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**Re: Quality Assurance/Quality Control Plan
License N5L1-1843**

**Submitted: September 26, 2020
Reviewed: September 28, 2020**

Thank you for the submission of the Quality Assurance and Quality Control Plan you have prepared on behalf of Wood Environment & Infrastructure Solution for the Gunghi Creek Crossing Replacement project. After review the draft plan as submitted has been found complete and approval granted.

If you have any questions or need further assistance please get in touch with me.

Sincerely,

Bruce Stuart

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Analyst under the Northwest Territories Waters Act
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Quality Assurance and Quality Control Plan

Surveillance Network Program

Gunghi Creek Crossing Replacement

Project: EB193003

Prepared for:

Government of the Northwest Territories, Department of Infrastructure

Yellowknife, Northwest Territories

September 2020

Quality Assurance and Quality Control Plan - Surveillance Network Program

Gunghi Creek Crossing Replacement

Project: EB193003

Prepared for:

Government of the Northwest Territories, Department of Infrastructure
Yellowknife, Northwest Territories

Prepared by:

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September 2020

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1.0 Introduction

The Government of the Northwest Territories, Department of Infrastructure (GNWT) proposes replacement of the Gunghi Creek culvert carrying the Inuvik to Tuktoyaktuk Highway (ITH), south of Tuktoyaktuk, Northwest Territories (the 'Project'). This Quality Assurance and Quality Control Plan (QA/QC)^[1, 2] document has been developed by Wood Environment & Infrastructure Solutions (Wood) and approved by a Taiga Environmental Laboratory Analyst to meet conditions for the Surveillance Network Program (SNP) of the Inuvialuit Water Board (IWB) *Water Licence N5L1-1843*.

2.0 Field Sampling

All sampling and preservation will be conducted in accordance with the *Standard Methods for the Examination of Water and Wastewater*^[3].

2.1 Sample Collection

2.1.1 Location

Signs to identify monitoring stations will be posted within seven (7) days prior to the beginning of construction and be located and maintained to the satisfaction of the Inspector. Monitoring stations will be located 50 m upstream (Station No. 1843-1a) and 50 m downstream (Station No. 1843b) of the watercourse crossing.

2.1.2 Sampling Equipment

Temperature, dissolved oxygen, pH and conductivity parameters will be measured in-situ using a YSI Pro-Plus multi meter or other similar multi meter. Equipment used to measure in-situ water quality will be cleaned and calibrated prior to each use, to ensure the meter does not contaminate or alter the concentration or accuracy of parameters being measured. Calibration will be conducted using at least three concentrations of standards and one blank. Sample bottles will be provided by Taiga Environmental Laboratory in order to ensure they do not contaminate or otherwise alter the concentrations of parameters of interest.

Sample devices, bottles, and filtration devices will be constructed of non-metallic material. New bottles provided by Taiga Environmental Laboratory will be used for each monthly/annual sampling event. Filtering devices will consist of either a syringe and 45 µm filter or manual vacuum pump with filter. A new syringe will be used for each sample event and location. Alternatively, samples required to be filtered can be submitted to Taiga Environmental Laboratory without preservative within 24 hours - 2 days, depending on the sample storage time. Table 1 provides a list of the appropriate sample bottle material, minimum sample size, applicable preservative, and maximum storage time before being processed by the lab.

¹ **Quality Assurance (QA):** is the system of activities designed to better ensure that quality control is done effectively
² **Quality Control (QC):** is the use of established procedures to achieve standards of measurement for the three principal components of quality: precision, accuracy, and reliability
³ Rice, E.W., R.B. Baird, A.D. Eaton. 2017. *Standard Methods for the Examination of Water and Wastewater*, 23rd Edition. American Public Health Association, The American Waterworks Association and the Water Environmental Federation.

Table 1. Applicable Sample Bottle Material, Sample Size, Preservative and Storage Times

Parameter		Container	Minimum Sample Size (ml)	Preservation	Maximum Storage Time
Conductivity		polyethylene	500	Refrigerate 4°C	24 hours
Hardness		polyethylene	100	add 1:3 nitric acid or unpreserved	6 months
Metals, General		polyethylene	250	Total: add 1:3 nitric acid Dissolved: filter immediately, add 1:3 nitric acid	1 month
Mercury (Hg; Total)		Glass	500	Add Conc. HNO ₃ or pH<2 or H ₂ SO ₄ + 1 ml of 5% K ₂ Cr ₂ O ₇ , refrigerate 4°C	28 days
Nitrogen	Ammonia	polyethylene	500	Analyze as soon as possible or add 1:3 nitric acid, refrigerate OR (*) unpreserved	7 days
	Nitrate	polyethylene	100	Analyze as soon as possible or refrigerate	48 hours
Total Suspended Solids		polyethylene	500	Refrigerate	7 days
Turbidity		polyethylene	500	Analyze same day; store in dark up to 24 hours, refrigerate	
Total Petroleum Hydrocarbon (TPH)		Glass or wide-mouth calibrated	1000	Add 1:3 nitric acid, refrigerate	28 days

2.1.3 Sampling Methods

The water quality parameters to be sampled and analyzed under the SNP are detailed below. Turbidity, temperature, DO, pH and conductivity will be measured in-situ using a water quality multi-probe. All other parameters will be sent to Taiga Environmental Laboratory for analysis.

- Total Suspended Solids (TSS);
- Turbidity (Nephelometric Turbidity Units);
- Temperature;
- Dissolved Oxygen (DO);
- pH;
- Conductivity;
- Calcium;
- Magnesium;
- Hardness;
- Nutrients (ammonia, nitrate, nitrite);
- Total Arsenic;
- Basic metal scan (including: total Cd, Cr, Cu, Co, Mn, Ni, Pb, Zn, Fe);
- Total mercury; and
- Total petroleum hydrocarbons.

Sample Frequency

The licence stipulates that frequency of sampling and analysis will be conducted in two parts:

- 1) Immediately following the completion of the construction activities sample monthly during periods of open water.
- 2) Once annually during spring freshet for the duration of the licence (i.e., up to and including 2025).

Sample Collection and Equipment

Temperature, dissolved oxygen, pH and conductivity parameters will be measured in-situ using a YSI Pro-Plus multi meter or other similar approved equipment. The meter probe(s) will be placed in the water column above the substrate at each sample location.

Water samples collection, using bottles provided by Taiga Environmental Laboratory will be conducted by plunging a sample bottle to mid depth, with the opening positioned toward the current before allowing it to fill. The bottle will be rinsed in the channel water three times before collecting the sample on the fourth submersion. Room will be left (approximately 2% of the sample container) in the bottle for preservative addition and mixing.

Field Blanks and Replicate Samples

Field blanks will be provided by Taiga Environmental Laboratory and contain distilled/deionized water that are to be treated in exactly the same manner as the other samples. Blanks will be taken to the field and handled and preserved as part of the sample program. Replicate samples (duplicates) will be collected from the same station at the same time as other samples at each sample location.

2.2 Sample Handling

2.2.1 Preservation

After collection, samples will be preserved by adding chemicals provided by Taiga Environmental Laboratory and as directed by the lab in order to prevent chemical or biochemical changes to the sample. Chemicals will be added to the sample bottle(s) immediately after the sample is collected. Alternatively, only samples required to be filtered can be submitted to the lab without preservative within 24 hours – two (2) days, depending on the sample storage time. Table 1 provides a list of applicable preservatives and maximum storage time prior to sample being processed.

2.2.2 Sample Identification and Chain of Custody

Samples will be identified by marking bottle labels provided by the lab, with a water resistant, non-smear felt pen or pencil. Bottle labels will include a minimum of the following information:

- Company Name and Sampling Persons;
- Sample Location (i.e., Station No. 1843-1a or Station No. 1843-1b);
- Date and Time;
- Sample type (e.g., water); and
- Preservative.

The chain of custody form provided in Appendix A will be filled out and submitted to lab to identify where lab results will be sent, track samples (sample type and number of bottles), and identify lab required lab analysis/parameter.

2.2.3 Transportation

Immediately following sample collection, samples will be placed upright in a cooler or other storage container that does not contaminate the samples and permits a snug, immobile storage space during transfer. Samples will be kept cool (i.e., 4 °C) and delivered to Taiga Environmental Laboratory as soon as possible after collection (i.e., within 24 hours) in order to ensure samples are analyzed by the lab within appropriate timing windows (see Table 1 for maximum storage time). Samples with will

3.0 Lab Analysis

3.1 Lab Accreditation

Taiga Environmental Laboratory will conduct analyses. The labs' certificate of accreditation, including parameters for which they are certified for is provided in Appendix B.

3.2 Detection Limits

Detection limits for all parameters will be identified and provided by the lab and will be reported when any SNP data is submitted in the Annual Report to the Inuvialuit Water Board.

3.3 Methodology

Lab analyses will be conducted in accordance with the *Standard Methods for the Examination of Water and Wastewater*^[4].

Baseline water quality data was not available at the time of writing to characterize conditions of Gungghi Creek to develop site-adapted or site-specific environmental quality objectives/criteria. As standards have not been stipulated in conditions of the *Water Licence N5L1-1843*, criteria for water quality will follow the *Canadian Water Quality Guidelines for the Protection of Aquatic Life*, which are generally the most stringent guidelines. Water quality guidelines for parameters outlined in the *Water Licence N5L1-1843* are presented in Appendix C.

Long-term exposure guidelines are presented to identify waterborne concentrations intended to protect all forms of aquatic life for indefinite exposure periods, following construction completion. **Short-term** exposure guidelines are not presented as they are intended for guidance on the impacts of severe, but transient, situations (e.g., spill events to aquatic receiving environments, infrequent releases of short-lived/non-persistent substances or inappropriate use or disposal of a substance). Where a short-term/severe exposure is identified during Surveillance Network Program, the cause of the event and compliance criteria should be identified, and additional compliance monitoring may be required.

4 Rice, E.W., R.B. Baird, A.D. Eaton. 2017. *Standard Methods for the Examination of Water and Wastewater*, 23rd Edition. American Public Health Association, The American Waterworks Association and the Water Environmental Federation.

4.0 Reporting Requirements

In accordance with the *Water Licence N5L1-1843*, the monthly and annual SNP results, including laboratory results, QA/QC results and interpretation, and data analysis or calculations will be submitted as part of the Annual Report to the Inuvialuit Water Board by January 31st of each year for the term of the licence (i.e., 2020 up to and including 2025). All data and information from the SNP will be presented in tabular summaries. The report will also include any information used to analyze the samples and determine acceptability of the data. Any anomalies and trends will be identified. Rationale for why any samples were not collected will also be provided. Results of the duplicate and field blank samples will be submitted with each required SNP report.

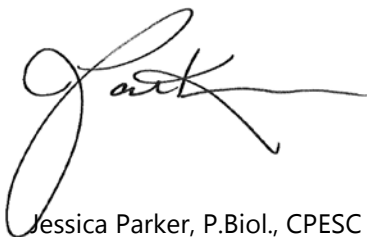
5.0 Closure

This plan has been prepared for the exclusive use of the Government of the Northwest Territories and their authorized users for specific application to the project site. The methods identified were prepared in accordance with the proposed work scope for the site, industry best management practices and guidelines, and conditions of approvals for the Project. No other warranty, expressed or implied, is made.

We trust that the information contained within this report satisfies your requirements. Should you have any questions, please contact the undersigned at your earliest convenience.

Respectfully submitted,

**Wood Environment & Infrastructure Solutions
a Division of Wood Canada Limited**



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Reviewed by:



Paul Kalashnikoff, B.Sc., P.Biol.
Senior Environmental Biologist

6.0 References

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- _____. 2019c. Scientific criteria document for the development of the Canadian water quality guidelines for the protection of aquatic life: manganese. Canadian Council of Ministers of the Environment, Winnipeg, MB.
- Canadian Council of Resource and Environment Ministers (CCREM). 1987. Canadian water quality guidelines. Prepared by the Task Force on Water Quality Guidelines.

Appendix A
Chain of Custody Form



TAIGA ENVIRONMENTAL LABORATORY – FIELD SHEET

4601 – 52 Avenue, Yellowknife, NT, X1A 2L9 • Tel: (867) 767-9235 • Fax: (867) 920-8740 • email: taiga@gov.nt.ca

Laboratory Use Only	
Batch No.:	

Send Results and Invoice to: <i>(Please notify if results or invoice are to be sent to different locations)</i>	
Company/Agency:	
Address:	
City/Town:	
Province/Territory:	Postal Code:
Phone:	Fax:
E-mail:	
Signature:	

Client Project No.:	
Date Collected:	Time Collected:
Sampler:	
Location:	
Rush Required:	<input type="checkbox"/> Yes <input type="checkbox"/> No
Note: <i>Analysis may be subcontracted without prior notice. See reverse for how to complete form and sampling protocols.</i>	
Laboratory Use Only	
Date Received:	Received By:
Comments:	

WATER SAMPLES

Sample Type <i>(freshwater, sewage, wastewater, potable, groundwater, salt water, etc.)</i>		
Client Sample ID (as it should appear on final report)		
Taiga Sample ID (Laboratory Use Only)		

Bottle Type and Parameter		[V] PLEASE CHECK PARAMETERS REQUESTED BELOW:																	
Routine	pH, Conductivity, Alkalinity	<input type="checkbox"/> pH	<input type="checkbox"/> Cond	<input type="checkbox"/> Alk	<input type="checkbox"/> pH	<input type="checkbox"/> Cond	<input type="checkbox"/> Alk	<input type="checkbox"/> pH	<input type="checkbox"/> Cond	<input type="checkbox"/> Alk	<input type="checkbox"/> pH	<input type="checkbox"/> Cond	<input type="checkbox"/> Alk						
	Individual Anions Suite <input type="checkbox"/>	<input type="checkbox"/> Cl	<input type="checkbox"/> SO ₄	<input type="checkbox"/> F	<input type="checkbox"/> NO ₂ -N	<input type="checkbox"/> NO ₃ -N	<input type="checkbox"/> Cl	<input type="checkbox"/> SO ₄	<input type="checkbox"/> F	<input type="checkbox"/> NO ₂ -N	<input type="checkbox"/> NO ₃ -N	<input type="checkbox"/> Cl	<input type="checkbox"/> SO ₄	<input type="checkbox"/> F	<input type="checkbox"/> NO ₂ -N	<input type="checkbox"/> NO ₃ -N			
	Total Nitrite (NO ₂) + Nitrate (NO ₃)	<input type="checkbox"/> NO ₂ -N + NO ₃ -N						<input type="checkbox"/> NO ₂ -N + NO ₃ -N						<input type="checkbox"/> NO ₂ -N + NO ₃ -N					
	Individual Cations Suite <input type="checkbox"/>	<input type="checkbox"/> Ca	<input type="checkbox"/> Mg	<input type="checkbox"/> Na	<input type="checkbox"/> K	<input type="checkbox"/> Ca	<input type="checkbox"/> Mg	<input type="checkbox"/> Na	<input type="checkbox"/> K	<input type="checkbox"/> Ca	<input type="checkbox"/> Mg	<input type="checkbox"/> Na	<input type="checkbox"/> K	<input type="checkbox"/> Ca	<input type="checkbox"/> Mg	<input type="checkbox"/> Na	<input type="checkbox"/> K		
	Hardness (Calculated)	<input type="checkbox"/> Hardness						<input type="checkbox"/> Hardness						<input type="checkbox"/> Hardness					
	Reactive Silica	<input type="checkbox"/> SiO ₂						<input type="checkbox"/> SiO ₂						<input type="checkbox"/> SiO ₂					
Colour	<input type="checkbox"/> Apparent			<input type="checkbox"/> True			<input type="checkbox"/> Apparent			<input type="checkbox"/> True			<input type="checkbox"/> Apparent			<input type="checkbox"/> True			
Laboratory Use Only	Received: <input type="checkbox"/> Y <input type="checkbox"/> N				Received: <input type="checkbox"/> Y <input type="checkbox"/> N				Received: <input type="checkbox"/> Y <input type="checkbox"/> N										
Nutrients	Chlorine: Total, Residual	<input type="checkbox"/> T. Cl		<input type="checkbox"/> R. Cl		<input type="checkbox"/> T. Cl		<input type="checkbox"/> R. Cl		<input type="checkbox"/> T. Cl		<input type="checkbox"/> R. Cl							
	Chemical Oxygen Demand	<input type="checkbox"/> COD						<input type="checkbox"/> COD											
	Turbidity	<input type="checkbox"/> Turbidity						<input type="checkbox"/> Turbidity											
	Total Suspended Solids, Dissolved Solids	<input type="checkbox"/> TSS			<input type="checkbox"/> TDS			<input type="checkbox"/> TSS			<input type="checkbox"/> TDS			<input type="checkbox"/> TSS			<input type="checkbox"/> TDS		
	Ammonia	<input type="checkbox"/> NH ₃ -N						<input type="checkbox"/> NH ₃ -N						<input type="checkbox"/> NH ₃ -N					
	Phosphorus: Total, Dissolved, Ortho	<input type="checkbox"/> TP	<input type="checkbox"/> DP	<input type="checkbox"/> OP	<input type="checkbox"/> TP	<input type="checkbox"/> DP	<input type="checkbox"/> OP	<input type="checkbox"/> TP	<input type="checkbox"/> DP	<input type="checkbox"/> OP	<input type="checkbox"/> TP	<input type="checkbox"/> DP	<input type="checkbox"/> OP	<input type="checkbox"/> TP	<input type="checkbox"/> DP	<input type="checkbox"/> OP			
	Carbon: Total, Dissolved	<input type="checkbox"/> TOC			<input type="checkbox"/> DOC			<input type="checkbox"/> TOC			<input type="checkbox"/> DOC			<input type="checkbox"/> TOC			<input type="checkbox"/> DOC		
	Nitrogen: Total, Dissolved	<input type="checkbox"/> TN			<input type="checkbox"/> DN			<input type="checkbox"/> TN			<input type="checkbox"/> DN			<input type="checkbox"/> TN			<input type="checkbox"/> DN		
Visible Oil and Grease	<input type="checkbox"/> Visible						<input type="checkbox"/> Visible						<input type="checkbox"/> Visible						
Laboratory Use Only	Received: <input type="checkbox"/> Y <input type="checkbox"/> N				Received: <input type="checkbox"/> Y <input type="checkbox"/> N				Received: <input type="checkbox"/> Y <input type="checkbox"/> N										
Sterile	Fecal Coliforms (FC)	<input type="checkbox"/> FC						<input type="checkbox"/> FC						<input type="checkbox"/> FC					
	Total Coliforms (TC), E. Coli (EC)	<input type="checkbox"/> TC			<input type="checkbox"/> EC			<input type="checkbox"/> TC			<input type="checkbox"/> EC			<input type="checkbox"/> TC			<input type="checkbox"/> EC		
	Enterococci (EN)	<input type="checkbox"/> EN						<input type="checkbox"/> EN						<input type="checkbox"/> EN					
Laboratory Use Only	Received: <input type="checkbox"/> Y <input type="checkbox"/> N °C				Received: <input type="checkbox"/> Y <input type="checkbox"/> N °C				Received: <input type="checkbox"/> Y <input type="checkbox"/> N °C										
Sterile Container:	<input type="checkbox"/> Y <input type="checkbox"/> N				<input type="checkbox"/> Y <input type="checkbox"/> N				<input type="checkbox"/> Y <input type="checkbox"/> N										
	<input type="checkbox"/> Y <input type="checkbox"/> N °C				<input type="checkbox"/> Y <input type="checkbox"/> N °C				<input type="checkbox"/> Y <input type="checkbox"/> N °C										
Metals	Biochemical Oxygen Demand	<input type="checkbox"/> BOD						<input type="checkbox"/> BOD						<input type="checkbox"/> BOD					
	Carbonaceous BOD	<input type="checkbox"/> CBOD						<input type="checkbox"/> CBOD						<input type="checkbox"/> CBOD					
	Laboratory Use Only	Received: <input type="checkbox"/> Y <input type="checkbox"/> N °C				Received: <input type="checkbox"/> Y <input type="checkbox"/> N °C				Received: <input type="checkbox"/> Y <input type="checkbox"/> N °C									
	Please indicate if sample is preserved and/or filtered	<input type="checkbox"/> Pres	<input type="checkbox"/> Filt	<input type="checkbox"/> Pres	<input type="checkbox"/> Pres	<input type="checkbox"/> Filt	<input type="checkbox"/> Pres	<input type="checkbox"/> Pres	<input type="checkbox"/> Filt	<input type="checkbox"/> Pres	<input type="checkbox"/> Pres	<input type="checkbox"/> Filt	<input type="checkbox"/> Pres	<input type="checkbox"/> Pres	<input type="checkbox"/> Filt	<input type="checkbox"/> Pres			
	ICP-MS(1): Cd, Cr, Cu, Co, Mn, Ni, Pb, Zn, Fe	<input type="checkbox"/> Total			<input type="checkbox"/> Dissolved			<input type="checkbox"/> Total			<input type="checkbox"/> Dissolved			<input type="checkbox"/> Total			<input type="checkbox"/> Dissolved		
ICP-MS(2): 25 element scan includes As <i>(not included: B, Bi, Hg, Sn)</i>	<input type="checkbox"/> Total			<input type="checkbox"/> Dissolved			<input type="checkbox"/> Total			<input type="checkbox"/> Dissolved			<input type="checkbox"/> Total			<input type="checkbox"/> Dissolved			
Individual Metals by ICP-MS (please circle each metal): Ag, Al, As, B, Ba, Be, Bi, Cd, Co, Cr, Cs, Cu, Fe, Hg, Li, Mn, Mo, Ni, Pb, Rb, Sb, Se, Sn, Sr, Ti, Tl, U, V, Zn	<input type="checkbox"/> Total			<input type="checkbox"/> Dissolved			<input type="checkbox"/> Total			<input type="checkbox"/> Dissolved			<input type="checkbox"/> Total			<input type="checkbox"/> Dissolved			
Laboratory Use Only	TM Rec'd: <input type="checkbox"/> Y <input type="checkbox"/> N		DM Rec'd: <input type="checkbox"/> Y <input type="checkbox"/> N		TM Rec'd: <input type="checkbox"/> Y <input type="checkbox"/> N		DM Rec'd: <input type="checkbox"/> Y <input type="checkbox"/> N		TM Rec'd: <input type="checkbox"/> Y <input type="checkbox"/> N		DM Rec'd: <input type="checkbox"/> Y <input type="checkbox"/> N		TM Rec'd: <input type="checkbox"/> Y <input type="checkbox"/> N		DM Rec'd: <input type="checkbox"/> Y <input type="checkbox"/> N				
Hexane Extractable Material (O&G)	<input type="checkbox"/> HEM						<input type="checkbox"/> HEM						<input type="checkbox"/> HEM						
	Laboratory Use Only	Rec'd: <input type="checkbox"/> Y <input type="checkbox"/> N		Pres: <input type="checkbox"/> Y <input type="checkbox"/> N		Rec'd: <input type="checkbox"/> Y <input type="checkbox"/> N		Pres: <input type="checkbox"/> Y <input type="checkbox"/> N		Rec'd: <input type="checkbox"/> Y <input type="checkbox"/> N		Pres: <input type="checkbox"/> Y <input type="checkbox"/> N		Rec'd: <input type="checkbox"/> Y <input type="checkbox"/> N		Pres: <input type="checkbox"/> Y <input type="checkbox"/> N			
BTEX, Purgeable HC (40mL x 2 vials)	<input type="checkbox"/> BTEX			<input type="checkbox"/> Purg HC			<input type="checkbox"/> BTEX			<input type="checkbox"/> Purg HC			<input type="checkbox"/> BTEX			<input type="checkbox"/> Purg HC			
	<input type="checkbox"/> Ext HC						<input type="checkbox"/> Ext HC						<input type="checkbox"/> Ext HC						
	<input type="checkbox"/> THM						<input type="checkbox"/> THM						<input type="checkbox"/> THM						
Laboratory Use Only	Vial Rec'd: <input type="checkbox"/> Y <input type="checkbox"/> N		Ext Rec'd: <input type="checkbox"/> Y <input type="checkbox"/> N		Vial Rec'd: <input type="checkbox"/> Y <input type="checkbox"/> N		Ext Rec'd: <input type="checkbox"/> Y <input type="checkbox"/> N		Vial Rec'd: <input type="checkbox"/> Y <input type="checkbox"/> N		Ext Rec'd: <input type="checkbox"/> Y <input type="checkbox"/> N		Vial Rec'd: <input type="checkbox"/> Y <input type="checkbox"/> N		Ext Rec'd: <input type="checkbox"/> Y <input type="checkbox"/> N				
Other: <i>See special request form</i>																			













For safety purposes, please disclose any contaminants (e.g. heavy metals, cyanide, etc.) that may be present at high levels and pose a risk to human health:

HOW TO FILL OUT THIS FORM

Company/Agency	The full, legal company name.
Address	Full street address, including suite or unit number, if applicable. Final reports will be sent to this address.
City/Town	City or Town
Province/Territory	Province or Territory
Postal Code	Postal Code
Phone	Full telephone number, including area code and extension, if applicable.
Fax	Facsimile number.
E-mail	E-mail address, if available.
Signature	Signature of the individual filling out the form.
Client Project No.	This information will appear on the final analytical report.
Date Collected	Enter the date(s) that the samples were collected.
Time Collected	Enter the time(s) the sample(s) were collected in military time or note if it is a.m or p.m.
Sampler	The name of the individual who collected the sample.
Location	The general location of where the samples were collected.
Rush Required	Indicate if regular or Rush turnaround time is required. Check yes only if Rush is required, no if not.
Sample Type	Identify the sample matrix (freshwater, drinking water, soil, etc.).
Client Sample ID	Identify each submitted sample. This identification will appear on the analytical report.
Test Column	Check off the tests you require for each sample submitted.

IMPORTANT INFORMATION

<p>Turnaround Time Standard turnaround time is 10 business days. Please note that turnaround time delays may occur if the <i>Field Sheet</i> is incomplete or incorrectly filled out.</p> <p>RUSH Analysis Rush turnaround time is 5 business days. All samples received at the lab are analyzed on a 'first come, first serve' basis unless otherwise specified as Rush. Rush samples will be placed in the front of the line and analyzed prior to routine samples. A premium charge of 100% shall be charged for the analysis. Rush services depend on staff availability, analysis required and capabilities of the lab. Please contact the lab prior to requesting this service.</p> <p>Sample Receipt, Custody and Storage All submitted samples remain the sole property of the client and may be returned to the client for appropriate storage or disposal at the discretion of Taiga Environmental Laboratory.</p> <p>All submitted samples will be stored for 30 days from the date the final report is printed. Arrangements can be made to hold the samples for an extended time at a nominal fee.</p> <p>Sampling Supplies Sample bottles, preservatives, labels and forms are available at no cost when requesting services. To place a bottle order, please submit a <i>Bottle &/or Preservative Order Form</i> a minimum of 48 hours in advance. Please note the shipment of Dangerous Goods may be delayed due to availability of qualified airline agents to process the paperwork.</p> <p>Shipping Charges All shipping costs are the responsibility of the client.</p> <p>Confidentiality All data and reports are considered confidential and the property of the client. No information shall be released to others without documented approval from the client.</p> <p>Limit of Liability Although every care and precaution is taken in the performance of our services, our liability for loss or damage in all circumstances is limited to re-analysis of the sample(s) at our expense or the cancellation of charges.</p> <p>Taiga Environmental Laboratory reserves the right to refuse to proceed with an analysis if the lab does not have the capability and/or resources to meet analysis requirements, including facilities and equipment, scientific expertise, analytical capabilities, staff scheduling, Quality Assurance/Quality Control specifications and report.</p>

Parameter Group	Marking	Preservative	Instructions
 Routine	GREEN	Keep Cool at 4°C	<ol style="list-style-type: none"> 1. Rinse bottle three (3) times with sample. 2. Fill to top and cap bottle.
 Nutrients	BLACK	Keep Cool at 4°C	
 Biochemical Oxygen Demand (BOD)/Carbonaceous BOD (CBOD)	PURPLE	Keep Cool at 4°C	<ol style="list-style-type: none"> 1. Rinse bottle three (3) times with sample. 2. Fill to top and cap bottle. 3. Sample must be sent to the lab within 24 hours of collection.
 Microbiological	STERILE	Sodium Thiosulphate Keep Cool at 4°C	<ol style="list-style-type: none"> 1. DO NOT RINSE BOTTLE. 2. Fill to top and cap. 3. Sample must be sent to the lab within 24 hours of collection.
 Total Metals	RED	5 mL of 1:3 nitric acid in Red-dot vial	<ol style="list-style-type: none"> 1. Rinse bottle three (3) times with sample. 2. Fill to near the top. 3. Add contents of preservative vial. 4. Cap bottle and mix.
 Dissolved Metals	RED	5 mL of 1:3 nitric acid in Red-dot vial	<ol style="list-style-type: none"> 1. Filter sample with 0.45 um Cellulose Acetate filter. 2. Rinse bottle three (3) times with filtrate. 3. Fill to near the top. 4. Add contents of preservative vial. 5. Cap bottle and mix.
 Hexane Extractable Material (HEM)	YELLOW	4 mL of 1:3 sulphuric acid in Yellow-dot vial	<ol style="list-style-type: none"> 1. DO NOT RINSE BOTTLE. 2. Fill to shoulder of bottle. 3. Add contents of preservative vial. 4. Cap bottle and mix.
 BTEX, THM and Purgeable Hydrocarbons	40 mL CLEAR GLASS W/ WHITE LID	Keep Cool at 4°C	<ol style="list-style-type: none"> 1. DO NOT RINSE BOTTLE. 2. Fill vials completely leaving NO air bubbles.
 Extractable Hydrocarbons	1 L AMBER GLASS WITH WHITE LID	Keep Cool at 4°C	<ol style="list-style-type: none"> 1. DO NOT RINSE BOTTLE. 2. Fill to top and cap.
 Cyanide, Total and WAD	BLUE	1 mL of 6N sodium hydroxide solution	<ol style="list-style-type: none"> 1. Rinse bottle three (3) times with sample. 2. Fill to near the top of container. 3. Add contents of preservative vial. 4. Cap bottle and mix.
 Thiocyanate	ORANGE	2 mL 25% sulphuric acid; or keep cool at 4°C	
 Phenol	YELLOW with P	2 mL of 20% sulphuric acid	

Appendix B

Taiga Environmental Laboratory Certificate of Accreditation



CALA

Canadian Association for
Laboratory Accreditation Inc.

CALA Directory of Laboratories

Membership Number: 2635
Laboratory Name: Taiga Environmental Laboratory
Parent Institution: Government of Northwest Territories (GNWT)
Address: P.O. Box 1320 4601 - 52nd Avenue Yellowknife NT X1A 2L9
Contact: Mr. Bruce Stuart
Phone: (867) 767-9235
Fax: (867) 920-8740
Email: bruce_stuart@gov.nt.ca; taiga@gov.nt.ca; Glen_hudy@gov.nt.ca

Standard: Conforms with requirements of ISO/IEC 17025
Clients Served: All Interested Parties
Revised On: December 11, 2019
Valid To: March 5, 2022

Scope of Accreditation

Solids (Inorganic)

Moisture - Solids [Soil] (030)
TEL007; CCME CWS PETROLEUM HYDROCARBONS IN SOIL - TIER 1 METHOD
GRAVIMETRIC
Percent Moisture

Solids (Organic)

BTEX - Solids [Soil] (072)
TEL038; modified from EPA 502.2 and EPA 5030B and EPA 602
GC/MS - PURGE AND TRAP
Benzene
Ethylbenzene
m,p-Xylene
o-Xylene
Toluene

Solids (Organic)

Purgeable Hydrocarbons - Solids [Soil] (074)
TEL056; CCME CWS PETROLEUM HYDROCARBONS IN SOIL - TIER 1 METHOD
GC/FID - PURGE AND TRAP
F1: C6-C10

Water (Inorganic)

Alkalinity - Water (066)
TEL060:PC TITRATE; modified from SM 2320 A and SM 2320 B
AUTO TITRIMETRIC
Alkalinity (pH 4.5)

† "OSDWA" indicates the appendix is used for the analysis of Ontario drinking water samples, which is subject to the rules and related regulations under the Ontario "Safe Drinking Water Act" (2002).

The list of tests and measurement capabilities for which a laboratory is accredited can change at any time due to circumstances such as scope extensions, voluntary withdrawal of tests by the laboratory and suspension. Scopes are published by the CALA via the Internet at http://www.cala.ca/cala_directories.html

Water (Inorganic)

Ammonia Nitrogen - Water (089)
TEL068; modified from SM 4500-NH3 G
COLORIMETRIC - DISCRETE
Ammonia

Water (Inorganic)

Anions - Water (059)
TEL055; modified from SM 4110 B
ION CHROMATOGRAPHY
Chloride
Fluoride
Nitrate
Nitrite
Sulfate

Water (Inorganic)

Biochemical Oxygen Demand (BOD) - Water (004)
TEL019; modified from SM 5210 A and SM 5210 B
D.O. METER
BOD (5 day)
CBOD (5 day)

Water (Inorganic)

Carbon - Water (029)
TEL033; modified from SM 5310 B
INFRARED
Organic Carbon

Water (Inorganic)

Cations - Water (042)
TEL055; modified from SM 4110 B
ION CHROMATOGRAPHY
Calcium
Magnesium
Potassium
Sodium

Water (Inorganic)

Chemical Oxygen Demand (COD) - Water (061)
TEL016; modified from SM 5220 D
REFLUX - COLORIMETRIC
COD

Water (Inorganic)

Colour - Water (063)
TEL051; modified from SM 2120 C
SPECTROPHOTOMETRIC
Apparent Colour
True Colour

Water (Inorganic)

Conductivity - Water (068)
TEL059:PC TITRATE; modified from SM 2510 B
AUTO CONDUCTIVITY METER
Conductivity (25°C)

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Water (Inorganic)

Dissolved Metals - Water (013)

TEL035; modified from EPA 200.8

ICP/MS

Aluminum

Antimony

Arsenic

Barium

Beryllium

Boron

Cadmium

Cesium

Chromium

Cobalt

Copper

Iron

Lead

Lithium

Manganese

Molybdenum

Nickel

Rubidium

Selenium

Silver

Strontium

Thallium

Tin

Titanium

Uranium

Vanadium

Zinc

Water (Inorganic)

Mercury - Water (080)

TEL062; modified from EPA 245.7

ATOMIC FLUORESCENCE

Mercury

Water (Inorganic)

Oil and Grease - Water (060)

TEL024: HEM; modified from EPA 1664A (REVISION A)

GRAVIMETRIC - EXTRACTION

Total Oil and Grease

Water (Inorganic)

pH - Water (067)

TEL058:PC TITRATE; modified from SM 4500-H+ A and SM 4500-H+ B

AUTO - pH METER

pH

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Water (Inorganic)

Phosphate - Water (087)

TEL069; modified from SM 4500-P F

COLORIMETRIC - DISCRETE

Phosphate

Water (Inorganic)

Reactive Silica - Water (090)

TEL070; modified from SM 4500-SI F

COLORIMETRIC - DISCRETE

Reactive Silica

Water (Inorganic)

Solids - Water (011)

TEL008, TEL009; modified from SM 2540 C and SM 2540 D

GRAVIMETRIC

Total Dissolved Solids

Total Suspended Solids

Water (Inorganic)

Total and Dissolved Nitrogen - Water (086)

TEL066; modified from ASTM D5176-91 and ISO 11905

PYROLYSIS - CHEMILUMINESCENCE

Dissolved Nitrogen

Total Nitrogen

Water (Inorganic)

Total and Dissolved Phosphorus - Water (088)

TEL069; modified from SM 4500-P F

COLORIMETRIC - DISCRETE

Dissolved Phosphorus

Total Phosphorus

Water (Inorganic)

Total Metals - Water (054)

TEL035; modified from EPA 200.8

ICP/MS

Aluminum

Arsenic

Barium

Beryllium

Boron

Cadmium

Cesium

Chromium

Cobalt

Copper

Iron

Lead

Lithium

Manganese

Mercury

Molybdenum

† "OSDWA" indicates the appendix is used for the analysis of Ontario drinking water samples, which is subject to the rules and related regulations under the Ontario "Safe Drinking Water Act" (2002).

The list of tests and measurement capabilities for which a laboratory is accredited can change at any time due to circumstances such as scope extensions, voluntary withdrawal of tests by the laboratory and suspension. Scopes are published by the CALA via the Internet at http://www.cala.ca/cala_directories.html

Nickel
Rubidium
Selenium
Silver
Strontium
Thallium
Tin
Titanium
Uranium
Vanadium
Zinc

Water (Inorganic)

Turbidity - Water (028)
TEL006; modified from SM 2130 B
NEPHELOMETRY
Turbidity

Water (Microbiology)

Coliforms - Water (045)
TEL053; modified from IDEXX QUANTI-TRAY
MOST PROBABLE NUMBER (QUANTI-TRAY)
Escherichia coli
Total Coliforms

Water (Microbiology)

Fecal (Thermotolerant) Coliforms - Water (041)
TEL017; modified from SM 9222 D
MEMBRANE FILTRATION (mFC)
Fecal (Thermotolerant) Coliforms

Water (Microbiology)

Fecal Streptococci - Water (055)
TEL053; modified from IDEXX QUANTI-TRAY
MOST PROBABLE NUMBER (QUANTI-TRAY)
Fecal streptococci

Water (Organic)

BTEX - Water (070)
TEL037:BTEX; modified from EPA 502.2 and EPA 5030B and EPA 602
GC/MS - PURGE AND TRAP
Benzene
Ethylbenzene
m,p-Xylene
o-Xylene
Toluene

Water (Organic)

Extractable Hydrocarbons - Water (085)
TEL067; modified from EPA 3510C and EPA 3630C and SM 6010
GC/FID - SOLID PHASE EXTRACTION
C10-C50

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Water (Organic)

Purgeable Hydrocarbons - Water (084)

TEL044; modified from EPA 5030 and EPA 8000 and EPA 8015 and EPA 8260B

GC/FID - PURGE AND TRAP

C6-C10

Water (Organic)

Trihalomethanes (THM) - Water (077)

TEL039:THM; modified from EPA 502.2 and EPA 5030B and EPA 602

GC/MS - PURGE AND TRAP

Bromodichloromethane

Bromoform

Chlorodibromomethane

Chloroform

† "OSDWA" indicates the appendix is used for the analysis of Ontario drinking water samples, which is subject to the rules and related regulations under the Ontario "Safe Drinking Water Act" (2002).

The list of tests and measurement capabilities for which a laboratory is accredited can change at any time due to circumstances such as scope extensions, voluntary withdrawal of tests by the laboratory and suspension. Scopes are published by the CALA via the Internet at http://www.cala.ca/cala_directories.html

Appendix C

Canadian Water Quality Guidelines for the Protection of Aquatic Life

Table C1. Canadian Water Quality Guidelines (CWQG) for the Protection of Aquatic Life

Parameter	Criteria ^{1,2}	Criteria Source
Ammonia	Total Ammonia: see Table 3 below. Un-ionized Ammonia: concentration not to exceed 0.019 mg NH ₃ /L. (equivalent to 0.016 mg/L NH ₃ -N)	CCME 2010
Arsenic (As; Total)	Concentration not to exceed 5 µg/L	CCME 2001
Cadmium (Cd; Total)	Long-term: for waters of 50 mg CaCO ₃ /L hardness, concentration not to exceed 0.09 µg/L. At hardness values between 17 and 280 mg CaCO ₃ /L, the CWQG can be calculated with the equation: $CWQG (\mu g/L) = 10^{(0.83(\log[hardness]) - 2.46)}$	CCME 2014
Calcium	No water quality criteria for protection of aquatic life; used to determine hardness.	CCME 2019a
Chromium (Cr)	Total Chromium: No water quality criteria for protection of aquatic life. Hexavalent Chromium (Cr(VI)): concentration not to exceed 1 µg/L. Trivalent Chromium (Cr(III)): concentration not to exceed 8.9 µg/L	CCME 1999a
Cobalt (Co)	No water quality criteria for protection of aquatic life	CCME 2019a
Conductivity	No water quality criteria for protection of aquatic life.	CCME 2019a
Copper (Cu)	When the water hardness (CaCO₃) is 0 to < 82 mg/L , Cu concentration not to exceed 2 µg/L. At hardness ≥82 to ≤180 mg/L , Cu concentration not to exceed the value calculated using the following equation: $CWQG (\mu g/L) = 0.2 * e^{(0.8545[\ln(hardness)] - 1.465)}$ At hardness >180 mg/L , Cu concentration not to exceed 4 µg/L. If the hardness is unknown , not to exceed 2 µg/L.	CCME 2019a
Dissolved Oxygen	For cold water ecosystems: 6.5 mg/L to 9.5 mg/L	CCME 1999b
Hardness (CaCO ₃)	No water quality criteria for protection of aquatic life; Used to determine hardness dependent criteria of other parameters.	CCME 2019a
Iron (Fe)	Concentration not to exceed 300 µg/L	CCME 2019a
Lead (Pb)	When the hardness (CaCO₃) is 0 to ≤ 60 mg/L , Pb concentration not to exceed 1 µg/L At hardness >60 to ≤ 180 mg/L , Pb concentration not to exceed the value calculated using the following equation: $CWQG (\mu g/L) = e^{(1.273[\ln(hardness)] - 4.705)}$ (µg/L) At hardness >180 mg/L , Pb concentration not to exceed 7 µg/L. If the hardness is unknown , Pb concentration not to exceed 1 µg/L	CCME 2019a
Magnesium	No water quality criteria for protection of aquatic life; used to determine hardness.	CCME 2019a
Manganese (Mn)	Long-term: CWQG (µg/L dissolved Mn) is calculated using the calculator in Appendix B of the <i>Scientific Criteria Document for the Development of the Canadian Water Quality Guidelines for the Protection of Aquatic Life: Manganese</i> (CCME 2019c), found here: http://st-ts.ccme.ca/en/index.html?lang=en&factsheet=129 .	CCME 2019b CCME 2019c
Mercury (Hg; Total)	Concentration not to exceed 0.026 µg/L	CCME 2003

Parameter	Criteria ^{1,2}	Criteria Source
Nickel (Ni)	When the water hardness (CaCO₃) is 0 to ≤ 60 mg/L , Ni concentration not to exceed 25 µg/L. At hardness > 60 to ≤ 180 mg/L , Ni concentration not to exceed the value calculated using the following equation: $CWQG (\mu\text{g/L}) = e^{(0.76[\ln(\text{hardness})]+1.06)}$ At hardness >180 mg/L , Ni concentration not to exceed 150 µg/L. If the hardness is unknown , Ni concentration not to exceed 25 µg/L.	CCME 2019a
Nitrate	Long-term: concentration not to exceed 13 mg NO ₃ ⁻ /L (equivalent to 2.93 mg NO ₃ ⁻ -N/L)	CCME 2012
Nitrite	Concentration not to exceed 60 µg NO ₂ -N/L (equivalent to 197 µg NO ₂ /L).	CCREM 1987
pH	Acceptable between 6.0 and 9.0	WL
Total Petroleum Hydrocarbon (TPH)	Maximum average concentration not to exceed 3 mg/L Maximum concentration of any grab sample not to exceed 5 mg/L	WL
Total Suspended Solids (TSS)	During clear flow: Maximum average increase of 5 mg/L from background levels for a longer term exposure (e.g., 30-d period). During high flow or turbid waters: Maximum increase of 25 mg/L from background levels at any one time when background levels are between 25 and 250 mg/L. Should not increase more than 10% of background levels when background is >250 mg/L.	CCME 2002
Turbidity (Nephelometric Turbidity Units)	During clear flow: Maximum average increase of 2 NTUs from background levels for a longer term exposure (e.g., 30-d period). During high flow or turbid waters: Maximum increase of 5 NTUs from background levels at any one time when background levels are between 8 and 50 NTUs. Should not increase more than 10% of background levels when background is >50 NTUs.	CCME 2002
Temperature	Thermal Stratification: Thermal additions to receiving waters should be such that thermal stratification and subsequent turnover dates are not altered from those existing prior to the addition of heat from artificial origins. Maximum Weekly Average Temperature: Thermal additions to receiving waters should be such that the maximum weekly average temperature is not exceeded.	CCME 1999c
Zinc (Zn)	Long-term: CWQG for dissolved zinc and is calculated using the following equation, which is valid for hardness (CaCO ₃) between 23.4 and 399 mg/L, pH between 6.5 and 8.13, and DOC between 0.3 to 22.9 mg/L: $CWQG = \exp^{(0.947[\ln(\text{hardness mg}\cdot\text{L}^{-1})] - 0.815[\text{pH}] + 0.398[\ln(\text{DOC mg}\cdot\text{L}^{-1})] + 4.625)}$.	CCME 2018

Notes: 1: *Canadian Water Quality Guidelines for the Protection of Aquatic Life* available at the time of writing. Where updated guidelines are published prior to the start of sampling, the most recent criteria shall be followed; 2: WL – *Water Licence NSL1-1843*.

**Table C2. Canadian Water Quality Guideline for Total Ammonia (mg NH₃/L)
for the Protection of Aquatic Life**

Temperature (°C)	pH							
	6.0	6.5	7.0	7.5	8.0	8.5	9.0	10.0
0	231	73.0	23.1	7.32	2.33	0.749	0.25	0.042
5	153	48.3	15.3	4.84	1.54	0.502	0.172	0.034
10	102	32.4	10.3	3.26	1.04	0.343	0.121	0.029
15	69.7	22.0	6.98	2.22	0.715	0.239	0.089	0.026
20	48.0	15.2	4.82	1.54	0.499	0.171	0.067	0.024
25	33.5	10.6	3.37	1.08	0.354	0.125	0.053	0.022
30	23.7	7.50	2.39	0.767	0.256	0.094	0.043	0.021

Notes: CCME 2019c