REVELSTOKE COMMUNITY FOREST CORPORATION

WATER QUALITY MONITORING ON TFL 56

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SUMMARY

Aerial fertilization commenced on the Revelstoke Community Forest Corporations Tree Farm License on September 18th, 2020. Water quality monitoring was done on two unnamed S-6 streams on the TFL, for this project referred to as Coppermine and Keystone. Both streams run through or are adjacent to fertilization treatment areas. Due to the timing of fertilization a modified sampling schedule was developed which did not include pre-treatment sampling. Water quality sampling on the Coppermine stream was done immediately following fertilization treatment and then twice a week for three weeks and a conclusive sample four months post-treatment. Samples of the Keystone stream were taken once prior to treatment, immediately following fertilization and then twice a week for three weeks and a conclusive sample four months post-treatment. For both creeks, two samples were taken from above treatment areas during the first two visits for control samples. Samples were sent to ALS labs to determine levels of total ammonia (as N, Mg/L), nitrate (as N, Mg/L), and total nitrogen (Mg/L). Water temperature and pH were measured at the sites.

Based on the results given by ALS, total ammonia levels in both the creeks had a minimal increase following fertilization but returned to undetectable levels within three weeks post-treatment. Nitrate and total nitrogen levels were slightly elevated following treatment but remained well below allowable limits and showed a decline in levels by the final tests. Water temperatures dropped almost consistently throughout the monitoring as the weather got colder, and pH stayed relatively consistent in both creeks.

INTRODUCTION

An aerial fertilization project took place in the fall of 2020 on Louisiana Pacific's Tree Farm Licence (TFL) 55 and Revelstoke Community Forest Corporations (RCFC) TFL 56 (Figure 1). The treatment took place on TFL 55 from Sept 10 -18th and on TFL 56 from September 18th to October 3rd, 2020. The fertilization treatment of both licenses was conducted by Western Aerial Applications Ltd**.** (WAA), a contractor from Chilliwack, British Columbia. While this was the first time fertilization had been broadly applied on the two TFL's, WAA has years of previous experience conducting aerial fertilization applications across British Columbia and Alberta.

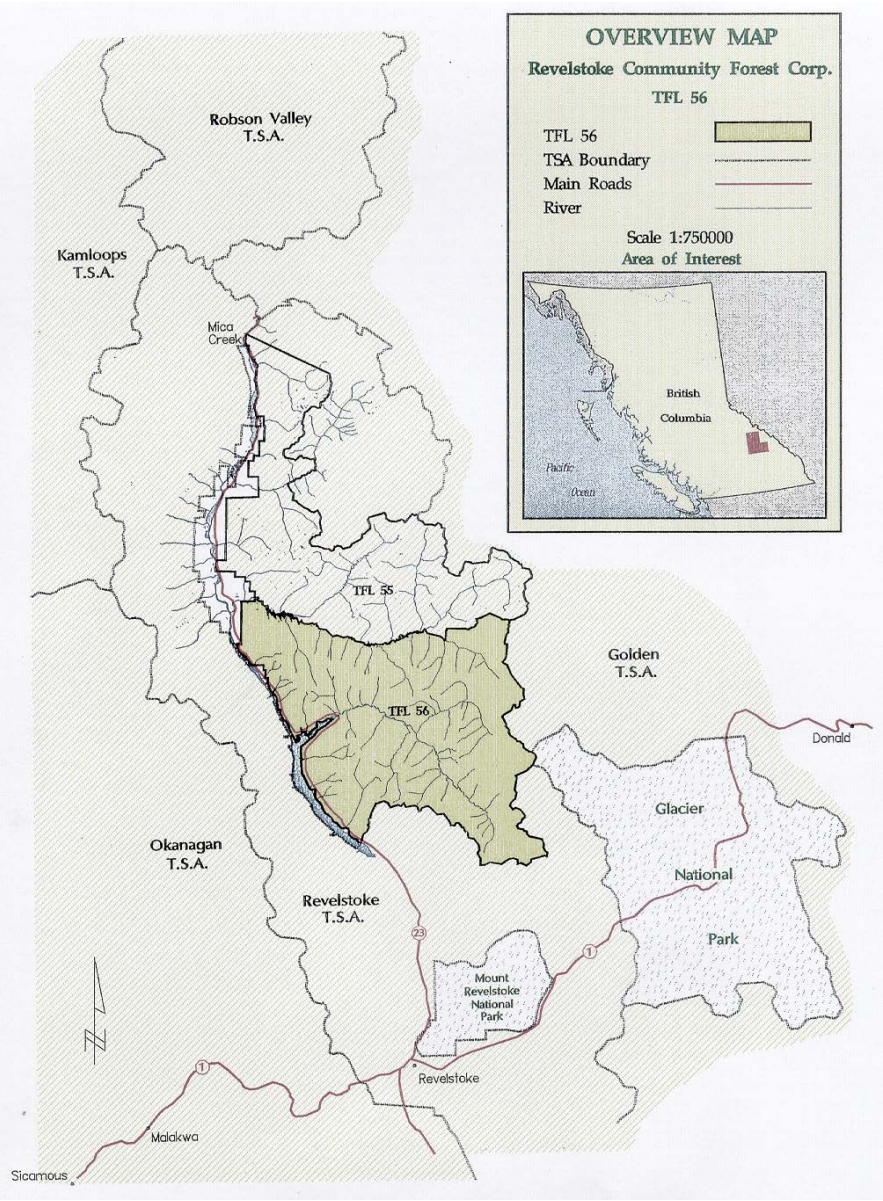

Figure 1 Figure 1. Overview of TFL 55 and TFL 56 Location

Combined, the project successfully treated 6066 hectares (ha) (3004ha on TFL 55 and 3062ha on TFL 56). The fertilizer mix was a combination of forestry grade urea, and ammonium sulphate blend (35-0-0-10.1S) applied at a rate of 564 kg/ha – (326.5 kg/ha urea and 237.5 kg/ha ammonium sulphate). This project was completed through the BC Forest Carbon Initiative, with the objective being to help mitigate the effects of climate change by increasing the carbon sequestration rate of BC's forests by adding deficient nutrients that were known to be limited on these sites. This project was completed in accordance with British Columbia's Fertilization Standards for Ministry funded programs (2015).

Both TFL's host rivers, an abundance of streams that are tributaries to Lake Revelstoke, a man-made reservoir lake which is part of the Columbia River system. Fertilization activities were not conducted around fish sensitive areas or community watersheds. Streams larger than S-6 were buffered out of treatment areas, and streams with water licences (one in the vicinity of treatment area). Weather conditions during the treatment of TFL 55 were warm and dry but began to deteriorate during the last few days and were generally cool with rain and fog during the TFL 56 project. The season leading up to treatment was mostly dry, and creeks were at their lowest point of the year since the spring freshet.

Due to operation logistics and timing, water quality monitoring was not completed on TFL 55 thus; this report focuses on water quality monitoring conducted on two unnamed tributary S6 streams on TFL56 (Coppermine and Keystone). Due to timing issues, a modified monitoring schedule took place which was not consistent with the Forest Fertilization Guidebook (1995). As stated in Appendix 4 of the guidebook, monitoring should take place pre-application for two weeks. However, there was not enough time to complete this step. The final test were conducted four months post-fertilization application instead of the three months mandated in the guidelines. RCFC's prescriptions for the project followed guidelines set out in the Fertilization guidebook for buffering streams and bodies of water. The monitoring was inducted to measure the amounts of total Ammonia (as N, Mg/L), total nitrogen (Mg/L) and nitrate (as N, Mg/L) to ensure that levels did not exceed the quality limits post-treatment.

METHODOLOGY

SAMPLE SITE LOCATIONS

The two sites were chosen based on finding mid-sized streams that ran through or adjacent to fertilization treatment areas. Easy vehicular access to the test site and control site was also a factor in stream choice. One stream was selected up the Coppermine (upper) and Keystone (lower) areas (Figure 2).

Figure 2. Overview of TFL 56 and approximate location of the Coppermine (upper) and Keystone (lower) water quality test streams

COPPERMINE

The Coppermine, S-6 stream, chosen for water quality monitoring, flows through and by multiple treatment areas near the Coppermine Road before emptying into the Goldstream River. Two test sites were established on the Coppermine stream, one upstream above any treatment areas (Figure 3), and one downstream below treatment areas (Figure 4). The stream flows through 729-4 and 728-303 (not visible from the air, thus not buffered) and west of 728-8 and 728-202. These areas were treated on the same day as the first samples were taken (above and downstream from the treatment area) (Figure 5 and 6).

Figure 3. Coppermine stream at control test site, upstream from fertilization treatment areas

Figure 4. Coppermine stream at test site downstream from fertilization treatment areas

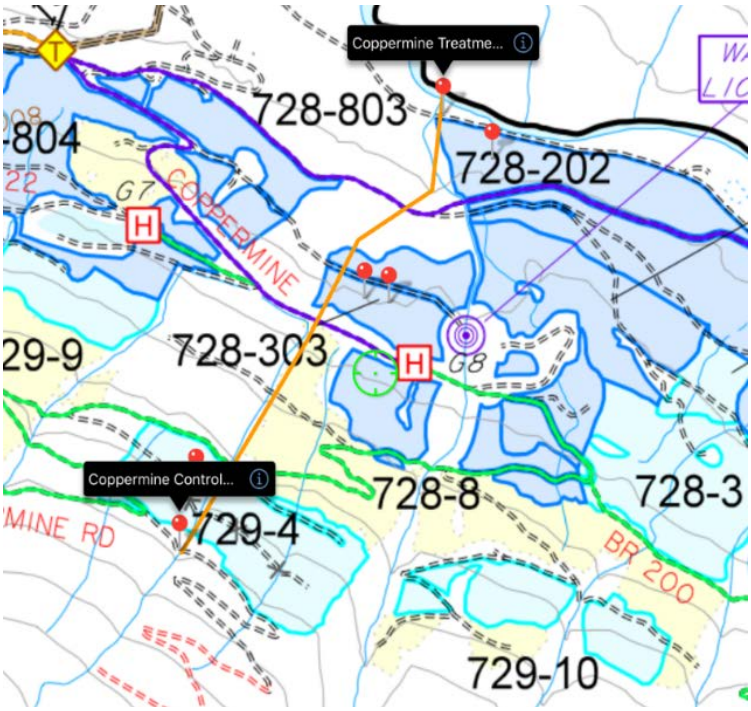

Figure 5.Coppermine (s-6) water quality monitoring stream, test and control site locations, and 2020 fertilization area

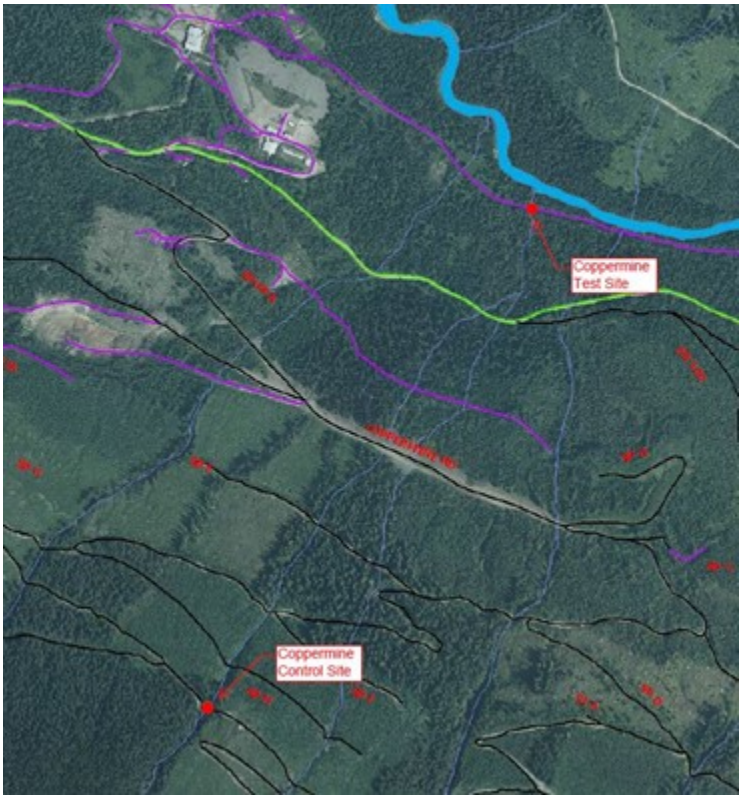

Figure 6. Ortho photo of Coppermine area, stream, and location of control and test sites

KEYSTONE

The Keystone S-6 stream chosen for water quality monitoring begins in the subalpine, eventually flowing down into the Revelstoke Reservoir Lake. This stream was not visible from the air and runs unbuffered through treatment areas 686-304 and 686-5A (Figure 7). The Keystone site was also chosen as there was still time to collect pre-treatment samples. Two sample sites were established on the Keystone stream, one above any fertilizer treatment areas (Figure 8), and the other established downstream of any affecting treatment areas (Figure 9 and 10).

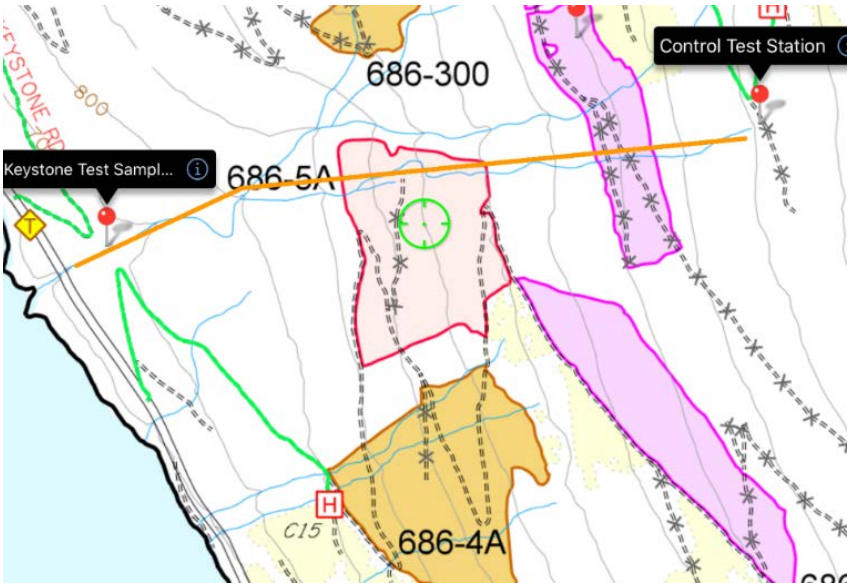

Figure 7. Keystone (s-6) water quality monitoring stream, test site and control site location and 2020 fertilization treatment areas

Figure 8. Keystone stream at control test site upstream from fertilization area

Figure 9. Keystone stream at test site downstream from fertilization treatment area

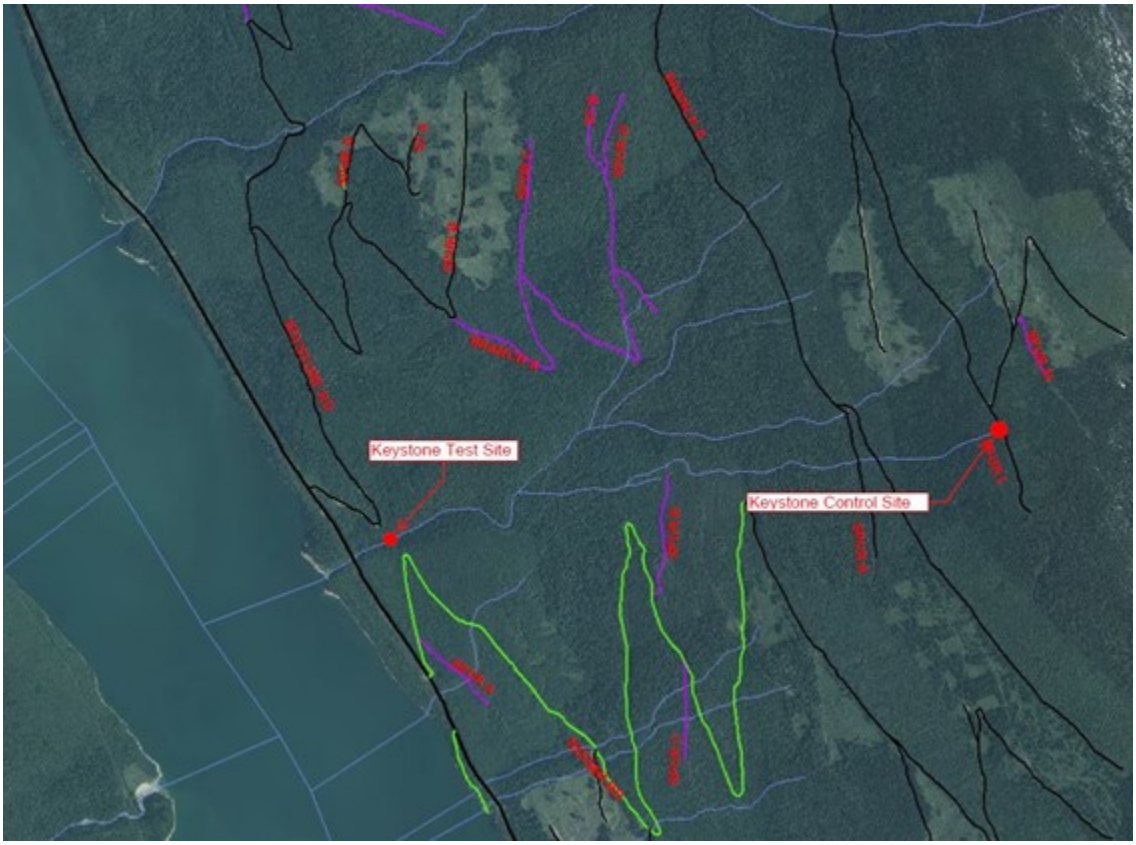

Figure 10. Ortho photo of Keystone, stream, and location of controls and test sites.

SAMPLING SCHEDULE

Table 1 Schedule of water quality monitoring samples and fertilization treatment on areas affecting test streams

Month	Week	Sun	Mon	Tues	Wed	Thurs	Fri	Sat
Sept	13-19th							
Sept	20-26th	Test#1 Sept 20th			Test #2 Sept 23rd			
Sept/Oct	27-3rd		Test #3 Sept 28th		Test#4 Sept 30th			
Oct	4-10th		Test #5 Oct 5th		Test #6 Oct 7th			
Oct	11-17th			Test#7 Oct 13th		Test#8 Oct 15th		
Jan/Feb	31-6th			4-month post-treatment test				
	= Date of fertilization treatment on areas affecting Coppermine test stream							
	= Date of fertilization treatment on areas affecting Keystone test stream							

SAMPLING METHODOLOGY

Water sampling was done in accordance with the Forest Fertilization Guidebook (1995), though a modified schedule was established due to project timing. The Coppermine site was sampled the day of treatment, three days post-treatment, and then bi-weekly for three more weeks. Samples from the Keystone site were taken three days prior to treatment, immediately following treatment application, and then bi-weekly for three weeks following. Final samples on both streams were collected four months post-treatment. Control samples were taken from the Coppermine stream and the Keystone stream, upstream of fertilization activities. These samples were collected on September 20th and 23rd,2020. Test sites were established on each stream downstream from fertilization activities. A subsequent sample was taken on both streams at the test site four months following treatment .

SAMPLING MATERIAL

ALS environmental labs in Burnaby provided most of the water sample materials. The lab provided the appropriate amount of sample bottles, coolers, icepacks, chain of custody forms, labels, packing material and sulfuric acid. Other materials, such as a colorimetric pH test kit and a digital thermometer, were obtained at a local hardware store.

Each sample consisted of collecting two bottles, a glass bottle for testing nutrients, and a plastic bottle for testing metals. To preserve the water samples, sulfuric acid was added to the water in the glass bottles at the time of collection. Samples were collected at midstream, at mid-depth, as per the guidelines set out in the B.C. Field Sampling Manual, Part E: Water and Wastewater Sampling (2013). Water temperature and pH were measured at the site. The weather and daily the temperature were also recorded.

Samples from the same week were kept cool by icepacks, packaging, and coolers. They were shipped to the lab together as soon as possible. At the lab, samples were tested for total ammonia (as N, Mg/L), nitrate (as N, Mg/L) and total nitrogen (Mg/L).

RESULTS

COPPERMINE RESULTS

Table 2 below summarizes the results produced by ALS analysis, and collected in the field for the Coppermine stream.

Table 2. Results from ALS lab and at site measurements from the Coppermine stream

	Area	Sample ID	Sample Date	Sample time	ALS analysis				Measured at site		Day time conditions during sampling	
					Ammonia, Total (as N)	Nitrogen, Total	Nitrate (as N)mg/L	pH	pH	Water Temp(°C)	Weather	Air Temp (°C)
Post	Coppermine	Test#1	2020-09-20	13:30	0.162	0.363	0.122	8	8	9.5	mix of sun and clouds with some precip	16
	- Treatment started on the blocks effecting the Coppermine area on September 19th 2020 - Treatment areas effecting this water source are: o 729-4- Stream goes through treatment area- fertilized September 19th2020 o 728-8- Treatment area is east of stream- fertilized September 19th 2020 o 728-303- Stream goes through treatment area- fertilized September 19th 2020 o 728-202- Treatment area is just east of stream- fertilized September 19th 2020 - First samples taken for the control and test site were done on September 20th 2020, immediately following fertilizer treatment in the area - Unable to obtain samples pre-treatment from the Coppermine area - Control site was established upstream of any fertilizer treatment area - The Coppermine test site was established downstream of all fertilizer treatment areas that directly effect the stream to monitor long term effects											
Post	Coppermine	Control #2	2020-09-23	12:00	<0.0050	0.054	0.0387	8	8	4.5	Raining	11
Post	Coppermine	Test #2	2020-09-23	12:30	0.0418	0.163	0.0805	8	7	8.9	Raining	11
	- Control#2 (above treatment area) and test #2 (below treatment area) were taken four days after fertilizer applications - The second sample of the control was done to have a better idea of nitrogen, total nitrate and ammonia on the stream, that is not influences by the treatment - Some rain on the day second tests were conducted on the control site and test site											
Post	Coppermine	Test #3	2020-09-28	9:00	0.0064	0.12	0.0715	8	7	9	Overcast in the am and sun and clouds in the pm	11
	- Test #3 was taken nine days post treatment. There were periods of rain with high humidity and fog between test #2 and #3.											
Post	Coppermine	Test #4	2020-09-30	12:30	<0.0050	0.088	0.0528	8	7	8.4	mix of sun and clouds, humid	16
	- Test #4 below treatment area was taken 11 days post treatment. Temperatures remain consistent. Weather stayed mostly overcast, rainy or high humidity.											
Post	Coppermine	Test #5	2020-10-05	15:00	<0.0050	0.084	0.0362	8	7	8.6	Raining	11
	- Test #5 was taken 16 days post treatment. Temperatures dropped slightly, and there was a fair amount of precip between test 4 and 5.											
Post	Coppermine	Test #6	2020-10-07	9:00	0.0066	0.214	0.0482	8	8	8.6	Overcast with periods of rain	11
	- Taken 18 days post treatment, weather got warmer, but stayed wet with periods of rain.											
Post	Coppermine	Test #7	2020-10-13	15:00	<0.0050	0.34	0.0747	8	7	5.5	Snowing and cold	1
Post	Coppermine	Test #8	2020-10-15	15:00	<0.0050	0.113	0.0551	8	7	4.7	Cloudy	4
	- Temperatures continued to drop in the to the last week of sampling - The last two samples were taken three weeks post treatment - A lot of precipitation over the third week of sampling, even some falling as snow											
Post	Coppermine	4 Month	2021-02-02	11:00	<0.0050	0.136	0.0614	8	8	1.1	Winter	
	- Three month post treatment test - Winter, and snowy											

AMMONIA (as N/ Mg/L)

Ammonia levels at the control site on the Coppermine stream (Figure 11) above the treatment areas had undetectable levels which means very little ammonia is in this stream regularly. Ammonia levels rose slightly immediately following treatment at the test site below fertilized area and dropped back to normal levels within a week. Ammonia levels in the Coppermine stream remain well below the approved acute and chronic limits determined by the look-up table below (Table 3).

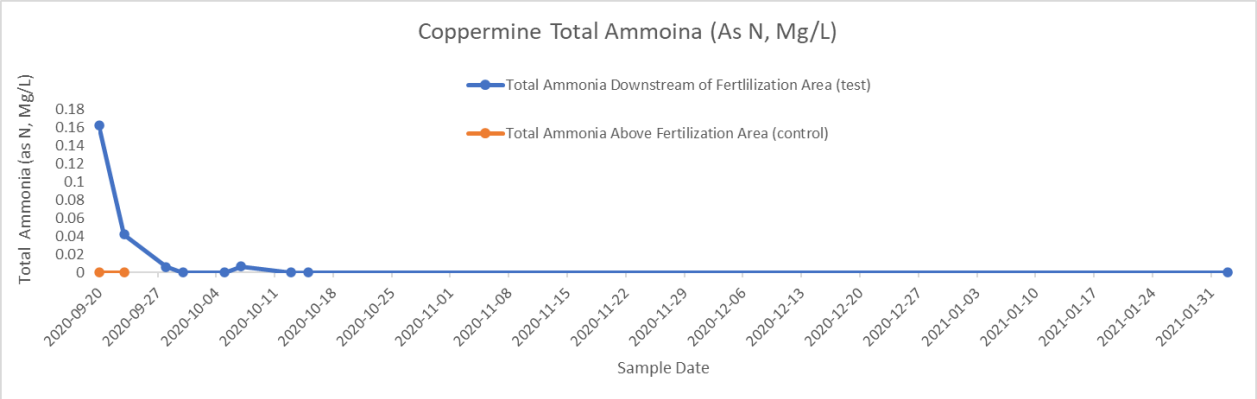

Figure 11. The Coppermine streams total ammonia levels (as n, Mg/L) at the control and test site immediately following fertilization, biweekly for three weeks and four months post-treatment.

Table 3. Acute and chronic thresholds for the Coppermine streams ammonia levels based on the stream's average temperature and pH at the test site

	Coppermine
Average Temperature (°C)	7.1
Average pH	7.5
Acceptable short-term (acute) mg/L	<=15
Acceptable long-term (chronic) mg/L	<=1.9

TOTAL NITROGEN (mg/L)

The nitrogen levels in the Coppermine stream were the highest immediately following treatment (Figure 12). Nitrogen levels declined after the first test with an increase in the third week of sampling. The Coppermine streams nitrogen levels at the test site by the final test were still slightly elevated from the control test amounts, but significantly lower than immediately following treatment.

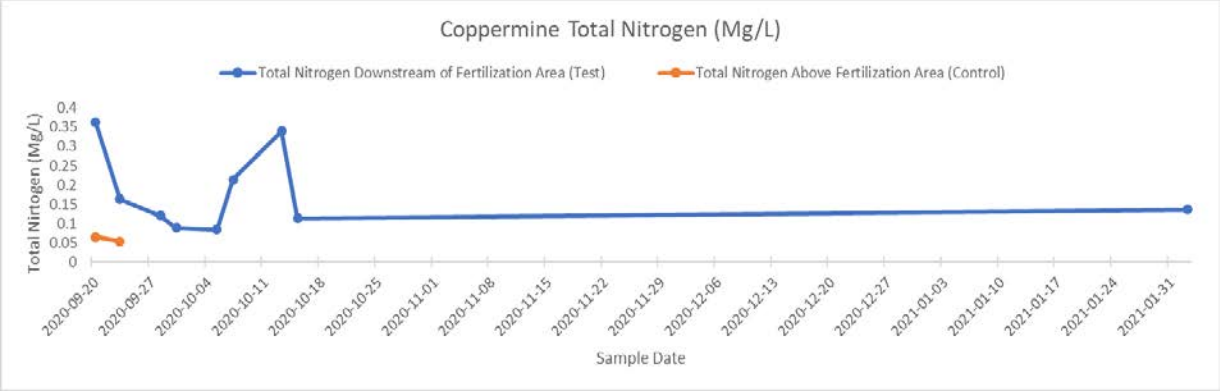

Figure 12. The Coppermine streams total nitrogen amounts (Mg/L) measured at the control and test site immediately following treatment, biweekly for three weeks and four months post- treatment.

NITRATE (as N, Mg/L)

The ALS lab results report that nitrate levels in the Coppermine stream (Figure 13) never exceeded 0.12 Mg/L. There was a small increase in nitrate levels following fertilization application, with small incremental drops over time. Levels increased again slightly from October 5th to October 13th, which seem to coincide with total nitrogen levels. Nitrate levels remained consistent between the last test in September and the final test, four months post treatment.

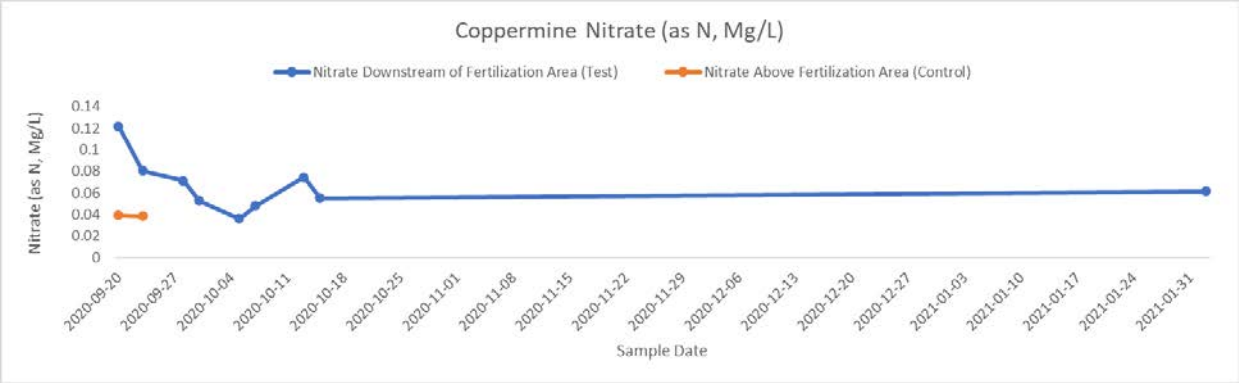

Figure 13. Coppermine's nitrate levels (as N/Mg/L) measured at the control and test site immediately following treatment and then biweekly for three weeks following and four months post-treatment.

KEYSTONE RESULTS

Table 4 below summarizes the results produced by ALS analysis, and collected in the field for the Keystone stream.

Table 4. Results from ALS lab and at site measurements from the Keystone stream

	Area	Sample ID	Sample Date	Sample time	ALS analysis				Measured at site		Day time conditions during sampling	
					Ammonia, Total (as N)	Nitrogen, Total	Nitrate (as N)mg/L	pH	pH	Water Temp(°C)	Weather	Air Temp (°C)
Pre	Keystone	Control #1	2020-09-20	15:00	<0.0050	0.034	<0.0050	7.7	8	6.9	mix of sun and clouds with some precip	16
Pre	Keystone	Test #1	2020-09-20	15:30	<0.0050	0.044	0.0089	7.9	7	11.4	mix of sun and clouds with some precip	16
	- Treatment on the area effecting the Keystone sample creek started and completed on September 23rd											
	- Test #1 was done September 20th, three days pre-treatment. A sample was taken at the control (above treatment areas) and one at the test site (below treatment areas)											
	- The treatment areas effecting this water source are:											
	o 686-304- fertilized on September 23rd 2020											
	o 686-5A- fertilized on September 23rd 2020											
	- The Keystone sample stream goes directly through the two treatment areas											
Post	Keystone	Control #2	2020-09-23	14:30	0.045	0.183	<0.0050	7.7	8	6.5	Raining	10
Post	Keystone	Test #2	2020-09-23	15:00	0.0064	0.067	0.0101	7.9	7	10.4	Raining	10
	- Test #2 was sampled on Sept 23rd 2020 the day of fertilizer treatment on areas effecting sample stream											
	o During Test #2 another sample was taken upstream of the treatment areas as another control											
	- It was raining during treatment and water sample collections											
Post	Keystone	Test #3	2020-09-28	16:30	0.144	0.703	0.506	7.4	7	7.8	Overcast in the am, sun and clouds in the pm	11
	- Test #3 was sampled five days following treatment. There were no more samples from the control. From test #2 onward, samples were collected downstream from treatm											
	- Weather up to test #3 from treatment was wet and cool, and then got warmer and cleared up											
Post	Keystone	Test #4	2020-09-30	16:30	0.0505	0.685	0.595	7.7	8	8.1	Clear and sunny	16
	- Test #4 was conducted a week following treatment.											
	- Weather was wet up to this test and then got warmer and drier											
Post	Keystone	Test #5	2020-10-05	16:00	0.0367	0.806	0.0353	7.8	8	9.6	cloudy and rainy	13
Post	Keystone	Test #6	2020-10-07	16:00	0.0166	0.748	0.642	7.8	7	10.2	Mix of sun and clouds	15
	- Tests #5 and #6 were collected in the second week post treatment											
	- Test #5 was sampled 12 days post treatment											
	- Test #6 was sampled 14 days post treatment											
Post	Keystone	Test #7	2020-10-13	16:30	0.0079	0.402	0.31	7.7	8	6.3	Raining	2
Post	Keystone	Test #8	2020-10-15	16:30	<0.0050	0.348	0.282	7.7	8	5.9	Over cast	4
	- Temperatures continued to drop in the to the last week of sampling											
	- The last two samples were taken three weeks post treatment											
	- A lot of precipitation over the third week of sampling, even some falling as snow											
Post	Keystone	4 months	2021-02-02	16:30	<0.0050	0.175	0.0951	7.5	8	0.8	winter	
	- Three month post treatment test											
	- Winter, and snowy											

AMMONIA (as N. Mg/L)

The Keystone stream (Figure14) detected a low amount of ammonia at the control. Following treatment ammonia levels at the test site increased slightly. Ammonia levels remained well below the approved acute and chronic limits determined by the look-up table (Table 5). By the final measurement, the Keystones ammonia levels dropped to undetectable levels.

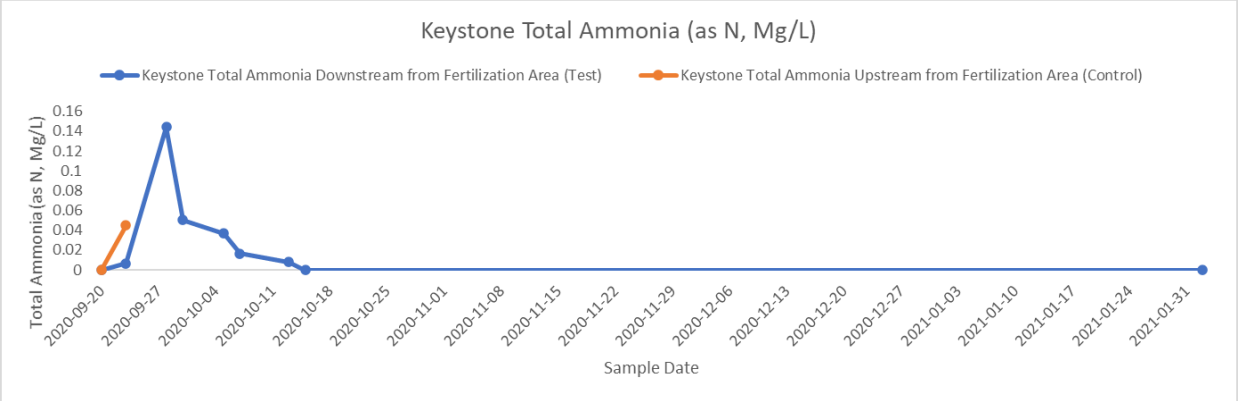

Figure 14 The Keystone streams total ammonia levels (as N, Mg/L) at the control and test site immediately following fertilization, biweekly for three weeks and then four-months post-fertilization.

Table 5. Acute and chronic thresholds for ammonia levels in Keystone stream based on the average pH and water temperature at the test site.

	Keystone
Average Temperature (°C)	7.8
Average pH	7.6
Acceptable short-term (acute) mg/L	<=11
Acceptable long-term (chronic) mg/	<=1.9

TOTAL NITROGEN (Mg/L)

Nitrogen levels were the highest following fertilization treatment (Figure 15). The levels stayed consistently elevated for four tests. Two weeks post-treatment levels began to decrease and by the third week nitrogen concentrations were roughly half of the maximum reached during the sampling period. The four-month post-treatment test levels continued to decline but were still above the levels detected in the control samples.

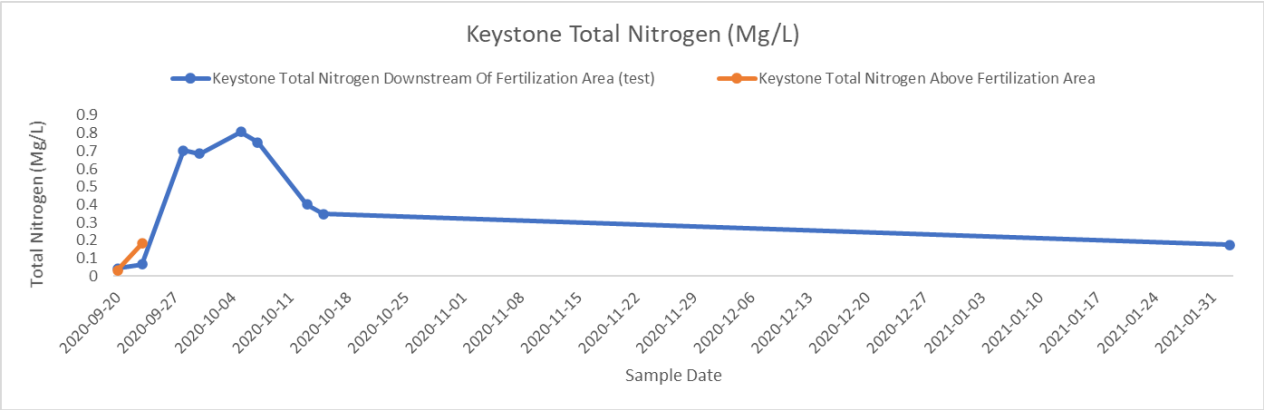

Figure 65. The Keystone streams total nitrogen amounts (Mg/L measured at the control and test site three days prior to treatment, immediately following and then biweekly post-treatment

NITRATE (as N, Mg/L)

The results from the ALS lab report that nitrate levels the Keystone stream (Figure 16) never exceed 0.65 Mg/L. There was a small increase in nitrate levels following fertilization application, which dropped small amounts over time. Levels in the Keystone stream were a bit sporadic following treatment, with two elevated events, but remained well below acceptable levels. The final test levels continued to decline but were still slightly higher that the pre-treatment concentrations.

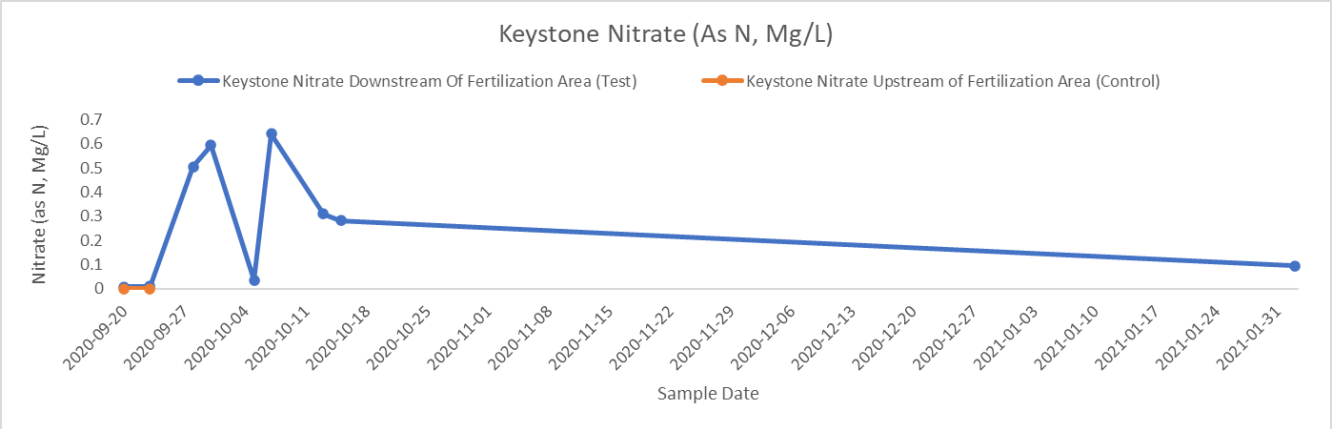

Figure 16. The Keystone streams Nitrate levels (as N. Mg/L) measured at the control and test site three days prior to fertilization, immediately following, biweekly for three weeks post-treatment and then four months post treatment.

DISCUSSION

Although water quality sampling is recommended when a fertilization treatment has been applied in a Community watershed or fisheries-sensitive area, neither of which applies to this situation, monitoring was done on the TFL56 in two sites within treatment areas. Samples were taken to measure post-treatment levels of total ammonia (as N/ Mg/L), total nitrogen (Mg/L), nitrate (as N, Mg/L), pH and water temperature (^{0}C).

TOTAL AMMONIA

There is no threshold for acceptable levels of ammonia for drinking water. However, the Guideline Look-up table on the BC government website for Approved Water Quality Guidelines was used to assess the approved short-term and long-term limits of ammonia for the health of aquatic life in freshwater. The look-up table relates pH and water temperature to determine the allowable limits. An average of the Coppermine and Keystone streams pH measurements and water temperatures measured

at the test site (below treatment area) was used in determining the approved limits (Table 3 and 5). Ammonia levels in both streams did not exceed 0.2 Mg/L following treatment, which means both streams remained well below maximum allowable acute (11-15 Mg/L) and chronic levels (1.9 Mg/L) acceptable for aquatic life in freshwater. On both streams levels returned back to undetectable levels within 10 to 20 days of treatment.

NITRATE (An N, Mg/L) & NITROGEN (Mg/L)

As stated in the Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) Fertilization Standard for Ministry funded programs (2015), water quality limits allow for a concentration of 10ppm or 9.988 Mg/L of nitrate (as N) in-stream following treatment. The ALS lab reported that nitrate levels (as N), in both the Coppermine and Keystone streams (Figures 13 & 16), never exceeded 1Mg/L, which is well below the allowable amount of 10 Mg/L.

There were variable levels of detectable nutrients in both streams post fertilizer treatment. The results saw similar nutrient levels that J.S Sanford & Associates Ltd (2018) found in the Lang Creek Watershed. On the TFL 56, nitrate and nitrogen levels initially increased post treatment and continued to decline over the testing period. All levels were well below the maximum allowable concentrations of ammonia and nitrate.

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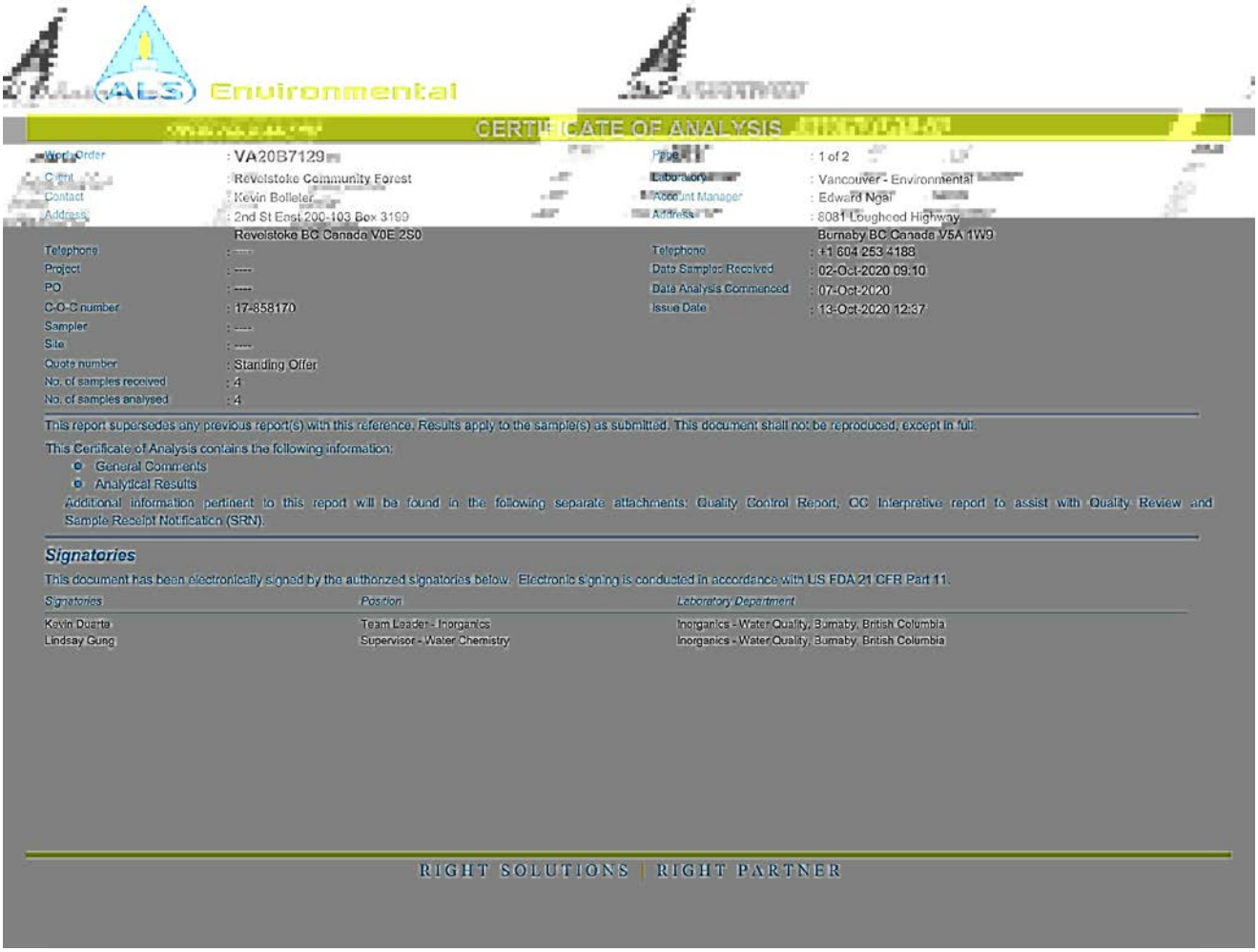
APPENDIX

- **ALS Lab test results**



ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: VA20B7129	Page	: 1 of 2
Client	: Revelstoke Community Forest	Laboratory	: Vancouver - Environmental
Contact	: Kevin Bolleter	Account Manager	: Edward Ngai
Address	: 2nd St East 200-103 Box 3189 Revelstoke BC Canada V0E 2S0	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 02-Oct-2020 09:10
PO	: ----	Date Analysis Commenced	: 07-Oct-2020
C-O-C number	: 17-858170	Issue Date	: 13-Oct-2020 12:37
Sampler	: ----		
Site	: ----		
Quote number	: Standing Offer		
No. of samples received	: 4		
No. of samples analysed	: 4		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	Position	Laboratory Department
Kevin Duarte	Team Leader - Inorganics	Inorganics - Water Quality, Burnaby, British Columbia
Lindsay Gung	Supervisor - Water Chemistry	Inorganics - Water Quality, Burnaby, British Columbia

RIGHT SOLUTIONS | RIGHT PARTNER

Page : 2 of 3
Work Order : VA20B6171
Client : Revelstoke Community Forest
Project : Water testing

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, EC, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key: CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances.
LOR: Limit of Reporting (detection limit).

Unit	Description
mg/L	milligrams per litre
pH units	pH units

< : less than.

> : greater than.

Surrogate: An analyte that is similar in behavior 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.

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

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in reports identified as "Preliminary Report" are considered authorized for use.

Analytical Results

Sub-Matrix: Water (Matrix: Water)					Client sample ID	Control #1 - Copper Mine	Test #1- Copper Mine	Control #1 - Copper Mine	Test #1 - Copper Mine	Control #1 - Keystone
					Client sampling date / time	20-Sep-2020 12:00	20-Sep-2020 13:30	20-Sep-2020 12:00	20-Sep-2020 11:30	20-Sep-2020 15:00
Analyte	CAS Number	Method	LOR	Unit		VA20B6171-001	VA20B6171-002	VA20B6171-003	VA20B6171-004	VA20B6171-005
						Result	Result	Result	Result	Result
Physical Tests										
pH	----	E108	0.10	pH units		8.13	8.05	----	----	7.72
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		----	----	<0.0050	0.162	----
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L		0.0393	0.122	----	----	<0.0050
nitrogen, total	7727-37-9	E366	0.030	mg/L		----	----	0.065	0.363	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: Water (Matrix: Water)					Client sample ID	Test#1 - Keystone	Control #1- Keystone	Test#1- Keystone	----	----
					Client sampling date / time	20-Sep-2020 15:30	20-Sep-2020	20-Sep-2020	----	----
Analyte	CAS Number	Method	LOR	Unit		VA20B6171-006	VA20B6171-007	VA20B6171-008	--------	--------
						Result	Result	Result	----	----
Physical Tests										
pH	----	E108	0.10	pH units		7.88	----	----	----	----
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		----	<0.0050	<0.0050	----	----
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L		0.0089	----	----	----	----
nitrogen, total	7727-37-9	E366	0.030	mg/L		----	0.034	0.044	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

General Comments

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Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.
Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	Description
mg/L	milligrams per litre
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior 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.

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

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Analytical results in reports identified as "Preliminary Report" are considered authorized for use.

Workorder Comments

Sampling Dates/Times not marked on COC. Sampling Dates logged in as per bottles.

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	Control # 2-Copper mine (a)	Control # 2-Copper mine (b)	Test # 2 -Copper mine (a)	Test # 2 -Copper mine (2)	Control #2 -Keystone (a)
					Client sampling date / time	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020
						VA20B6467-001	VA20B6467-002	VA20B6467-003	VA20B6467-004	VA20B6467-005
						Result	Result	Result	Result	Result
Physical Tests										
pH	----	E108	0.10	pH units		----	8.11	----	8.01	----
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		<0.0050	----	0.0418	----	0.0450
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L		----	0.0387	----	0.0805	----
nitrogen, total	7727-37-9	E366	0.030	mg/L		0.054	----	0.163	----	0.183

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	Control #2 -Keystone (b)	Test # 2 -Keystone (a)	Test # 2 -Keystone (b)	----	----
					Client sampling date / time	23-Sep-2020	23-Sep-2020	23-Sep-2020	----	----
						VA20B6467-006	VA20B6467-007	VA20B6467-008	--------	--------
						Result	Result	Result	----	----
Physical Tests										
pH	----	E108	0.10	pH units		7.71	----	7.88	----	----
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		----	0.0064	----	----	----
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L		<0.0050	----	0.0101	----	----
nitrogen, total	7727-37-9	E366	0.030	mg/L		----	0.067	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

Environmental

CERTIFICATE OF ANALYSIS

Work Order	: VA20B7127	Page	: 1 of 2
Client	: Revelstoke Community Forest	Laboratory	: Vancouver - Environmental
Contact	: Kevin Bolleter	Account Manager	: Edward Ngai
Address	: 2nd St East 200-103 Box 3189 Revelstoke BC Canada V0E 2S0	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 02-Oct-2020 09:10
PO	: ----	Date Analysis Commenced	: 03-Oct-2020
C-O-C number	: 17-858169	Issue Date	: 13-Oct-2020 17:18
Sampler	: ----		
Site	: ----		
Quote number	: Standing Offer		
No. of samples received	: 4		
No. of samples analysed	: 4		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

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- General Comments
- Analytical Results

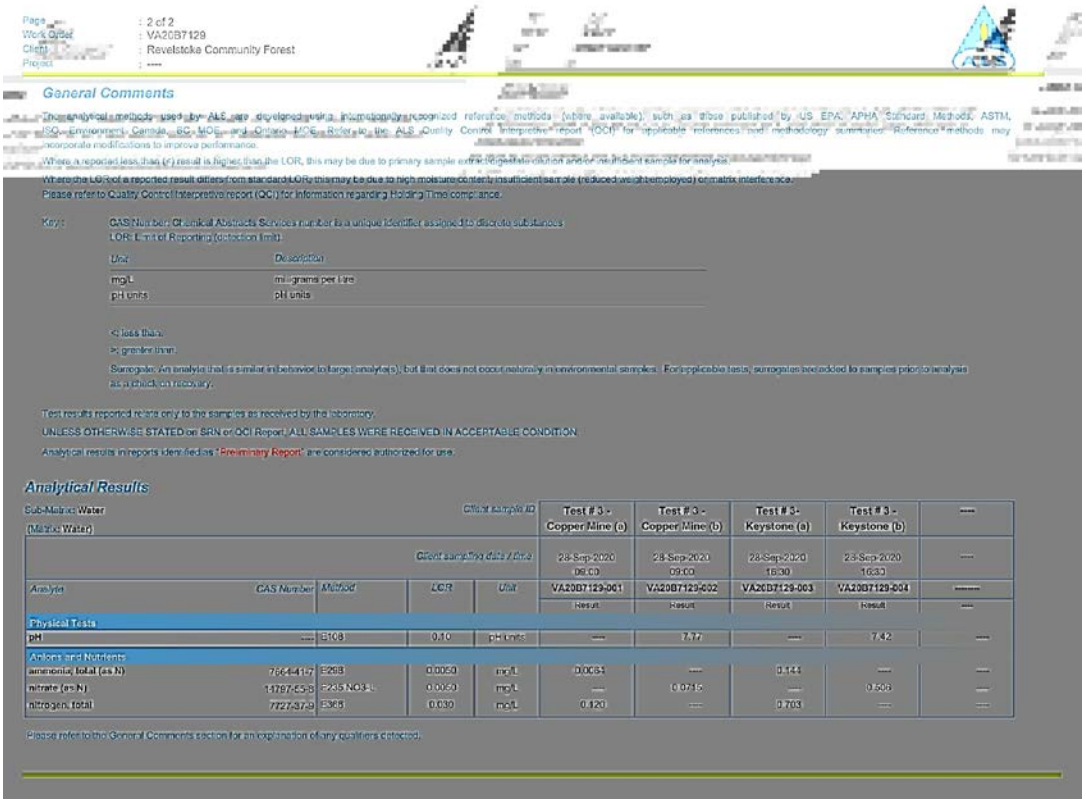
Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	Position	Laboratory Department
Lindsey Gung	Supervisor - Water Chemistry	Inorganics - Water Quality, Burnaby, British Columbia

RIGHT SOLUTIONS | RIGHT PARTNER



Page : 2 of 2
Work Order : VA20B7129
Client : Revelstoke Community Forest
Project : ----

General Comments

The analytical methods used by ALS are developed using, or equivalent to, recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or matrix/limited sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key: CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances.
LOR: Limit of Reporting (detection limit).

Unit	Description
mg/L	milligrams per Litre
pH units	pH units

<: less than.
>: greater than.

Surrogate: An analyte 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.

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

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Analytical results in reports identified as "Preliminary Report" are considered authorized for use.

Analytical Results

Sub-Matrix: Water (Matrix: Water)					Client sample ID	Test # 3 - Copper Mine (a)	Test # 3 - Copper Mine (b)	Test # 3 - Keystone (a)	Test # 3 - Keystone (b)	---
					Client sampling date / time	28-Sep-2020 09:00	28-Sep-2020 09:00	28-Sep-2020 15:30	28-Sep-2020 15:30	---
Analyte	CAS Number	Method	LOR	Unit	VA20B7129-001	VA20B7129-002	VA20B7129-003	VA20B7129-004	-------	
					Result	Result	Result	Result	---	
Physical Tests										
pH	----	E108	0.10	pH units	----	7.77	----	7.42	---	
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	0.0061	----	0.144	----	---	
nitrate (as N)	14797-55-8	EK15 NO3-L	0.0050	mg/L	----	0.0715	----	0.509	---	
nitrogen, total	7727-37-9	E365	0.030	mg/L	0.120	----	0.703	----	---	

Please refer to the General Comments section for an explanation of any qualifiers detected.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: VA20B7127	Page	: 1 of 2
Client	: Revelstoke Community Forest	Laboratory	: Vancouver - Environmental
Contact	: Kevin Bollefer	Account Manager	: Edward Ngai
Address	: 2nd St East 200-103 Box 3199 Revelstoke BC Canada V0E 2S0	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 02-Oct-2020 09:10
PO	: ----	Date Analysis Commenced	: 03-Oct-2020
C-O-C number	: 17-658169	Issue Date	: 13-Oct-2020 17:18
Samples	: ----		
Site	: ----		
Quote number	: Standing Offer		
No. of samples received	: 4		
No. of samples analysed	: 4		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

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- Analytical Results

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Signatories

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Signatories	Position	Laboratory Department
Lindsey Gung	Supervisor - Water Chemistry	Inorganics - Water Quality, Burnaby, British Columbia

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Page : 2 of 2
Work Order : VA20B7127
Client : Revelstoke Community Forest
Project : ----

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

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Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key: CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit)

Unit	Description
mg/L	milligrams per litre
pH units	pH units

< : less than.

> : greater than.

Surrogate: An analyte that is similar in behavior 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.

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Analytical Results

Sub-Matrix: Water (Matrix: Water)					Client sample ID	Test # 4 - Copper Mine (a)	Test # 4 - Copper Mine (b)	Test # 4 - Keystone (a)	Test # 4 - Keystone (b)	----
					Client sampling date / time	30-Sep-2020 12:30	30-Sep-2020 12:30	30-Sep-2020 15:30	30-Sep-2020 16:30	----
Analyte	CAS Number	Method	LOR	Unit	VA20B7127-001	VA20B7127-002	VA20B7127-003	VA20B7127-004	----	
					Result	Result	Result	Result	----	
Physical Tests										
pH	----	E108	0.10	pH units	----	7.85	----	7.74	----	
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050	----	0.0505	----	----	
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	----	0.0528	----	0.565	----	
nitrogen, total	7727-37-9	E366	0.030	mg/L	0.088	----	0.635	----	----	

Please refer to the General Comments section for an explanation of any qualifiers detected.

Environmental

CERTIFICATE OF ANALYSIS

Work Order	: VA20B7867	Page	: 1 of 2
Client	: Revelstoke Community Forest	Laboratory	: Vancouver - Environmental
Contact	: Kevin Bolleter	Account Manager	: Edward Nash
Address	: 2nd St East 200-103 Box 3199 Revelstoke BC Canada V0E 2S0	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 13-Oct-2020 09:10
PO	: ----	Date Analysis Commenced	: 13-Oct-2020
C-O-C number	: 174858173	Issue Date	: 23-Oct-2020 09:01
Sampler	: ----		
Site	: ----		
Quote number	: Standing Offer		
No. of samples received	: 4		
No. of samples analysed	: 4		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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Signatories

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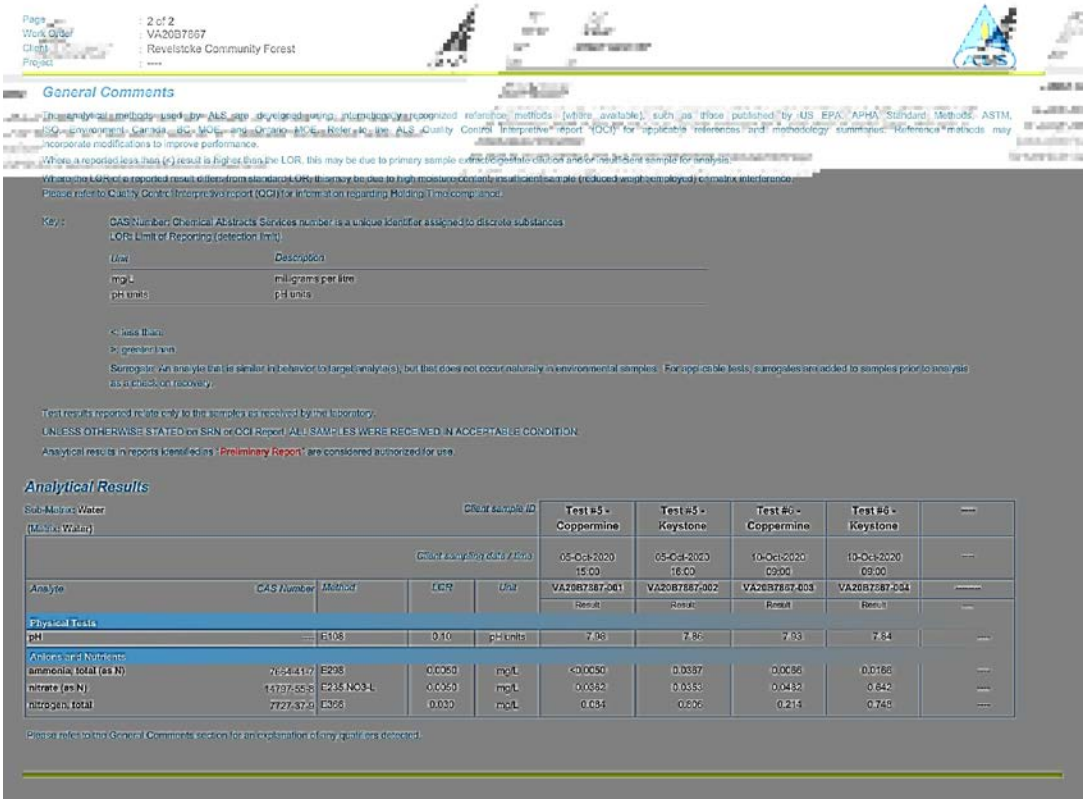
Signatories	Position	Laboratory Department
Lindsay Gung	Supervisor - Water Chemistry	Inorganics - Water Quality, Burnaby, British Columbia

RIGHT SOLUTIONS | RIGHT PARTNER



Page : 2 of 2
Work Order : VA20B7867
Client : Revelstoke Community Forest
Project : ----

General Comments

All analytical methods used by ALS are developed using, interlaboratory recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, environmental Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

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Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit)

Unit	Description
mg/L	milligrams per litre
pH units	pH units

< : less than.
> : greater than.

Surrogate: An analyte that is similar in behavior 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.

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Analytical Results

Sub-Matrix: Water (Matrix: Water)					Client sample ID	Test #5 - Coppermine	Test #5 - Keystone	Test #6 - Coppermine	Test #6 - Keystone	---
					Client sampling date / time	05-Oct-2020 15:00	05-Oct-2020 16:00	10-Oct-2020 09:00	10-Oct-2020 09:00	---
Analyte	CAS Number	Method	LOR	Unit		VA20B7867-001	VA20B7867-002	VA20B7867-003	VA20B7867-004	---
						Result	Result	Result	Result	---
Physical Tests										
pH	---	E108	0.10	pH units		7.98	7.86	7.93	7.84	---
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		<0.0050	0.0387	0.0086	0.0166	---
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L		0.0352	0.0353	0.0432	0.642	---
nitrogen, total	7727-37-9	E366	0.030	mg/L		0.034	0.036	0.214	0.745	---

Please refer to the General Comments section for an explanation of any qualifiers detected.

Environmental

CERTIFICATE OF ANALYSIS

Work Order	: VA20B8444	Page	: 1 of 2
Client	: Revelstoke Community Forest	Laboratory	: Vancouver - Environmental
Contact	: Kelvin Bolleter	Account Manager	: Edward Ngai
Address	: 2nd St East 200-103 Box 3199 Revelstoke BC Canada V0E 2S0	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 15-Oct-2020 09:40
PO	: ----	Date Analysis Commenced	: 20-Oct-2020
C-O-C number	: 17-853172	Issue Date	: 02-Nov-2020 11:23
Sampler	: ----		
Site	: ----		
Quote number	: Standing Offer		
No. of samples received	: 4		
No. of samples analysed	: 4		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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Signatories

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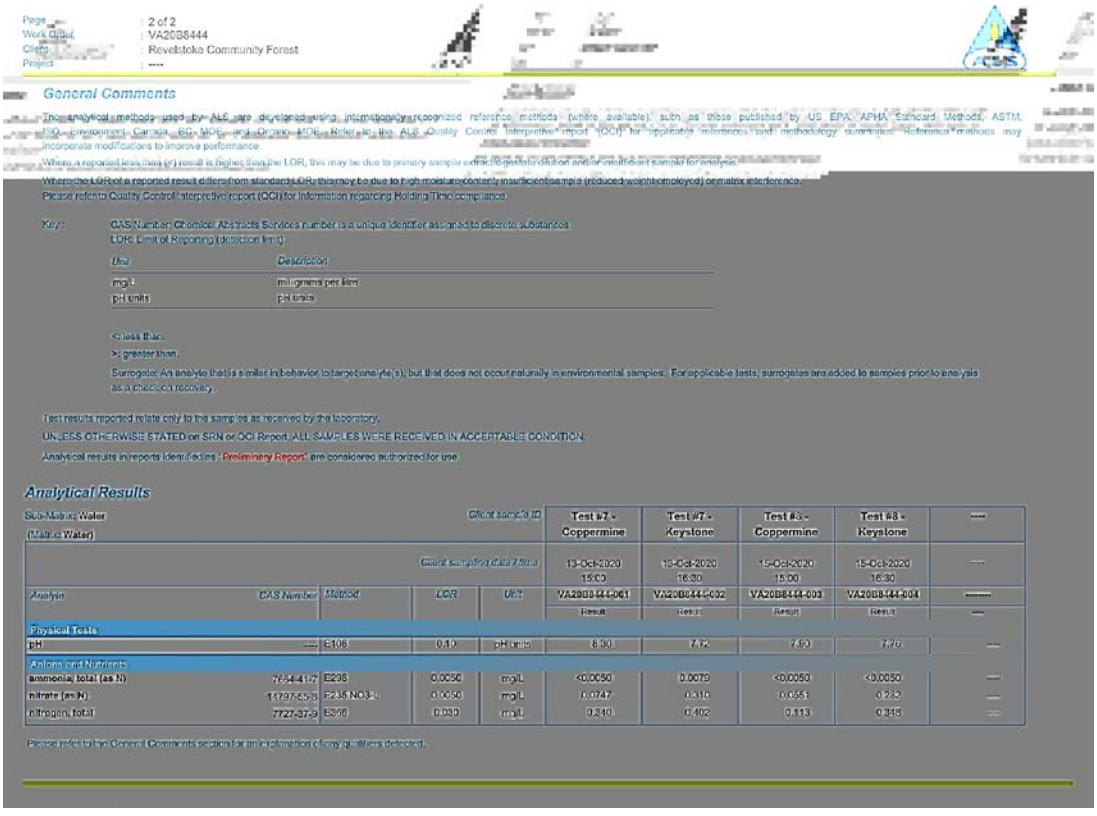
Signatories	Position	Laboratory Department
Lindsay Gung	Supervisor - Water Chemistry	Inorganics - Water Quality, Burnaby, British Columbia

RIGHT SOLUTIONS | RIGHT PARTNER



Page : 2 of 2
Work Order : VA20B8444
Client : Revelstoke Community Forest
Project : ----

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

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Unit	Description
mg/L	milligrams per litre
pH units	pH units

< : less than.
> : greater than.
Surrogate: An analyte that is similar in behavior 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.

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Analytical results in reports identifies "Preliminary Report" are considered authorized for use.

Analytical Results

Sub-Matrix: Water (Matrix: Water)					Client sample ID	Test #7 - Coppermine	Test #7 - Keystone	Test #8 - Coppermine	Test #8 - Keystone	----
					Client sampling date / time	13-Oct-2020 15:00	13-Oct-2020 16:30	15-Oct-2020 15:00	15-Oct-2020 16:30	----
Analyte	CAS Number	Method	LOR	Unit	VA20B8444-001	VA20B8444-002	VA20B8444-003	VA20B8444-004	----	
					Result	Result	Result	Result	----	
Physical Tests										
pH	----	E108	0.10	pH units	8.30	7.72	7.90	7.76	----	
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050	0.0075	<0.0050	<0.0050	----	
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	0.0747	0.310	0.0551	0.282	----	
nitrogen, total	7727-37-9	E366	0.030	mg/L	0.240	0.402	0.113	0.348	----	

Please refer to the General Comments section for an explanation of any qualifiers detected.

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

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Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
mg/L	milligrams per litre
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior 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.

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

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Analytical results in reports identified as "Preliminary Report" are considered authorized for use.

Analytical Results

Sub-Matrix: **Water** (Matrix: **Water**)				*Client sample ID*	**Goldstream (3 months)**	**Keystone (3 months)**	----	----	----
				Client sampling date / time	02-Feb-2021 11:00	02-Feb-2021 15:30	----	----	----
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	**VA21A2442-001**	**VA21A2442-002**	--------	--------	--------
					Result	Result	---	---	---
Physical Tests									
pH	----	E108	0.10	pH units	7.90	7.54	----	----	----
Anions and Nutrients									
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050	<0.0050	----	----	----
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	0.0614	0.0951	----	----	----
nitrogen, total	7727-37-9	E366	0.030	mg/L	0.136	0.175	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA21A2442**	Page	: 1 of 2
Client	: **Revelstoke Community Forest**	Laboratory	: Vancouver - Environmental
Contact	: Kevin Bolleter	Account Manager	: Edward Ngai
Address	: 2nd St East 200-103 Box 3199 Revelstoke BC Canada V0E 2S0	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 09-Feb-2021 09:15
PO	: ----	Date Analysis Commenced	: 11-Feb-2021
C-O-C number	: 17-858176	Issue Date	: 17-Feb-2021 16:43
Sampler	: ----		
Site	: ----		
Quote number	: Standing Offer		
No. of samples received	: 2		
No. of samples analysed	: 2		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Lindsay Gung	Supervisor - Water Chemistry	Inorganics, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Inorganics, Burnaby, British Columbia