0.0000523	0.0000490	0.0000529	0.0000480	0.0000389
Calcium (Ca)-Total (mg/L)	53.1	55.9	64.0	60.2	45.4
Chromium (Cr)-Total (mg/L)	0.0011	0.0012	0.0012	0.0013	0.0024
Cobalt (Co)-Total (mg/L)	0.00048	0.00048	0.00056	0.00054	0.00062
Copper (Cu)-Total (mg/L)	0.0034	0.0034	0.0031	0.0033	0.0037
Iron (Fe)-Total (mg/L)	0.514	0.538	0.528	0.585	1.08
Lead (Pb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	0.00050
Lithium (Li)-Total (mg/L)	0.0029	0.0028	0.0045	0.0043	0.0029
Magnesium (Mg)-Total (mg/L)	24.9	26.4	34.2	33.5	31.5
Manganese (Mn)-Total (mg/L)	0.134	0.126	0.122	0.115	0.0915
Mercury (Hg)-Total (mg/L)	0.0000089	0.0000079	0.0000078	0.0000074	0.0000110
Molybdenum (Mo)-Total (mg/L)	0.0012	0.0012	0.0014	0.0013	0.0011
Nickel (Ni)-Total (mg/L)	0.0047	0.0053	0.0088	0.0085	0.0078
Potassium (K)-Total (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
Selenium (Se)-Total (mg/L)	0.00118	0.00123	0.00163	0.00151	0.000974
Silver (Ag)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	0.000023
Sodium (Na)-Total (mg/L)	2.4	2.5	2.8	2.9	3.3
Thallium (Tl)-Total (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Tin (Sn)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Titanium (Ti)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	0.016
Uranium (U)-Total (mg/L)	0.00163	0.00167	0.00179	0.00180	0.00187
Vanadium (V)-Total (mg/L)	0.00106	0.00112	0.00106	0.00115	0.00234
Zinc (Zn)-Total (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050

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

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Beryllium (Be)-Total	DLA	L1668448-1, -2, -3, -4, -5
Duplicate	Cadmium (Cd)-Total	DLA	L1668448-1, -2, -3, -4, -5
Duplicate	Chromium (Cr)-Total	DLA	L1668448-1, -2, -3, -4, -5
Duplicate	Cobalt (Co)-Total	DLA	L1668448-1, -2, -3, -4, -5
Duplicate	Copper (Cu)-Total	DLA	L1668448-1, -2, -3, -4, -5
Duplicate	Lead (Pb)-Total	DLA	L1668448-1, -2, -3, -4, -5
Duplicate	Selenium (Se)-Total	DLA	L1668448-1, -2, -3, -4, -5
Duplicate	Silver (Ag)-Total	DLA	L1668448-1, -2, -3, -4, -5
Duplicate	Thallium (Tl)-Total	DLA	L1668448-1, -2, -3, -4, -5
Duplicate	Tin (Sn)-Total	DLA	L1668448-1, -2, -3, -4, -5
Duplicate	Vanadium (V)-Total	DLA	L1668448-1, -2, -3, -4, -5

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
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-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.

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).

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

TSS-MAN-WR	Water	Total Suspended Solids by Gravimetric	APHA 2540 D

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:

Laboratory Definition Code	Laboratory Location

Chain of Custody Numbers:

1

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

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

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L1668448-COFC

COC Number: 14 -

Page 1 of 1

Report To		Report Format / D	(Rush Turnaround Time (TAT) is not available for all tests)
Company:	Ecological Logistics & Research Ltd.	Select Report Format: ☑PDF ☑EXCEL ☑EDD (DIGITAL)	R ☑Regular (Standard TAT if received by 3 pm - business days)
Contact:	Chris Jastrebski	Quality Control (QC) Report with Report ☑ Yes ☐ No	P ☐Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
Address:	204-105 Titanium Way Whitehorse, YT Y1A 0E7	☐Criteria on Report - provide details below if box checked Select Distribution: ☑EMAIL ☐MAIL ☐FAX	E ☐Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 ☐Same day or weekend emergency - contact ALS to confirm TAT and surcharge
Phone:	867.668.6386	Email 1 or Fax chris@elr.ca Email 2 kmartens@minnow.ca	Specify Date Required for E2,E or P:

Invoice To	Same as Report To ☑ Yes ☐ No	Invoice Distribution	Analysis Request
	Copy of Invoice with Report ☐ Yes ☑ No	Select Invoice Distribution: ☑EMAIL ☐MAIL ☐FAX	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below
Company:	Ecological Logistics & Research Ltd.	Email 1 or Fax chris@elr.ca	
Contact:	Chris Jastrebski	Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:	Q52337	Approver ID:	Cost Center:
Job #:	15-210	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	

ALS Lab Work Order # (lab use only)		ALS Contact:	Sampler: L.P. + W.E.

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TSS	Total Metals and Mercury	Asbestos	pH	P	Number of Containers
	HL	31 Aug 15	10:37	Water	R	R		R		3
	CC1		9:51	Water	R	R		R		3
	CC2		9:31	Water	R	R		R		3
	CC3		9:15	Water	R	R		R		3
	WC		8:55	Water	R	R		R		3

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? ☐ Yes ☑ No Are samples for human drinking water use? ☐ Yes ☑ No	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐	No ☐
Ice packs	Yes ☑	No ☐	Custody seal intact	Yes ☐ No ☐
Cooling Initiated	☑			

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
3.2			8.2	10	6.5

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: (Glenn)	Date: SEPT 4 2015	Time: 1325.	Received by:	Date: 4Sept15	Time: 1325	Received by: PAUL	Date: SEP 5	Time: 12:52

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM-0328e v09 Front/04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

ECOLOGICAL LOGISTICS & RESEARCH LTD.
ATTN: Chris Jastrebski
204 - 105 Titanium Way
Whitehorse YT Y1A 0E7

Date Received: 13-SEP-15
Report Date: 23-SEP-15 11:41 (MT)
Version: FINAL

Client Phone: 867-668-6386

Certificate of Analysis

Lab Work Order #: L1672207

Project P.O. #: NOT SUBMITTED
Job Reference: 15-210
C of C Numbers: 1
Legal Site Desc:

Jamie Lo, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1672207-1	L1672207-2	L1672207-3	L1672207-4	L1672207-5
Description	Water	Water	Water	Water	Water
Sampled Date	08-SEP-15	08-SEP-15	08-SEP-15	08-SEP-15	08-SEP-15
Sampled Time	10:30	09:35	09:09	08:59	08:28
Client ID	HLB	CC1	CC2	CC3	WC
Grouping / **Analyte**					
WATER					
Physical Tests					
Hardness (as CaCO3) (mg/L)	277	278	391	428	344
pH (pH)	7.81	8.01	7.90	7.94	8.03
Total Suspended Solids (mg/L)	<3.0	<3.0	<3.0	4.0	9.3
Total Metals					
Aluminum (Al)-Total (mg/L)	0.115	0.0924	0.0961	0.145	0.221
Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	0.00051	0.00054
Arsenic (As)-Total (mg/L)	0.00091	0.00085	0.00117	0.00138	0.00108
Barium (Ba)-Total (mg/L)	0.061	0.060	0.057	0.062	0.059
Beryllium (Be)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Boron (B)-Total (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium (Cd)-Total (mg/L)	0.0000478	0.0000424	0.0000532	0.0000488	0.0000247
Calcium (Ca)-Total (mg/L)	60.2	60.5	74.4	78.0	62.1
Chromium (Cr)-Total (mg/L)	<0.0010	<0.0010	0.0012	0.0012	0.0013
Cobalt (Co)-Total (mg/L)	0.00047	0.00040	0.00066	0.00074	0.00038
Copper (Cu)-Total (mg/L)	0.0034	0.0030	0.0027	0.0025	0.0024
Iron (Fe)-Total (mg/L)	0.351	0.336	0.436	0.558	0.590
Lead (Pb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Lithium (Li)-Total (mg/L)	0.0034	0.0033	0.0080	0.0080	0.0040
Magnesium (Mg)-Total (mg/L)	30.7	30.9	49.7	56.7	45.9
Manganese (Mn)-Total (mg/L)	0.207	0.157	0.153	0.144	0.0993
Mercury (Hg)-Total (mg/L)	0.0000067	0.0000072	0.0000076	0.0000058	0.0000054
Molybdenum (Mo)-Total (mg/L)	0.0012	0.0012	0.0015	0.0016	0.0012
Nickel (Ni)-Total (mg/L)	0.0049	0.0050	0.0125	0.0136	0.0072
Potassium (K)-Total (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
Selenium (Se)-Total (mg/L)	0.00141	0.00135	0.00145	0.00137	0.00109
Silver (Ag)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Sodium (Na)-Total (mg/L)	2.7	2.7	3.7	4.4	4.1
Thallium (Tl)-Total (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Tin (Sn)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Titanium (Ti)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	0.010
Uranium (U)-Total (mg/L)	0.00175	0.00171	0.00197	0.00238	0.00268
Vanadium (V)-Total (mg/L)	0.00104	0.00094	0.00099	0.00124	0.00154
Zinc (Zn)-Total (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050

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

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Aluminum (Al)-Total	DLA	L1672207-1, -2, -3, -4, -5
Duplicate	Antimony (Sb)-Total	DLA	L1672207-1, -2, -3, -4, -5
Duplicate	Beryllium (Be)-Total	DLA	L1672207-1, -2, -3, -4, -5
Duplicate	Chromium (Cr)-Total	DLA	L1672207-1, -2, -3, -4, -5
Duplicate	Lead (Pb)-Total	DLA	L1672207-1, -2, -3, -4, -5
Duplicate	Silver (Ag)-Total	DLA	L1672207-1, -2, -3, -4, -5
Duplicate	Thallium (Tl)-Total	DLA	L1672207-1, -2, -3, -4, -5
Duplicate	Tin (Sn)-Total	DLA	L1672207-1, -2, -3, -4, -5
Duplicate	Vanadium (V)-Total	DLA	L1672207-1, -2, -3, -4, -5
Duplicate	Cadmium (Cd)-Total	DLM	L1672207-1, -2, -3, -4, -5
Matrix Spike	Calcium (Ca)-Total	MS-B	L1672207-1, -2, -3, -4, -5
Matrix Spike	Iron (Fe)-Total	MS-B	L1672207-1, -2, -3, -4, -5
Matrix Spike	Sodium (Na)-Total	MS-B	L1672207-1, -2, -3, -4, -5
Matrix Spike	Manganese (Mn)-Total	MS-B	L1672207-1, -2, -3, -4, -5
Matrix Spike	Molybdenum (Mo)-Total	MS-B	L1672207-1, -2, -3, -4, -5

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.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
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-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.

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).

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

TSS-MAN-WR	Water	Total Suspended Solids by Gravimetric	APHA 2540 D

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:

Laboratory Definition Code	Laboratory Location

Chain of Custody Numbers:

1

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

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

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L1672207-COFC

COC Number: 14 -

Page 1 of 1

Report To		Report Format / Distribution		Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
Company:	Ecological Logistics & Research Ltd.	Select Report Format:	☑ PDF ☑ EXCEL ☑ EDD (DIGITAL)	R ☑ Regular (Standard TAT if received by 3 pm - business days)
Contact:	Chris Jastrebski	Quality Control (QC) Report with Report	☑ Yes ☐ No	P ☐ Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
Address:	204-105 Titanium Way Whitehorse, YT Y1A 0E7	☐ Criteria on Report - provide details below if box checked		E ☐ Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT
		Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX	E2 ☐ Same day or weekend emergency - contact ALS to confirm TAT and surcharge
Phone:	867.668.6386	Email 1 or Fax	chris@elr.ca, patricia.randell@gov.yk.ca	Specify Date Required for E2,E or P:
		Email 2	kmartens@minnow.ca	

Invoice To		Invoice Distribution	
	Same as Report To ☑ Yes ☐ No	Select Invoice Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
	Copy of Invoice with Report ☐ Yes ☑ No	Email 1 or Fax	chris@elr.ca
Company:	Ecological Logistics & Research Ltd.	Email 2	
Contact:	Chris Jastrebski		

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:	Q52337	Approver ID:	Cost Center:
Job #:	15-210	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	

ALS Lab Work Order # (lab use only)		ALS Contact:	Sampler:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TSS	Total Metals and Mercury	Asbestos	pH	Number of Containers
	HLB	08-Sep-15	10:30	Water	R	R	X	R	
	CC1		9:35	Water	R	R	X	R	
	CC2		9:09	Water	R	R	X	R	
	CC3		8:59	Water	R	R	X	R	
	WC	08 Sep 15	8:28	Water	R	R	X	R	
							NVD		

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? ☐ Yes ☑ No	
Are samples for human drinking water use? ☐ Yes ☑ No	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐			SIF Observations	Yes ☐	No ☐	
Ice packs	Yes ☐	No ☐		Custody seal intact	Yes ☐	No ☐	
Cooling Initiated	☐						

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
1.0			6	6	6

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Wayne Tamery	Sept 13	11:00	Alyono	13 Sept 15	1100	Shatell	Sept. 16	1345

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

ALS-FM-0325e v09 Front/04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

Chris Jastrebski Sept 14 11:00 APPROV TO Air North

ECOLOGICAL LOGISTICS & RESEARCH LTD.
ATTN: Chris Jastrebski
204 - 105 Titanium Way
Whitehorse YT Y1A 0E7

Date Received: 18-SEP-15
Report Date: 30-SEP-15 16:38 (MT)
Version: FINAL

Client Phone: 867-668-6386

Certificate of Analysis

Lab Work Order #: L1675053

Project P.O. #: NOT SUBMITTED
Job Reference: 15-210
C of C Numbers: 1
Legal Site Desc:

Jamie Lo, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1675053-1	L1675053-2	L1675053-3	L1675053-4	L1675053-5
	Description	Water	Water	Water	Water	Water
	Sampled Date	15-SEP-15	15-SEP-15	15-SEP-15	15-SEP-15	15-SEP-15
	Sampled Time	15:58	14:56	14:30	13:54	14:17
	Client ID	HLB	CC1	CC2	CC3	WC
Grouping	**Analyte**					
WATER						
Physical Tests	Hardness (as CaCO3) (mg/L)	276	289	396	381	353
	pH (pH)	8.06	8.22	8.23	8.28	8.16
	Total Suspended Solids (mg/L)	6.0	3.3	4.0	8.0	15.3
Total Metals	Aluminum (Al)-Total (mg/L)	0.0583	0.0607	0.0407	0.134	0.347
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Arsenic (As)-Total (mg/L)	0.00079	0.00078	0.00106	0.00108	0.00105
	Barium (Ba)-Total (mg/L)	0.059	0.061	0.054	0.058	0.067
	Beryllium (Be)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Boron (B)-Total (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10
	Cadmium (Cd)-Total (mg/L)	0.0000395	0.0000470	0.0000493	0.0000460	0.0000337
	Calcium (Ca)-Total (mg/L)	62.5	65.1	78.1	73.8	68.0
	Chromium (Cr)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	0.0015
	Cobalt (Co)-Total (mg/L)	0.00041	0.00037	0.00065	0.00058	0.00051
	Copper (Cu)-Total (mg/L)	0.0030	0.0031	0.0024	0.0024	0.0027
	Iron (Fe)-Total (mg/L)	0.265	0.259	0.312	0.488	0.802
	Lead (Pb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Lithium (Li)-Total (mg/L)	0.0030	0.0030	0.0075	0.0062	0.0035
	Magnesium (Mg)-Total (mg/L)	29.2	30.7	48.8	47.7	44.6
	Manganese (Mn)-Total (mg/L)	0.203	0.167	0.153	0.138	0.117
	Mercury (Hg)-Total (mg/L)	0.0000079	0.0000085	0.0000082	0.0000081	0.0000093
	Molybdenum (Mo)-Total (mg/L)	0.0012	0.0014	0.0016	0.0014	0.0012
	Nickel (Ni)-Total (mg/L)	0.0044	0.0050	0.0129	0.0111	0.0068
	Potassium (K)-Total (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Selenium (Se)-Total (mg/L)	0.00134	0.00154	0.00144	0.00125	0.00100
	Silver (Ag)-Total (mg/L)	<0.000020	0.000052	<0.000020	<0.000020	<0.000020
	Sodium (Na)-Total (mg/L)	2.9	3.0	4.0	4.2	4.6
	Thallium (Tl)-Total (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
	Tin (Sn)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Titanium (Ti)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	0.015
	Uranium (U)-Total (mg/L)	0.00189	0.00211	0.00208	0.00242	0.00308
	Vanadium (V)-Total (mg/L)	0.00061	0.00057	<0.00050	0.00084	0.00162
	Zinc (Zn)-Total (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
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-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.

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).

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.

TSS-MAN-WR	Water	Total Suspended Solids by Gravimetric	APHA 2540 D

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:

Laboratory Definition Code	Laboratory Location

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 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

L1675053-COFC

COC Number: 14 -

Page 1 of 1

Report To		Report Format / Distribution	Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
Company:	Ecological Logistics & Research Ltd.	Select Report Format: ☑ PDF ☑ EXCEL ☑ EDD (DIGITAL)	R ☑ Regular (Standard TAT if received by 3 pm - business days)
Contact:	Chris Jastrebski	Quality Control (QC) Report with Report ☑ Yes ☐ No	P ☐ Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
Address:	204-105 Titanium Way Whitehorse, YT Y1A 0E7	☐ Criteria on Report - provide details below if box checked	E ☐ Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT
		Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	E2 ☐ Same day or weekend emergency - contact ALS to confirm TAT and surcharge
Phone:	867.668.6386	Email 1 or Fax chris@elr.ca	Specify Date Required for E2,E or P:
		Email 2 kmartens@minnow.ca	

Invoice To		Invoice Distribution
	Same as Report To ☑ Yes ☐ No	Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
	Copy of Invoice with Report ☐ Yes ☑ No	
Company:	Ecological Logistics & Research Ltd.	Email 1 or Fax chris@elr.ca
Contact:	Chris Jastrebski	Email 2

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:	Q52337	Approver ID:	Cost Center:
Job #:	15-210	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact:	Sampler:

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

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TSS	Total Metals and Mercury	Asbestos	pH	Number of Containers
	~~HLB~~	15 Sep 15	15:58	Water	R	R		R	
	CC1		14:56	Water	R	R		R	
	CC2		14:30	Water	R	R		R	
	CC3		13:54	Water	R	R		R	
	WC	↓	14:17	Water	R	R		R	

Short Holding Time

● *Rush Processing*

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? ☐ Yes ☑ No	Do Not use Sept 14 samples
Are samples for human drinking water use? ☐ Yes ☑ No	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐	No ☐	
Ice packs	Yes ☐	No ☐	Custody seal intact	Yes ☐	No ☐
Cooling Initiated	☐				

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C	
3.8			8/4/6/8	°C

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)		FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Wayne Emery	Date: Sept 15	Time: 18:30	Received by:	Date: 16 Sept 15	Time: 9:15	Received by: Shotell	Date: Sept 21	Time: 1130

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

ALS FM-0328e v09 Front/04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

Chris Jastrebski Sept 18/15 10:37 To Stephen Clark of Woodward Parsons for air mail.

ECOLOGICAL LOGISTICS & RESEARCH LTD.
ATTN: Chris Jastrebski
204 - 105 Titanium Way
Whitehorse YT Y1A 0E7

Date Received: 25-SEP-15
Report Date: 06-OCT-15 11:36 (MT)
Version: FINAL

Client Phone: 867-668-6386

Certificate of Analysis

Lab Work Order #: L1678817

Project P.O. #: NOT SUBMITTED
Job Reference: 15-210
C of C Numbers: 1
Legal Site Desc:

Jamie Lo, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1678817-1 Water 22-SEP-15 11:30 HLB	L1678817-2 Water 22-SEP-15 11:04 CC1	L1678817-3 Water 22-SEP-15 10:30 CC2	L1678817-4 Water 22-SEP-15 10:14 CC3	L1678817-5 Water 22-SEP-15 09:54 WC
WATER						
Physical Tests	Hardness (as CaCO3) (mg/L)	288	295	454	443	379
	pH (pH)	7.81	8.11	7.99	8.01	8.14
	Total Suspended Solids (mg/L)	<3.0	<3.0	<3.0	<3.0	5.3
Total Metals	Aluminum (Al)-Total (mg/L)	0.0518	0.0490	0.0321	0.0638	0.196
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	0.00053	0.00057	0.00073
	Arsenic (As)-Total (mg/L)	0.00080	0.00079	0.00125	0.00131	0.00121
	Barium (Ba)-Total (mg/L)	0.057	0.058	0.054	0.055	0.061
	Beryllium (Be)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Boron (B)-Total (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10
	Cadmium (Cd)-Total (mg/L)	0.0000391	0.0000419	0.0000652	0.0000565	0.0000203
	Calcium (Ca)-Total (mg/L)	64.6	65.8	86.0	82.7	68.1
	Chromium (Cr)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	0.0012
	Cobalt (Co)-Total (mg/L)	0.00045	0.00037	0.00081	0.00077	0.00035
	Copper (Cu)-Total (mg/L)	0.0028	0.0027	0.0021	0.0022	0.0022
	Iron (Fe)-Total (mg/L)	0.279	0.273	0.370	0.406	0.574
	Lead (Pb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Lithium (Li)-Total (mg/L)	0.0034	0.0035	0.0113	0.0101	0.0046
	Magnesium (Mg)-Total (mg/L)	30.6	31.7	58.2	57.5	50.8
	Manganese (Mn)-Total (mg/L)	0.249	0.181	0.179	0.173	0.100
	Mercury (Hg)-Total (mg/L)	0.0000056	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	0.0013	0.0013	0.0017	0.0016	0.0012
	Nickel (Ni)-Total (mg/L)	0.0048	0.0051	0.0174	0.0168	0.0093
	Potassium (K)-Total (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Selenium (Se)-Total (mg/L)	0.00162	0.00163	0.00157	0.00141	0.00104
	Silver (Ag)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Sodium (Na)-Total (mg/L)	2.9	3.0	4.5	4.5	4.5
	Thallium (Tl)-Total (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
	Tin (Sn)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Titanium (Ti)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	0.011
	Uranium (U)-Total (mg/L)	0.00203	0.00209	0.00236	0.00255	0.00313
	Vanadium (V)-Total (mg/L)	0.00075	0.00069	0.00065	0.00084	0.00127
	Zinc (Zn)-Total (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050

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

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Antimony (Sb)-Total	DLB	L1678817-1, -2, -3, -4, -5
Matrix Spike	Nickel (Ni)-Total	MS-B	L1678817-1, -2, -3, -4, -5
Matrix Spike	Uranium (U)-Total	MS-B	L1678817-1, -2, -3, -4, -5

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLB	Detection Limit Raised. Analyte detected at comparable level in Method Blank.
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**
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-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.

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).

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.

TSS-MAN-WR	Water	Total Suspended Solids by Gravimetric	APHA 2540 D

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:

Laboratory Definition Code	Laboratory Location

Chain of Custody Numbers:

1

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

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

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L1678817-COFC

COC Number: 14 -

Page 1 of 1

Report To		Report Format / Distribution		Turnaround Time (TAT) (Rush TAT is not available for all tests)
Company:	Ecological Logistics & Research Ltd.	Select Report Format:	☑ PDF ☑ EXCEL ☑ EDD (DIGITAL)	R ☑ Regular (Standard TAT if received by 3 pm - business days)
Contact:	Chris Jastrebski	Quality Control (QC) Report with Report	☑ Yes ☐ No	P ☐ Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
Address:	204-105 Titanium Way Whitehorse, YT Y1A 0E7	☐ Criteria on Report - provide details below if box checked		E ☐ Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT
Phone:	867.668.6386	Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX	E2 ☐ Same day or weekend emergency - contact ALS to confirm TAT and surcharge
		Email 1 or Fax	chris@elr.ca, patricia.randell@gov.yk.ca	Specify Date Required for E2,E or P:
		Email 2	kmartens@minnow.ca	

Invoice To		Invoice Distribution	
	Same as Report To ☑ Yes ☐ No	Select Invoice Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
	Copy of Invoice with Report ☐ Yes ☑ No		
Company:	Ecological Logistics & Research Ltd.	Email 1 or Fax	chris@elr.ca
Contact:	Chris Jastrebski	Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:	Q52337	Approver ID:	Cost Center:
Job #:	15-210	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact:	Sampler:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TSS	Total Metals and Mercury	Asbestos	pH	Number of Containers
	~~MW~~ HLB	22 Sep 15	11:30	Water	R	R	X	R	
	CC1		11:04	Water	R	R	X	R	
	CC2		10:30	Water	R	R	X	R	
	CC3		10:14	Water	R	R	X	R	
	WC		9:54	Water	R	R	X	R	

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? ☐ Yes ☑ No	Keep refrigerated
Are samples for human drinking water use? ☐ Yes ☑ No	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐	No ☐	
Ice packs	Yes ☐	No ☐	Custody seal intact	Yes ☐	No ☐
Cooling Initiated	☐				

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
4.0					

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Wayne Emery	Sept 24	7:03	Shyano	25Sep15	930			

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM-0326a v09 Front 04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

Chris Jastrebski Sept 25 9:30

ECOLOGICAL LOGISTICS & RESEARCH LTD.
ATTN: Chris Jastrebski
204 - 105 Titanium Way
Whitehorse YT Y1A 0E7

Date Received: 05-OCT-15
Report Date: 12-NOV-15 17:09 (MT)
Version: FINAL

Client Phone: 867-668-6386

Certificate of Analysis

Lab Work Order #: L1683409

Project P.O. #: NOT SUBMITTED
Job Reference: 15-210
C of C Numbers: 1
Legal Site Desc:

Jamie Lo, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1683409-1	L1683409-2	L1683409-3	L1683409-4	L1683409-5
Description	Water	Water	Water	Water	Water
Sampled Date	02-OCT-15	30-SEP-15	30-SEP-15	30-SEP-15	30-SEP-15
Sampled Time	09:30	11:45	14:30	15:00	16:50
Client ID	HL	CC1	CC2	CC3	WC
Grouping / **Analyte**					
WATER					
Physical Tests Hardness (as CaCO3) (mg/L)	322	337	471	426	379
pH (pH)	8.10	8.24	8.22	8.23	8.19
Total Suspended Solids (mg/L)	<3.0	<3.0	<3.0	10.7	25.3
Total Metals Aluminum (Al)-Total (mg/L)	0.0440	0.0525	0.0347	0.315	0.711
Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Arsenic (As)-Total (mg/L)	0.00071	0.00086	0.00120	0.00122	0.00138
Barium (Ba)-Total (mg/L)	0.061	0.063	0.058	0.066	0.077
Beryllium (Be)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Boron (B)-Total (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium (Cd)-Total (mg/L)	0.0000493	0.0000347	0.0000541	0.0000548	0.0000462
Calcium (Ca)-Total (mg/L)	70.9	74.2	89.6	79.6	69.9
Chromium (Cr)-Total (mg/L)	<0.0010	0.0013	0.0010	0.0015	0.0023
Cobalt (Co)-Total (mg/L)	0.00047	0.00042	0.00074	0.00069	0.00070
Copper (Cu)-Total (mg/L)	0.0028	0.0028	0.0022	0.0028	0.0035
Iron (Fe)-Total (mg/L)	0.294	0.327	0.397	0.867	1.54
Lead (Pb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	0.00071
Lithium (Li)-Total (mg/L)	0.0030	0.0033	0.0090	0.0062	0.0034
Magnesium (Mg)-Total (mg/L)	35.3	36.7	60.1	55.2	49.7
Manganese (Mn)-Total (mg/L)	0.276	0.181	0.170	0.149	0.127
Mercury (Hg)-Total (mg/L)	0.0000091	0.0000101	0.0000087	0.0000100	0.0000113
Molybdenum (Mo)-Total (mg/L)	0.0013	0.0014	0.0017	0.0014	0.0012
Nickel (Ni)-Total (mg/L)	0.0048	0.0063	0.0148	0.0115	0.0072
Potassium (K)-Total (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
Selenium (Se)-Total (mg/L)	0.00162	0.00174	0.00162	0.00136	0.00110
Silver (Ag)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Sodium (Na)-Total (mg/L)	3.0	3.1	4.4	4.3	4.3
Thallium (Tl)-Total (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Tin (Sn)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Titanium (Ti)-Total (mg/L)	<0.010	<0.010	<0.010	0.014	0.025
Uranium (U)-Total (mg/L)	0.00214	0.00231	0.00252	0.00285	0.00344
Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	0.00128	0.00248
Zinc (Zn)-Total (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050

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

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Calcium (Ca)-Total	MS-B	L1683409-2, -3, -4, -5
Matrix Spike	Iron (Fe)-Total	MS-B	L1683409-2, -3, -4, -5
Matrix Spike	Manganese (Mn)-Total	MS-B	L1683409-1

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**
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-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.

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).

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.

TSS-MAN-WR	Water	Total Suspended Solids by Gravimetric	APHA 2540 D

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:

Laboratory Definition Code	Laboratory Location

Chain of Custody Numbers:

1

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

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

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Submitted To: Janie Lo
ALS Laboratory Group
8081 Lougheed Hwy., Suite 100
Burnaby BC V5A 1W9

REFERENCE DATA **Asbestos in Water by TEM**

Sample Type:	Drinking Water
Method Reference:	EPA Method 100.2
Client Sample No.:	L1683409-1 HL through L1683409-3 CC2
Sample Location:	L1683409
PO No.:	L1683409
ALS Work Order No.:	1510365
ALS Sample No.:	1510365-01 through 1510365-03

The samples indicated in this report were analyzed by Transmission Electron Microscopy (TEM) for asbestos using EPA Method 100.2 "Detection of Asbestos Structures >10μm in Length in Drinking Water". Sample collection is performed outside the laboratory and is the responsibility of the client. Samples must be received by the lab and filtered within 48 hours of collection. Should sample collection or submission deviate from any method requirement, interpretation of the results under strict EPA guidelines cannot be made.

Upon receipt by ALS, the samples are ultrasonically treated in their original containers for 15 minutes to suspend the solids and aliquots of the suspension are filtered onto 0.22μm pore size MCE filters. These filters are later carbon coated and mounted on TEM grids for analysis. Whenever possible, a sufficient volume is analyzed to yield the method recommended analytical sensitivity (AS) of <0.20MFL. This is equivalent to the detection of one confirmed asbestos fiber in the total area analyzed and is also referred to as limit of detection (LOD). However, since the volume analyzed is based on the filter loading which is a result of the clarity of the ultrasonicated sample, analysis of water samples containing large amounts of suspended solids may not reach the recommended LOD/AS.

Analysis is performed on an FEI Tecnai Spirit G2 Twin TEM with EDAX Genesis System. Results apply only to portions of samples analyzed. Original samples are disposed after sufficient filtration. Filters are disposed after 1 year, and grids analyzed are archived for a minimum of 3 years.

Pamela Johnson
Analyst

Shawn Smythe
Project Manager

Ohio Analyst #2268; Ohio Lab #4077
PA DEP Lab ID #68-01320; Cert. #003
NELAC accredited through New York ELAP (LAB #11371)

CLIENT: ALS Laboratory Group
SAMPLE LOCATION: L1683409

SAMPLE PREP DATA		***ANALYSIS DATA***	
Date Received:	10/8/2015	Date and Time Analyzed:	10/19/2015 & 13:30
Date Filtered:	10/8/2015	Magnification:	13,500x
Time Filtered:	11:15	Calibration Constant:	1 cm = 0.74μm
Filter Type:	MCE, 0.22μm	EDXA Resolution:	<175eV
Filter Size:	47mm	Accelerating Voltage:	100keV
Collection Area:	1075mm^2	Camera Constant:	129.25mm-Å

SAMPLE IDENTIFICATION			
Client Sample No.:	L1683409-1 HL	L1683409-2 CC1	L1683409-3 CC2
ALS Sample No.:	1510365-01	1510365-02	1510365-03
Date Sampled:	10/2/2015	9/30/2015	9/30/2015
Time Sampled:	Not Provided	Not Provided	Not Provided
Volume Filtered (L):	0.010	0.025	0.025
No. Grid Openings Analyzed:	4	4	4
Average Grid Opening Area:	0.0105	0.0105	0.0105
AS (MFL):	2.56	1.02	1.02
Asbestos Fibers ≥ 10 microns			
Chrysotile:	16	26	24
Amosite:	0	0	0
Crocidolite:	0	0	0
Act-Tremolite†:	0	1	0
Anthophyllite:	0	0	0
Total Asbestos ≥ 10 microns			
Count:	**16**	**27**	**24**
Concentration (MFL):	**40.95**	**27.64**	**24.57**

†Act-Tremolite concentrations include: Actinolite, as well as the Libby Amphiboles; Tremolite, Winchite, and Richterite.
AS= Analytical Sensitivity MFL= Millions of Fibers per Liter

NOTE: All samples were received past the method hold time of 48 hours but were analyzed per client request. Because samples contained a large amount of suspended solids, we could only filter a small volume without overloading the filters. Analysis was terminated upon completion of the fourth grid opening due to the high asbestos concentration.

Pamela Johnson
Analyst

Shawn Smythe
Project Manager

Ohio Analyst #2268; Ohio Lab #4077
PA DEP Lab ID #68-01320; Cert. #003
NELAC accredited through New York ELAP (LAB #11371)

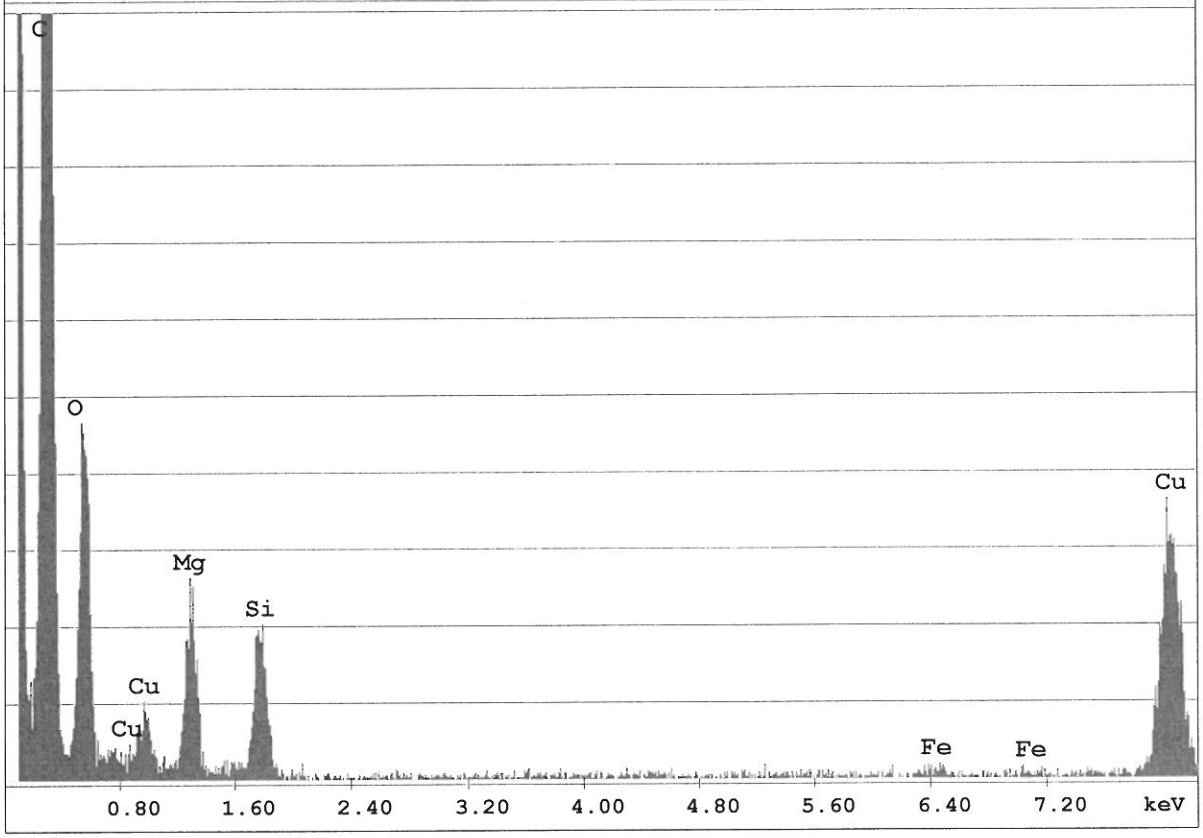
ALS Environmental
4388 Glendale-Milford Road, Cincinnati, Ohio 45242
Phone (513) 733 5336 Fax (513) 733 5347 www.alsenviro.com
A Campbell Brothers Limited Company

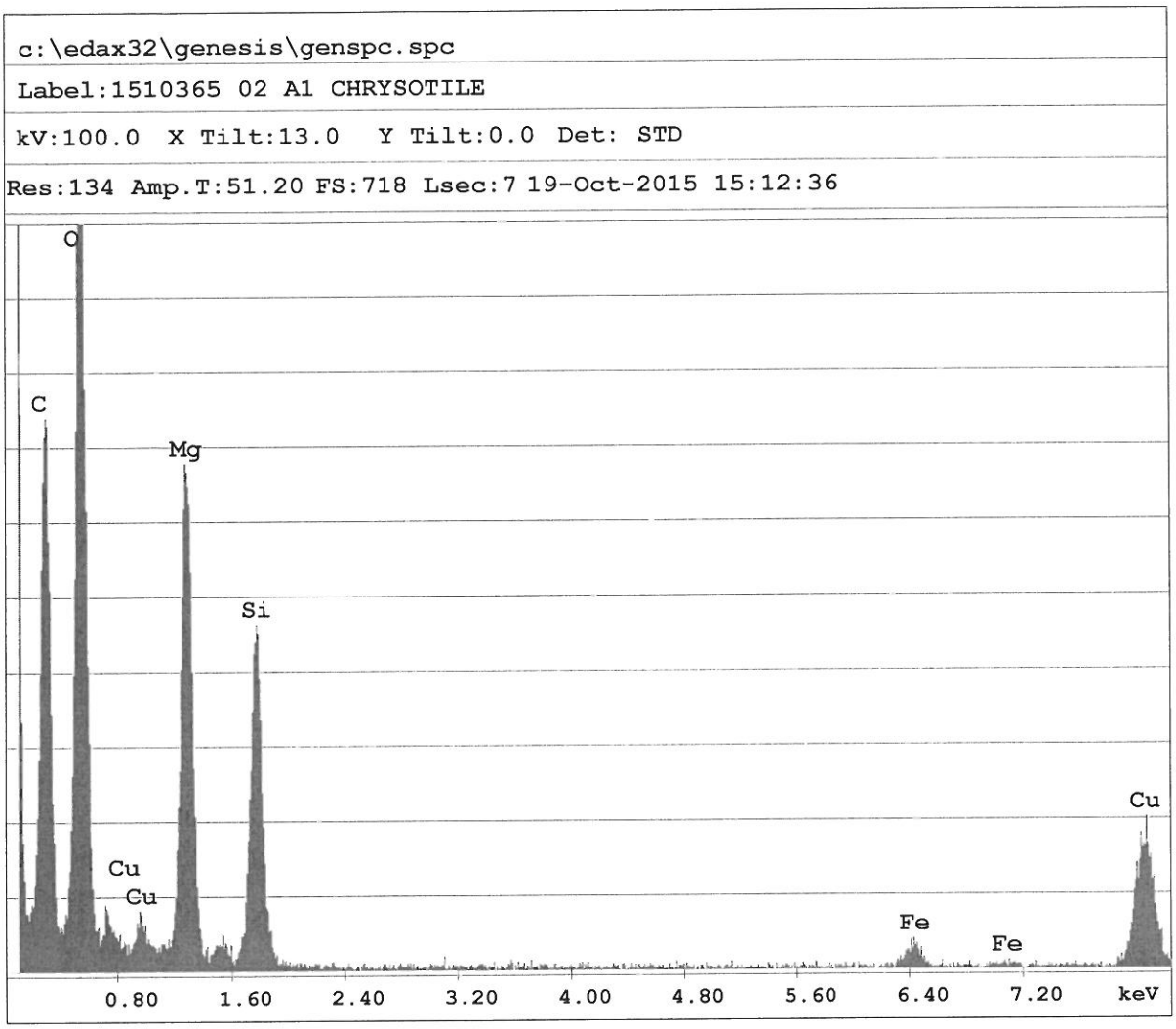
c:\edax32\genesis\genspc.spc

Label:1510365 01 A1 CHRYSOTILE

kV:100.0 X Tilt:13.0 Y Tilt:0.0 Det: STD

Res:134 Amp.T:51.20 FS:379 Lsec:15 19-Oct-2015 14:51:02

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kV:100.0 X Tilt:13.0 Y Tilt:0.0 Det: STD
Res:134 Amp.T:51.20 FS:718 Lsec:7 19-Oct-2015 15:12:36
O
C
Mg
Si
Cu
Cu
Fe
Fe
Cu
0.80
1.60
2.40
3.20
4.00
4.80
5.60
6.40
7.20
keV

c:\edax32\genesis\genspc.spc

Label:1510365 02 A2 ACTINOLITE-TREMOLITE

kV:100.0 X Tilt:13.0 Y Tilt:0.0 Det: STD

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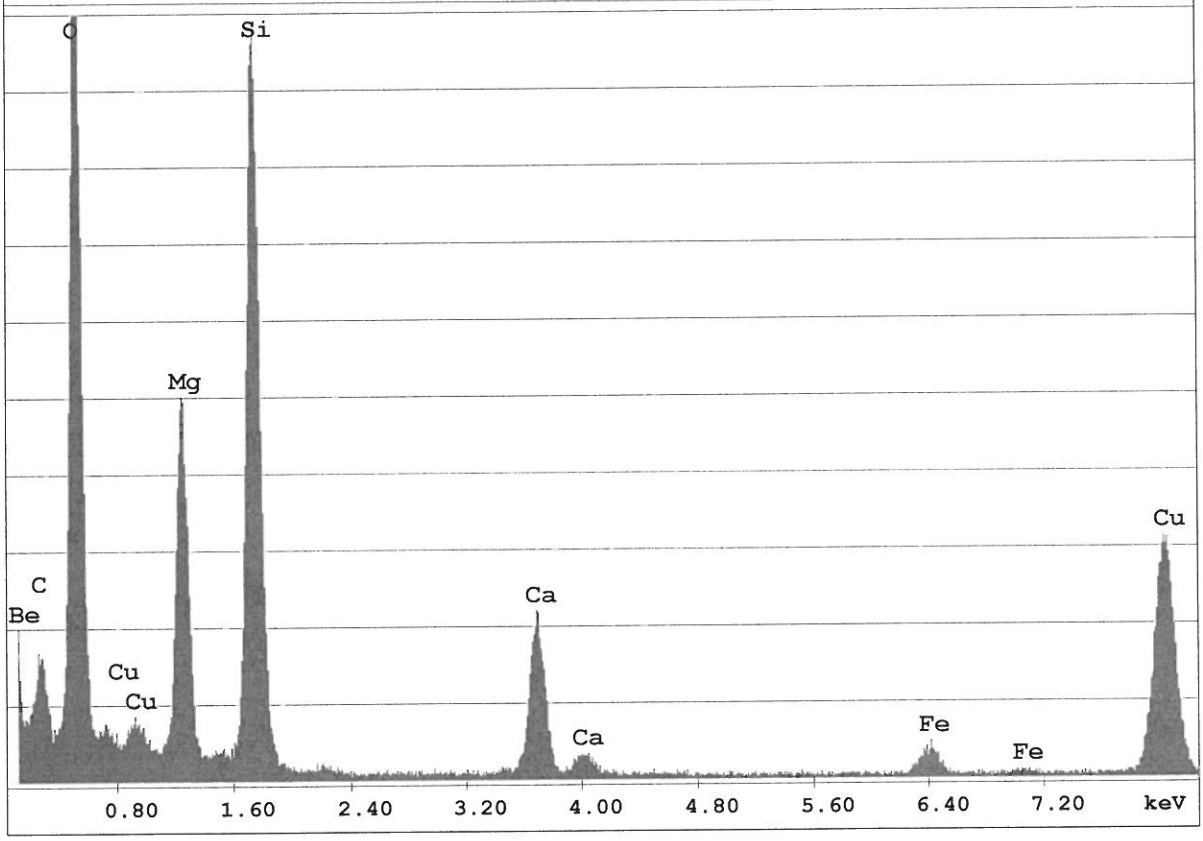

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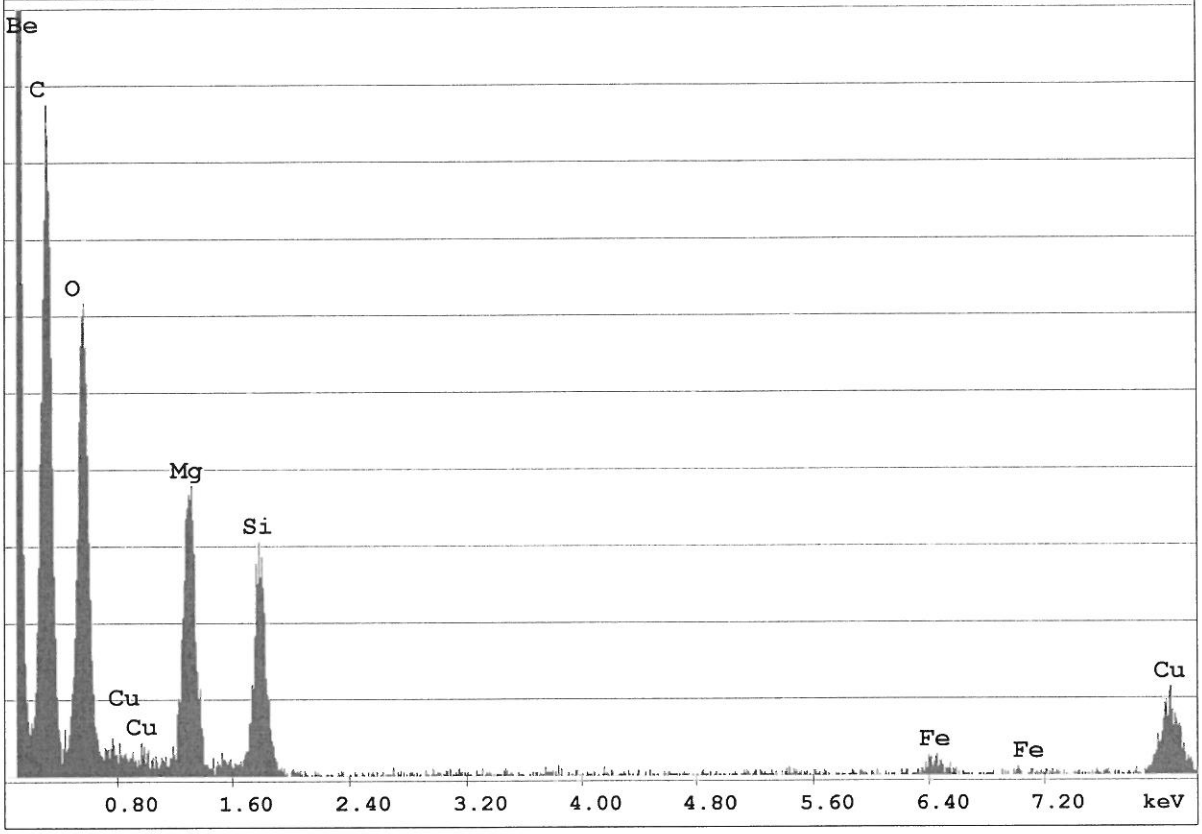
Label:1510365 03 A1 CHRYSOTILE

kV:100.0 X Tilt:13.0 Y Tilt:0.0 Det: STD

Res:134 Amp.T:51.20 FS:454 Lsec:5 19-Oct-2015 15:29:34



Chain of Custody (COC) / Analytical Request Form

ALS Environmental

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

L1683409-COFC

COC Number: 14 -

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Report To		Report Format / Distribution	Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
Company:	Ecological Logistics & Research Ltd.	Select Report Format: ☑ PDF ☑ EXCEL ☑ EDD (DIGITAL)	R ☑ Regular (Standard TAT if received by 3 pm - business days)
Contact:	Chris Jastrebski	Quality Control (QC) Report with Report ☑ Yes ☐ No	P ☐ Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
Address:	204-105 Titanium Way Whitehorse, YT Y1A 0E7	☐ Criteria on Report - provide details below if box checked Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	E ☐ Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 ☐ Same day or weekend emergency - contact ALS to confirm TAT and surcharge
Phone:	867.668.6386	Email 1 or Fax: chris@elr.ca, patricia.randell@gov.yk.ca	Specify Date Required for E2,E or P:
		Email 2: kmartens@minnow.ca	

Invoice To	Same as Report To ☑ Yes ☐ No	Invoice Distribution	Analysis Request
	Copy of Invoice with Report ☐ Yes ☑ No	Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below
Company:	Ecological Logistics & Research Ltd.	Email 1 or Fax: chris@elr.ca	
Contact:	Chris Jastrebski	Email 2: Patricia.Randell@gov.yk.ca	

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:	Q52337	Approver ID:	Cost Center:
Job #:	15-210	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	

ALS Lab Work Order # (lab use only)		ALS Contact:	Sampler:

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TSS	Total Metals and Mercury	Asbestos	pH									Number of Containers
						P											
	HL	02-Oct-15	9:30	Water	R	R	R	R									4
	CC1	30-Sep-15	11:45	Water	R	R	R	R									4
	CC2	30-Sep-15	14:30	Water	R	R	R	R									4
	CC3	30-Sep-15	15:00	Water	R	R		R									3
	WC	30-Sep-15	16:50	Water	R	R		R									3

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? ☐ Yes ☑ No	
Are samples for human drinking water use? ☐ Yes ☑ No	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice packs Yes ☐ No ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
5.0			12 coolers 8	C Avg	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Chris Jastrebski	Date: Oct 15/15	Time: 17:70	Received by: Bruno	Date: 5 Oct 15	Time: 16:30 5:08	Received by: Shafee	Date: Oct.6	Time: 1800

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

Appendix 3 – In-Situ Turbidity Monitoring Data

Date	Time	HL - Hudgeon Lake	HLB - Hudgeon Lake Alternate (While Diversion Active)	CC1 - Clinton Creek Compliance point Downstream of Construction	CC2 - Clinton Creek Upstream of Wolverine Creek	WC - Wolverine Creek Upstream of Clinton Creek	CC3 – Clinton Creek Downstream of Wolverine Creek	Clinton Creek Downstream of Construction – Alternate Sites	
								Centre of stream	North side of stream
10-Aug-15	8:10	0.5		0.2	0.09	2.43	1.01		
10-Aug-15	14:30			5.36					23
10-Aug-15	14:45			13.26				11.3	11.35
10-Aug-15	15:00			14.7					24.7
10-Aug-15	15:25			0.93				0.97	0.79
10-Aug-15	16:10			0.82					
11-Aug-15	7:40	1.88		0.33	1.06	12.9	6.03		
12-Aug-15	8:22	0.62		0.48	0.65	12.05	3.74		
13-Aug-15	9:56	0.99		0.78	0.6	7.54	1.59		
14-Aug-15	9:37	0.52		0.43	0.63	9.01	1.87		
15-Aug-15	8:04	0.49		0.47	0.43	6.33	2.68		
16-Aug-15	8:15	0.66		0.23	0.33	5.01	2.13		
16-Aug-15	9:56			10.2					7.34
16-Aug-15	10:00			1.21					1.21
16-Aug-15	10:15			33.7					23.1
16-Aug-15	10:30			1.48					1.04
16-Aug-15	10:45			0.93					0.75
17-Aug-15	7:47	1.68		0.67	2.03	20.4	12.52		
18-Aug-15	7:35	0.36		0.43	0.71	27.7	14.8		
19-Aug-15	7:40	0.42		2.57	2.34	23.3	11.19		
19-Aug-15	8:20			14.9					
19-Aug-15	8:30			21.2					
19-Aug-15	8:43			17.1					
19-Aug-15	8:56			23.5					
19-Aug-15	9:10			1.69					
20-Aug-15	10:55	1.72		2.81	3.11	19.3	7.88		
20-Aug-15	7:55			2.28					
20-Aug-15	8:20			22.3					
20-Aug-15	8:51			17.1					
20-Aug-15	9:30			33.8					
20-Aug-15	10.04			8.65					
20-Aug-15	10:41			3.87					
21-Aug-15	9:30	16.2		3.92	8.05	11.2	7.98		
21-Aug-15	9:30	2.89							
22-Aug-15	8:35	2.42		2.23	1.99	9.33	2.6		
23-Aug-15	8:08	1.29		1.27	1.24	6.68	1.67		
24-Aug-15	8:08	2.03		2.47	2.39	12.45	3.23		
25-Aug-15	7:50	1.8		2.24	1.76	9.68	1.97		
26-Aug-15	8:29	2.76		3.36	3.37	20.4	9.92		
27-Aug-15	7:57	1.97		4.89	4.8	33.6	12.5		
27-Aug-15	9:08			4.45					
27-Aug-15	9:18			**60.1**					
27-Aug-15	9:28			12.9					
27-Aug-15	9:38			9.24					
27-Aug-15	9:48			23.8					
27-Aug-15	9:54			65					

Date	Time	HL - Hudgeon Lake	HLB - Hudgeon Lake Alternate (While Diversion Active)	CC1 - Clinton Creek Compliance point Downstream of Construction	CC2 - Clinton Creek Upstream of Wolverine Creek	WC - Wolverine Creek Upstream of Clinton Creek	CC3 – Clinton Creek Downstream of Wolverine Creek	Clinton Creek Downstream of Construction – Alternate Sites	
								Centre of stream	North side of stream
27-Aug-15	10:05			27.2					
27-Aug-15	10:20			11.1					
27-Aug-15	11:15			6.39					
28-Aug-15	7:50	4.29		4.7	5.75	24.4	9.99		
29-Aug-15	7:42	3.83		4.9	4.88	15.1	6.13		
30-Aug-15	9:32	11.63		5.54	5.87	11.31	6.3		
31-Aug-15	8:55		4.83	5.36	4.71	7.58	4.74		
01-Sep-15	7:51		6.23	3.93	3.66	7.37	4.38		
02-Sep-15	10:06		3.7	4.93	4.52	6.8	4.06		
03-Sep-15	7:59		3.68	3.63	3.05	5.08	3.41		
04-Sep-15	11:01		2.99	3.79	3.01	5	3.61		
05-Sep-15	8:12		3.05	2.97	3.1	5.66	2.96		
06-Sep-15	7:58		2.51	2.94	2.24	4.64	2.82		
07-Sep-15	7:59		2.58	2.71	2.35	4.83	2.88		
08-Sep-15	8:28		2.28	2.43	2.65	3.78	2.3		
09-Sep-15	11:13		2.05	1.63	2	3.51	1.96		
10-Sep-15	8:39		2.04	1.82	1.15	3.43	1.45		
11-Sep-15	8:19		1.46	1.6	1.24	3.73	1.82		
12-Sep-15	8:54		1.32	2.06	1.92	4.19	2.08		
13-Sep-15	7:48		1.11	2.26	0.86	3.78	1.25		
14-Sep-15	11:37		0.95	0.93	0.65	4.36	1.89		
15-Sep-15	13:54		1.01	1.38	0.96	6.74	2.89		
16-Sep-15	15:20		1.1	0.97	0.88	6.52	2.42		
17-Sep-15	8:24		1.22	0.7	0.63	6.21	1.46		
18-Sep-15	8:09		2.81	0.97	0.62	4.5	1.42		
19-Sep-15	8:46		0.59	0.53	0.68	4.11	1.6		
20-Sep-15	8:19		0.55	0.48	1.39	2.88	0.84		
21-Sep-15	11:56	0.8		0.91	0.69	3.41	1.81		
22-Sep-15	9:54	0.79		0.78	0.62	3.32	1.1		
23-Sep-15	17:05	0.86		0.98	0.56	3.34	1.51		
24-Sep-15	9:04	2.11		2.83	0.76	3.04	1.85		
25-Sep-15	8:27	0.46		0.75	0.53	3.23	1.07		

Appendix 4 – Scientific Collection Permit

Fisheries and Oceans Canada | Pêches et Océans Canada

Licence Number: XR 249 2015
Valid From: 23-Jul-2015
Expiry Date: 31-Aug-2015

This licence and/or permit is issued under the authority of SECTION 52 OF THE FISHERY (GENERAL) REGULATIONS.

This licence and/or permit authorizes the person(s) listed below, subject to the following terms and conditions, to collect the species and quantity of fish identified below for: Scientific purposes. Non-compliance with any condition of this licence and/or permit may result in the cancellation of this licence and/or permit.

Licence/Permit Activity Description:
To conduct a fish salvage in conjunction with instream work that is occuring in Clinton Creek.

Period of Activity:
Note: as per the conditions of this licence, notification with details is required prior to the commencement of each sampling period.

Licence Holder:
FIN: 126381
204-105 Titanium Way
Whitehorse YT Y1A 0E7

Ecological Logistics & Research Ltd.

Contact Number: 867-668-6386
Fax Number: 867-668-6385

Contact Party:
FIN: 125636 Jastrebski, Chris

Contact Number: 867-335-1932
Fax Number: 867-668-6385

Individuals or groups assisting with the authorized activity:

Any additional assistants not listed below, must be named as part of the notification prior to sampling. Detailed information requirements is found under conditions of this licence.

FIN: 136864 Michelle Mckay Contact Number: 867-393-5350

Species, Quantity of Fish, Area(s) and Gear:

Species:	Unknown Species
Gear:	Electroshocker Seine, Beach Rod And Reel Net, Dip Trap, Gee/Minnow
Licence Area:	Yukon/Transboundary: Clinton Creek; Watershed: 80068123105564
To be Retained:	0

Reporting Requirements:

XR 249 2015 Summary Data Report **Due Date** 31-Dec-15
See "Terms and Conditions" of this licence for detailed reqirements.

Terms and Conditions:

This licence authorizes collections to be made by the licensee and employees, volunteers and students of the licensee provided that all persons, other than minors who are engaged in activities under the authority of this licence, are carrying suitable photo identification to be produced upon request of a Fishery Officer or Guardian.

This license is subject to immediate termination upon written or verbal notice from a representative of the Yukon Government- Department of Environment, or of Fisheries and Oceans Canada.

Samplers: It is the responsibility if the license holder to ensure that samplers are experienced and competent in the fish collection methods authorized in this license.

Need to carry and produce permit: A copy of this license must be in the immediate possession of the samplers during sampling, and must be produced upon the request of any representative designated as a Fishery Officer or Fishery Guardian pursuant to the Fisheries Act (Canada).

Notice: Prior to commencing sampling, notice is to be given to:

• Fisheries and Oceans Canada, Yukon/Transboundary Rivers Area - Tel: (867) 393-6722 Fax (867) 393-6738 or Email: YTLicence@dfo-mpo.gc.ca

• Oliver Barker, YTG Fisheries - Email: fisheries@gov.yk.ca

• Appropriate First Nation Government in whose Traditional Territory the activity is taking place.

The notice is to include following information:
i. The Collection License number,
ii. The watercourse or water body on which, and the location where the sampling is to take place,
iii. The dates on which sampling will occur
iv. The names of all assistants which will be engaged in the sampling.

• Note: Notice is also to be given to the Government of Yukon Conservation Officer responsible for any area where sampling is to take place at least 24 hours prior to the start of sampling.

Release of fish: All live fish must be released unharmed into the water body or course from which they originated and as near as possible to the location from which they were captured. Exception to this is where fish are retained for identification or forensic purposes.

Electrofishing: Is not permitted in the vicinity of spawning fish or their redds. A trained and certified electrofisher operator must be a part of the electrofishing crew.

Gear: All gear left unattended must be clearly labelled with the Licence Number and must not interfere with the public right of navigation.

Aquatic Invasive Species
To prevent the introduction of aquatic invasive species there are a few simple things that can be considered: a) Before leaving an area: Drain water from boat, trailer and gear, remove all plant parts and mud and b) Before entering another water body: Wash all your gear including waders with soapy water. For Further Information: http://www.pac.dfo-mpo.gc.ca/publications/docs/invasives-envahissantes-eng.htm, http://www.dfo-mpo.gc.ca/science/enviro/ais-eae/plan/plan-eng.htm

Disposition of fish: Any fish captured and retained under the authority of this license are not to enter any commercial

markets or establishments. Any fish collected and retained, or incidental mortalities associated with non-lethal sampling, are not to be utilized for human consumption or personal use purposes unless authorized by Fisheries & Oceans Canada.

Species at Risk: Section 32 (1) of the federal Species at Risk Act prohibits killing, harming, harassing, capturing or taking an individual of a wildlife species which is listed on Schedule 1 as an extirpated species, an endangered species or a threatened species. Refer to the SARA Public Registry at http://www.sararegistry.gc.ca to determine if species at risk may be in your research area and to apply for a permit if required.

Transport or transplant of live fish and/or eggs/milt: Live fish and/or eggs (spawn) cannot be transported without prior written approval of the transplant committee or transplanted without a licence granted pursuant to Section 56 of the Fishery (General) Regulations.

Report: A report must be submitted after completion of sampling, in electronic spreadsheet form as provided by email with permit. If no sampling takes place a nil report is required. The report must be in the form of the spreadsheet provided but is not limited to and may also include photocopied data sheets or field notes, or the final report for the project, and must include the following:

a. The Collection License number
b. The location(s) of the sampling with GPS coordinates, and a map or detailed described if GPS coordinates were not possible;
c. Names of all individuals engaged in sampling;
d. The dates on which the sampling occurred;
e. The number of fish sampled, by species;
f. Any mortalities

A summary report is to be submitted by December 31, 2015 to:

Area Licensing Manager
Fisheries and Oceans Canada
100-419 Range Rd
Whitehorse Yukon
Y1A 3V1
Email: YTLicence@dfo-mpo.gc.ca

By signing on this document, the person(s) listed below, agree to be bound by the terms and conditions that pertain to each person as an individual and to the group as a whole.

126381

FIN	Licence Holder - Print Name	Signature	Date

Licence Issued: 22 July 2015

Licence Printed: 22 July 2015
Licence Issued By: LOUISE NAYLOR