Annual Report-2015

Water Licence: 3BM-KUG-1520

Hamlet of Kugluktuk, NU

Submitted to the Nunavut Water Board

March 22, 2016

Submitted by
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Municipal Planning Engineer,
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March 11th 2016

Hamlet of Kugluktuk
P.O Box 271,
X0B 0E0
1-867-982-6505

This letter is to Authorize Shah Alam, to submit the Annual Report 2015, to the Water Board,

On behalf of the Hamlet of Kugluktuk.

Donald LeBlanc
Donald LeBlanc
Senior Administrative Office

Annual Report 2015

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Kugluktuk Water Licence: 3BM-KUG 1520 Annual Report 2015

March 22, 2016

Nunavut Water Board
P.O. Box 119
Gjoa Haven, NU X0B 1L0

Attention: Karen Kharatyan, Ph. D., P. Eng. , Manager of Licensing

RE: Annual Report 2015 - Hamlet of Kugluktuk Water Licence: 3BM-KUG 1520

Dear Mr. Karen,

The Hamlet of Kugluktuk is pleased to submit to Nunavut Water Board the attached file of “Annual Report 2015” of water uses and sewage solid waste disposal as required under the compliance of Water Licence; 3BM-KUG120. Copies of required tests reports are attached herewith for your reference.

The Licensee remains in operation of those facilities and adhere the compliance requirements with the help of Government of Nunavut though Community and Government Services. Samples test result shown excellent remediation of contamination parameters within allowable limit comprising BOD, TSS, E-coli and Toxicity components and quality control on effluent.

We summarized those conditions and requirements outlined in Part B through part H.

We hope that Nunavut Water Board will find this report and enclosed test results valuable to Annual Report in operating the Licence for water, sewage and solid waste facilities.

Best Regards,

Shah Alam, P. Eng. E.P.
Municipal Planning Engineer,
Government of Nunavut
Community and Government Services
Cambridge Bay, Nu

Enclosure: Annual Report 2015 NWB Form, effluent water sample results, compliance Part B-H
Cc: Donald LeBlanc, Senor Administrative Officer (SAO), Kugluktuk, NU
Baba Pedersen, Resource management Officer, AANDC
Sonia Aredes, Technical Advisor, NWB

Part B: General Conditions

- Tabular Form of Annual water consumptions are filled from daily water distribution and sewage quantity estimated from daily sewage disposal in the lagoon.
- No modification to water supply or sewage disposal from ongoing scopes; water intakes from Coppermine River (KUG-1) and sewage disposal at the lined lagoon. The new water treatment plant construction in progress and expecting in operation in late 2016.
- Decanting of sewage water from the lagoon cell to wetland (KUG-3) is done using a mechanical pump with approval; samples are taken for test of parameters compliances.
- No abandonment or restoration activity to any facilities of water or sewage system, but part of the old sewage facility is uses by leaked sewages flowing towards the wetland.
- No changes of current active O&M manuals for water, sewage and solid waste. Amendment to A&R plan and Compliance Plan submitted to the Board as outlined.
- Inspection to sewage facility including berm, drop-off location and containment structure done by a consultant engineer in July and by GN CGS in subsequent times. Plan for any remedial measures are now with GN CGS Capital Plan.
- The Licensee is aware of the approval process for any changes in operation, monitoring and submittals. AANDC inspector has been contacted before decanting, sampling and facility inspection including the lagoon leaking issue and station location fixing.
- Monitoring program continued as noted in the Compliance Plan and sampling stations marked of facilities, signage were installed with English letters and Inuktitut as needed.
- No device Meter was used for water volume measurement, however, truck-fill uses as precise for water, sewage and solid waste quantities.
- Except the leaking issue, no other types of actual spills or emergency occurrences happened and no report has been made during this period.
- Amendment to the Plan of Compliance updated and followed with facilities operation. Water intakes changes based on source water quality in terms of salt and turbidity quantities and thus switched to mobile shack, pump houses and storage reservoir.

Part C: Water Use:

- Water drawn from the Coppermine River using twin intake lines from new intake pump houses and old intake pump house as a backup plus ice melts water using auxiliary hose on shack as needed during November-May. The annual quantity of 54,215 cubic metres limited within the allowable annual limit of 77,000 cubic metres.
- Water intake system integrated a screen at the very last point to separate fish & debris.
- Reported erosion measure on sides of new intake lines was done with earth and gravels.

Part D: Waste Disposal

- Raw sewage collect from household sewage tank by hamlet operated vacuum trucks and discharge into the lagoon at designated drop off location through discharge flute. Annual decanting from lagoon to wetland mechanical pump. An overflow pipe also uses for extra water in the case of snow break up towards outside from the lagoon.
- Sewage effluent samples (leaked) taken in July 6-8 by the consultant and tested at ALS laboratory in Edmonton. Samples taken by the Licensee in August 24 and tested at Taiga laboratory, Yellowknife. All samples results shown contaminant parameters within allowable limits, set out in the *'Guidelines for the discharge of treated municipal wastewater in the Northwest Territories'* and the *final discharge point for the Sewage lagoon (end -of-pipe).*
- Final discharge point (KUG-4) previously identified, approved and no changes.

Part E-G: Modification, construction, operation, A&R

- No modification to lagoon berm, waste facility or water intake structures during this year. The new water treatment building and structure required some site improvement which includes cutting-filling to grade the foundation. All documents, design, drawings were submitted to the Board and development proceeded with approval.
- A&R plan of old sewage facility has identified the scope of partial removal of soil-sludge and dry in designated cell if emergency situation.
- The old sewage facility abandonment report stated for reuse the land for sludge drying facility or land farm activities, then a restoration plan to the facility, otherwise a natural remediation through water washout. At the moment, no other activities included there, therefore, a natural remediation process leaves to the old sewage facility.

Part H: Monitoring Program

- Annual monitoring of sewage & waste effluent carried from station KUG-2, KUG-3, KUG-4 and KUG-5 during the summer. Samples were taken from stations where available and convenient, and tested for parameters. Test results included in this report.
- Sewage truck operator keeps record for each load of sewage disposes-full load of sewage truck is 10,000 liters and 3 trucks in operation with one standby as back up. Quantity of sewage disposal estimated from total water uses over the year.
- Location of sewage disposal identified to the east side but the sampling location of raw sewage marked to the north side nearby to the decanting point for convenient and better representation of samples. This facility keeps raw sewage away from quick mixing with waited sewage water in the lagoon for decanting.
- During the late summer, monitoring stations found mostly dry and no run-off from solid waste site, therefore, no more samples were possible from solid waste facility in this year.

Monitoring Stations of sewage and solid waste sample collection

Sampling Station	Description	comments
KUG-1	Raw Water source intake location at Coppermine River	Volume of water intake annually
KUG-2	Discharge from Solid Waste water retention	Monitoring station, outside of solid waste facility
KUG-3	Discharge point from Sewage Disposal facility to wetland	Sampling point at sewage lagoon inside
KUG-4	Effluent outfall from wetland	Before meeting to Coronation Gulf
KUG-5	Effluent discharge and run-off from land farm	Sampling point outside of land farm collection sump

Executive Summary

The sewage lagoon serving the Hamlet of Kugluktuk is an earth berm structure, with a rectangular shape, supporting a single HDPE lined cell. The facility was commissioned in 2009, however, when the Hamlet began using the lagoon, it was identified that there were some tears in the lagoon liner, and remedial work to repair the liner was completed in 2011. Another issue with the lagoon liner, which was first observed 2009, are "islands" associated with floating segments of the liner; remedial work to address this issue has not been undertaken. In 2014, it was reported that there was seepage from a segment of the toe on the east side of lagoon; it was also reported that there was subsidence in the top of the berm in the same section as the seepage.

A site inspection and review of the existing structure by Stantec in July 2015 confirmed that a segment of the east berm had subsided approximately 40 centimetres. Associated with this subsidence is slumping and seepage in the same section of the east berm; additional slumping is also occurring in segments of the west and south berms. It was recommended that until the subsiding berm is stabilized, the facility needs to be monitored for any signs of accelerated failure, which would indicate the need for immediate interim remedial action.

Based upon sampling and testing of the seepage along the east berm, it was concluded that the liner has failed, and it is not providing full containment. Based upon water samples collected and tested, the leakage is meeting the effluent quality criteria in the current water licence. Several features in the design of the liner system were noted to be contributing to the issues, including the fact that there is no subdrain for controlling the leakage.

Options were developed for remedial work on the lagoon, which included the addition of a buttress to the existing berm, berm reconstruction, removal and replacement of the existing liner, and repair of the existing liner. The capital costs for these options range from $400,000 to $4.6 million. For purposes of comparison, an option for the application of a mechanical treatment plant was also developed, and would cost $18 million. The buttress addition would not provide complete containment of the sewage, and therefore may require a relaxation of the operating criteria of the facility.

It was recommended that the remedial work be completed to provide a facility that fully contains the sewage; however it is recognized that the possibility exists for a relaxation of the operating criteria, which could allow the leaking to continue, and accommodate the addition of a buttress structure to the existing berm to provide long term stability to the structure.

Annual Report 2015

Water Licence 3BM KUG 1520

Date of issuance: December 8, 2015

Date of expiry: December 7, 2020

Hamlet of Kugluktuk, NU

ANNUAL REPORT-2015

YEAR BEING REPORTED: 2015

The following information is compiled pursuant to the requirements of Part B, Item 1 of Water Licence **3BM-KUG1520** issued to **Kugluktuk.**

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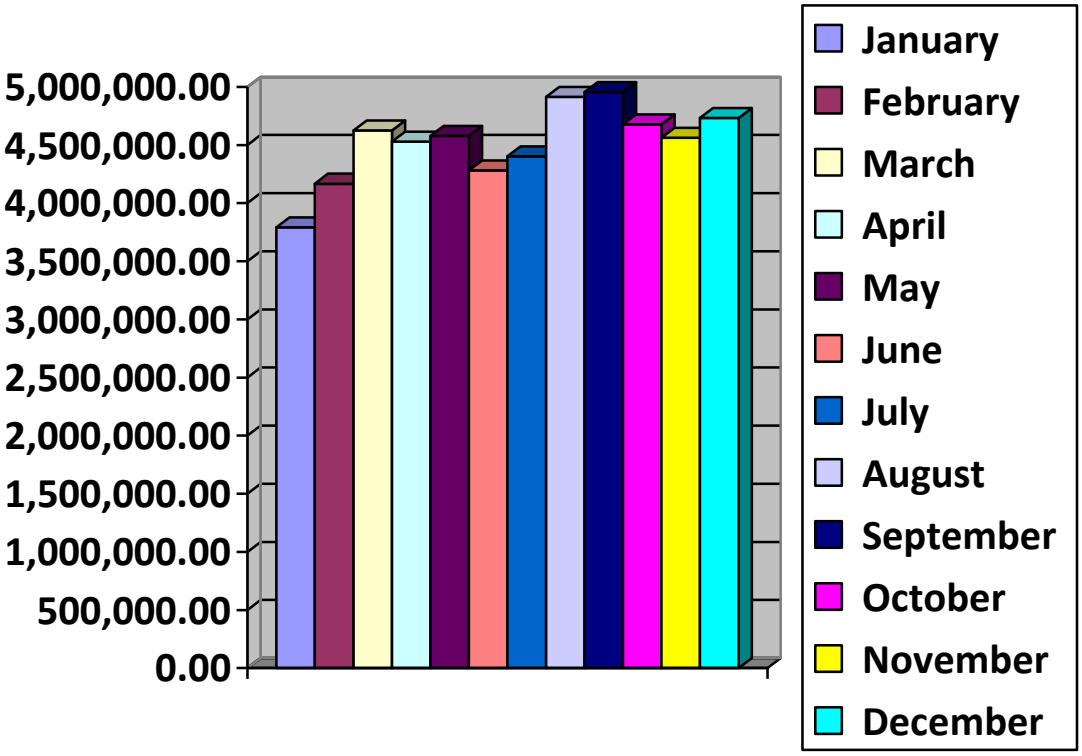
i) - iii) tabular summaries of all data generated under the "Monitoring Program"; monthly and annual quantities in cubic metres of freshwater obtained from all sources; monthly and annual quantities in cubic metres of each and all wastes discharged;

Attached are quantities of water used as reported in our Fluid Manager Water Delivery System and the estimated discharge of sewage waste based on quantities used.

Month Reported	Quantity of Water Obtained from all sources (Litres)	Quantity of Sewage Waste Discharged
January	3,790,659.20	3,601,126.24
February	4,167,044.60	3,958,692.37
March	4,625,741.00	4,394,453.95
April	4,529,120.30	4,302,664.29
May	4,578,559.40	4,349,631.43
June	4281,449.90	4,067,377.41
July	4,402,492.80	4,182,368.16
August	4,913,718.20	4,668,032.29
September	4,955,019.90	4,707,268.91
October	4,676,523.10	4,442,696.95
November	4,561,790.80	4,333,701.26
December	4,733,015.70	4,496,364.92
ANNUAL TOTAL	**54,215,134.90**	**51,504,378.16**



Water intake and distribution 2015 (January – December)
X-axis: Month of the year
Y-axis: Quantity of monthly water intake (histogram)

iv. a summary of modifications and/or major maintenance work carried out on the Water Supply and Waste Disposal Facilities, including all associated structures and facilities;

Water Supply:

- No maintenance work to existing structure of water intake, supply, treatment, distribution system. A new treatment plant construction in progress to add with existing Cartage Filtration system.
- Sewage waste containment lagoon remains in full operation directed in the O&M manual. Sewage leak to the east side of the lagoon has been inspected during July 6-8, 2015 by a consultant to find causes, risk, status and any future risk. Repair to noted bubbles on liner has been done in 2011 and followed up in 2013, but could not eliminated since the actual causes remains unclear. But the licensee is aware of it and looking for the best option to dissolve the issue with minimum risk of maintenance. Lagoon leak maintenance is now in priority and expecting a remediation plan in summer 2016.
- No changes or issue of solid waste facility operation or maintenance, but an addition of seacan for batteries and hazardous waste placed on site and will be shipping out later.

Water intakes system:

The water intake structure from Coppermine River comprises in several ways:

- **Intake though mobile shack:** collection of ice water through mobile shack and a pump is placed on wooden skid at the point of intake along the shoreline when high salt wedge in river bed water. This system uses almost 6-7 months of the year from Nov-May before the ice break up. Hooked a 15 HP pump to the line power, insulated pipe surrounded electric heat-trace and 3-inch HDPE pipe uses for water collection from a depth of 3-4 m from ice surface to a distance of water available and less or no salt wedges. This intake system is very useful to control salinity and suspended turbidity in the water, thus reduce numbers of cartage filters for the treatment plant.
- **Old intake pump house**: uses when ice break-up but not a complete flow in the river water source; mainly collection of ice melts from nearby and from upstream. This structure also uses to facilitate the mobile shack for power supply and water delivery to treatment plant- mostly uses June-July.
- **New intake pump house**: twin intake from the higher depth; use for summer intake and safer from salt wedge to river bed sedimentation.
- **Storage reservoir**: uses mostly for diverting intake into the reservoir to allow natural sediment of salt wedge and larger suspended particles before sending to treatment plant when needed – generally happened in summer and fall.

v. a list of unauthorized discharges and summary of follow-up action taken;

No unauthorized water intake or waste discharges during this period except the noted leak effluent prolonged from before. The Licensee is monitoring such leak issue and remedial measure is in plan with GN project, expecting the action plan in coming summer 2016.

Annual decanting of sewage water onto wetland using a pump took place during the summer; thus reduced effluent water inside, effluent samples were taken from lagoon inside (at decant point), on wetland monitoring station and at Final Discharge point and tested at Taiga Lab.

vi. a summary of any abandonment and restoration work completed during the year and an outline of any work anticipated for the next year;

Abandonment of existing sewage facility does not include any restoration activities but a plan of reusing the spot in future for sewage sludge dry pad if necessary. One leak spot identified through the current lagoon berm at this side and water effluent passing through the down toe of the old lagoon berm towards the wetland, causing a continuous dampness and flow on it. Leak inspection carried, possible causes been verified and remedial plan in 2016. Expected such remedial work will stop the sewage effluent leak and keep the old lagoon toe free from dampness which will facilitate the complete abandonment of the old lagoon spot.

vii. **a summary of any studies requested by the Board that relate to waste disposal, water use or reclamation, and a brief description of any future studies planned**;

Indicated in AANDC inspection on May 19 and report June 18, 2015, licensee to follow up:

a. Lagoon leak be inspected, identify causes, and provide information of remedial measures, compliances and effluent quality tests results.

- ✓ Lagoon leak inspection was done by Stantec consultant on July 6-8 and leaked samples were tested at ALS laboratory, Edmonton. Samples test results shown leaked effluent are meeting the quality as directed in the current Licence.
- ✓ However, a continuous leak may lead to a risk to containment duration or a breach to berm locally in the worst case scenario. It is advised for a short and long term remedial plan such as earth buttress along the outer toe and ties liner inside on affected areas.

b. Barrels, paints, batteries and other hazardous materials stored in the land farm and need to be managed in accordance to meet guidelines.

- ✓ The lined cell facility uses for hazardous materials containment in separate spots for barrels, batteries, paints and others. The licensee has a put a seacan inside the facility to replace those hazardous substances such as batteries, paint peels, waste oils in spate boxes from the facility. Plan for shipping these hazardous materials with the seacan approximately in every 5-6 years using 3rd party recipient.
- ✓ The land farm is basically for contaminated soils and spills materials for storage and re-purposing or shipping-out in meeting HC parameters criteria for Class B. This facility is not for batteries or hazardous materials open storages. However the licensee is aware of it and removing those unauthorized substances from the land farm facility. A plan to remove top layers of stored soils for solid waste cover.

c. Sewage Lagoon bubble and gas entrap inside causing lagoon capacity decreasing

- ✓ Entrapped gas was released in 2013 as part of lagoon maintenance work. Gas generates naturally from HC components - either from natural marine soil layers or from lagoon

effluent collected underneath the liner. Consultant report revealed, pre-existing standby water stream wasn't diverted properly and appears to be flowing underneath the liner, causing the air bubbles (Ref: Executive summary).

d. Monitoring station signs be reinstalled where missing:

✓ Signs were in place or reinstalled at noted monitoring stations including KUG-3 (lagoon decanting point) and KUG-2 (effluent outfall from solid waste facility) considering the suitability of sampling. Other monitoring stations KUG-1 (water intake), KUG-4 (Final outfall to Coronation Gulf) and KUG-5 (Land farm runoff) are remain unchanged. Signs were faded since not painted letters or background on proper board and not on proper post. Plan for repainting those reported signage in coming summer 2016

e. Plans updating:

✓ O&M manual of Sewage facility and A&R plan of old lagoon were updated in 2014

f. Notification to inspector:

✓ The licensee will maintain this requirement at least 10 days ahead of the plan of decanting and sampling, mostly done once a year during late July or early August.

viii. any other details on water use or waste disposal requested by the Board by November 1st of the year being reported; and

- ✓ Annual Reports available were updated as shown outstanding in the Licence.
- ✓ Signs were installed to all monitoring stations marked for sampling & monitoring.
- ✓ Amendment to Spills Contingency Plan (SCP) was submitted on Apr 06, 2015.
- ✓ Engineering reports, intake manuals, compliance plan submitted on Apr 02, 2015
- ✓ Barrels and batteries in the landfarm were contained inside the seacan and secured from leaching on site and plan for shipping out with accredited organization.
- ✓ Secured landfarm soil from blowing outside and used partly to cover solid waste and thus created room for new candidate materials.

ix. **Updates or revisions to the approved Operation and Maintenance Plans**

- ✓ Information to Sewage Treatment Facility O&M manual, section 3.7 has been updated with the Board as requested in the amendment Licence.
- ✓ The O&M manual for water system and distribution remains active until the new treatment plant comes in operation-expecting late 2016.

ADDITIONAL INFORMATION THAT THE LICENSEE DEEMS USEFUL:

- ✓ A complete report of sewage leak and facility status received from the consultant. The report has revealed several opinions and causes of leaking through inspection and review of previous documents and drawings of the lagoon development. Also it noted in the report, sample test results has shown meeting compliance criteria set out in the Licence,

but continuous leaking is a concern as well as any other location with similar weakness. Among the many options, a constructive solution is to install earthen buttress along the lower toe on effected side and any other locations of chance to leak. Repairs to depressions and cracks on berm can be taken as measures for long term remedial measures to lagoon stability. The report and options are GN review and funding arrangement, expecting short-term remedial buttress development in sometime summer 2016.

- ✓ The licensee will request for a secondary location for sewage drop-off since wind flow becoming a concern of spilling on the operator while dumping at the current location.
- ✓ Water samples from source Coppermine River and treated water from truck-fill were sent to EHO at Cambridge Bay on a monthly basis and as necessary for EC and FC tests. No concerns about Ecoli or Coliform in the water.

FOLLOW-UP REGARDING INSPECTION/COMPLIANCE CONCERNS:

- ✓ The licensee has been operating sewage and waste facilities with own trucks and operators. A full time foreman is employed locally to monitor those facilities operation. The Licensee also has a plan to repair the fence and berm to secure the solid waste and land farm facility.
- ✓ Hazardous materials shipping out in 3-5 years or anytime convenient of barge in.
- ✓ The licensee is looking forward for an incinerator or other equipment for control burning of waste on site.
- ✓ A soil remediation & spill materials management facility on site is plan in future.

Part- 'H'

Table: Summary of Effluent sampling results (SNP Monitoring Station)

Sewage and solid waste effluent samples collected on Aug 24, 2015

Parameter	MAC Limit			units	Aug 24, 2015			
	Sewage Effluent	Wetland outlet	Fresh water		KUG-2	KUG-3	KUG-4	KUG-5
Alkalinity	NV			mg/L	312	150	115	
Conductivity	NV			µS/cm	714	507	745	
P^H	6-9	6-9	6-9		7.97	7.25	7.5	7.65
TSS	*180		15	mg/L	3	62	5	NP
Ammonia as N2	NV		1.25	mg/L	0.008	21.5	0.66	NP
BOD	*120		25	mg/L	3	61	7	NP
CBOD	*120		25	mg/L	3	54	2	NP
Nitrate as N2	NV	16	13	mg/L	0.09	0.13	1.76	
Nitrite as N2	NV		0.06	mg/L	0.01	0.01	0.08	
Calcium	NV			mg/L	79.2	9.6	29.5	
chloride	250			mg/L	45.6	39.1	146	
Hardness ($CaCO_3$)	500			mg/L	365	41.9	176	
Magnesium	NV			mg/L	38.4	4.3	24.7	
Potassium	NV			mg/L	0.5	16.1	4.1	
Sodium	200			mg/L	25.2	36.9	78.9	
Sulphate	500			mg/L	8	13	27	
Fecal Coliform	10^6		10^4	CFU/100mL	7	5.5×10^4	13	
Oil and Grease	5000			µg/L	none	None	None	NP
Aluminium	1000		100	µg/L	114	196	40.2	
Arsenic	1000	12.5	5	µg/L	0.5	0.5	0.5	0.9
Cadmium	100	0.12	0.017	µg/L	0.2	0.2	0.2	0.15
Chromium	100	56	8.9	µg/L	0.5	0.6	0.4	0.2
Cobalt	50			µg/L	<0.10	0.4	0.4	0.3
Copper	200		4	µg/L	7.6	30.9	6.3	1.5
Iron	1000		300	µg/L	114	578	838	
Lead	50		7	µg/L	0.2	0.5	<0.1	<0.1
Manganese	NV			µg/L	13.4	33.9	293	
Nickel	200		150	µg/L	0.9	1.9	3.3	6.2
Zinc	500		30	µg/L	8.9	29.2	<5.0	
Mercury (Hg)	0.6	0.016	0.026	µg/L				0.03
Phenols	20		4	µg/L				0.00045
Benzene	NV	110	370	µg/L				NP

* Parameters MAC value as identified in the Water Licence.

NP: Not Possible for analysis. NV: No value provided; all others values are Standard for effluent

KUG-2: Solid waste; KUG-3: Lagoon sample; KUG-4: Wetland outfall (End-of-pipe); KUG-5: Land farm

Appendix: A

Pages from Water Licence: Part B-H

Water Licence 3BM KUG 1520

Hamlet of Kugluktuk, NU

"**Water Retention Area**" compromises the 'Water Retention Area' as identified on Nuna Burnside Project No. N-O 09755.0 Drawing No.1," *The Hamlet of Kugluktuk, Solid Waste Disposal Facility Improvements*", record drawing dated November 18, 2008;

"**Wetland Treatment Area**" comprises the 'Expanded Wetland Treatment Area' as identified on Nuna Burnside Project No. N-O 09755.0 Drawing No.2, "*The Hamlet of Kugluktuk Sewage Lagoon Plan*" and the "*Meandering Wetland Treatment Area*" as identified on Drawing No.3, *The Hamlet of Nunavut Kugluktuk Proposed Sewage Lagoon Sections* stamped and dated June 18, 2007.

3. Enforcement

a. Failure to comply with this Licence will be a violation of the *Act*, subjecting the Licensee to the enforcement measures and the penalties provided for in the *Act*;

b. All inspection and enforcement services regarding this Licence will be provided by Inspectors appointed under the *Act*; and

c. For the purpose of enforcing this Licence and with respect to the use of Water and deposit or discharge of Waste by the Licensee, Inspectors appointed under the *Act*, hold all powers, privileges and protections that are conferred upon them by the *Act* or by other applicable law.

PART B: GENERAL CONDITIONS

1. The Licensee shall file an Annual Report on the Appurtenant Undertaking with the Board no later than 31st of March of the year following the calendar year being reported, containing the following information:

a. tabular summaries of all data generated under the "Monitoring Program" as described under Part H
b. the daily, monthly, and annual quantities, in cubic metres, of freshwater obtained from Monitoring Station KUG-1;
c. the daily, monthly and annual quantities in cubic metres of sewage effluent discharged at Monitoring Station KUG-3;
d. the monthly and yearly quantities of authorized Waste – bulky metal, hazardous, wood and soil—accepted at the Solid Waste Facilities;
e. a summary of modifications and/or major maintenance work carried out on the Water Supply and Waste Disposal Facilities, including all associated structures and facilities;
f. a list of unauthorized discharges and summary of follow-up action taken;
g. a summary of any abandonment and restoration work completed during the year and an outline of any work anticipated for the next year, including a summary of the Old Sewage Lagoon (Decommissioned Sewage Disposal Facility) Facility's Inspection Report in accordance with Part G, Item 1;
h. any updates or revisions for manuals and plans *(Including Operations and*

Maintenance Plans, Spill Contingency, Abandonment and Restoration, QA/QC Plans) as required by changes in operation and/or technology;

i. a summary of any studies, reports and plans requested by the Board that relate to Water use, Waste disposal or reclamation, and a brief description of any future studies planned;

j. summary of any inspections completed by federal or territorial authorities, geotechnical or municipal engineers, on undertakings related to Water use, Waste disposal or reclamation activities; and

k. any other details on Water use or Waste disposal requested by the Board by November 1st of the year being reported.

2. The Licensee shall notify the NWB of any changes in operating plans or conditions associated with this project at least thirty (30) days prior to any such change.

3. The Licensee shall comply with the "Monitoring Program" described in this Licence, and any amendments to the "Monitoring Program" as may be made from time to time, pursuant to the conditions of this Licence.

4. The "Monitoring Program" and compliance dates specified in the Licence may be modified at the discretion of the Board.

5. The Licensee shall install flow meters or other such devices, or implement suitable methods required for the measuring of Water volumes as required under Part H, Item 1.

6. The Licensee shall, post the necessary signs, to identify the stations of the "Monitoring Program". All signage shall be in the Official Languages of Nunavut.

7. The Licensee shall, for all Plans submitted under this Licence, include a proposed timetable for implementation. Plans submitted, cannot be undertaken without subsequent written Board approval and/or direction. The Board or an Inspector may alter or modify a Plan if necessary to achieve legislative objectives and will notify the Licensee in writing of acceptance, rejection or alteration of the Plan.

8. The Licensee shall, for all Plans submitted under this Licence, implement the Plan as approved by the Board in writing.

9. The Licensee shall review the Plans referred to in this Licence, as required by changes in operation and/or technology, and modify the Plan accordingly. Revisions to the Plans shall be submitted in the form of an Addendum to be included with the Annual Report.

10. Every Plan to be carried out pursuant to the terms and conditions of this Licence shall become a part of this Licence, and any additional terms and conditions imposed upon approval of a Plan by the Board become part of this Licence. All terms and conditions of the Licence should be contemplated in the development of a Plan where appropriate.

11. The Licensee shall ensure a copy of this Licence is maintained at the site of operations at

all times. Any communication with respect to this Licence shall be made in writing to the attention of:

(a) Manager of Licensing:
Nunavut Water Board
P.O. Box 119
Gjoa Haven, NU X0B 1J0
Telephone: (867) 360-6338
Fax: (867) 360-6369
Email: licensing@nwb-oen.ca

(b) Inspector Contact:
Manager of Field Operations, AANDC
Nunavut District, Nunavut Region
P.O. Box 100
Iqaluit, NU X0A 0H0
Telephone: (867) 975-4295
Fax: (867) 979-6445

12. The Licensee shall submit one paper copy and one electronic copy of all reports, studies, and plans to the Board. Reports or studies submitted to the Board by the Licensee shall include a detailed executive summary in Inuktitut.

13. The Licensee shall ensure that any document(s) or correspondence submitted by the Licensee to the NWB is received and acknowledged by the Manager of Licensing.

14. This Licence is assignable as provided for in Section 44 of the *Act*.

15. The expiry or cancellation of this Licence does not relieve the Licensee from any obligation imposed by the Licence, or any other regulatory requirement.

PART C: CONDITIONS APPLYING TO WATER USE

1. The Licensee shall obtain all freshwater for municipal purposes from the Coppermine River, as indicated in its Application.

2. The annual quantity of Water withdrawn for all purposes under Part C, Item 1 in this Licence shall not exceed seventy thousand (70,000) cubic metres *per year* at a maximum withdrawal rate of two-hundred and ninety-nine (299) cubic metres *per day*.

3. The Licensee shall equip all Water intake hoses with a screen of appropriate mesh size to ensure that fish are not entrained and shall withdraw Water at a rate such that fish do not become impinged on the screen.

4. Where the use of Water is of a sufficient volume that the source Water body may be drawn down, the Licensee shall submit to the Board for approval in writing, the

following:

a. details of Water volume involved;
b. hydrological overview of the Water body;
c. details of impacts; and
d. proposed mitigation measures.

5. The Licensee shall maintain the Water Supply Facility to the satisfaction of the Inspector.

6. The Licensee shall not remove any material from below the ordinary High Water Mark of any Water body unless approved by the Board in writing.

7. The Licensee shall not cause erosion to the banks of any body of Water and shall provide necessary controls to prevent such erosion.

8. The Licensee shall implement sediment and erosion control measures prior to and maintain as required during Hamlet operations, to prevent entry of sediment into Water.

PART D: CONDITIONS APPLYING TO WASTE DISPOSAL

1. The Licensee shall direct all Sewage to the Sewage Disposal Facility or as otherwise approved by the Board.

2. All Effluent discharged from the Sewage Disposal Facility at the Final Discharge Point at Monitoring Program Station KUG-3 end-of-pipe to the Wetland Treatment Area, shall not exceed the following Effluent quality limits:

Parameter	Maximum Concentration of any Grab Sample
BOD_5	120 mg/L
Total Suspended Solids	180 mg/L
Faecal Coliforms	1 x 10^6 CFU/100 mL
Oil and grease	No visible sheen
pH	Between 6 and 9

3. All Effluent discharged from the Old Sewage Lagoon, Monitoring Station KUG-6 shall not exceed the Effluent quality limits set under Part D, Item 2.

4. The Licensee shall maintain at all times a Freeboard limit of at least 1.0 metre, or as recommended by a qualified Geotechnical Engineer and as approved by the Board in writing, for all dams, dykes, or structures intended to contain, withhold, divert or retain Water or Waste.

5. The Sewage Disposal Facility shall be maintained and operated, to the satisfaction of an Inspector and in such a manner as to prevent structural failure.

6. All discharge of Effluent at Monitoring Program Station KUG-5, from within the perimeter of the Landfarm Facility, shall not exceed the following Effluent quality limits:

Parameter	Maximum Concentration of any Grab Sample (µg/L)
pH	6 to 9 (units)
Oil and Grease	5,000 and no visible sheen
TSS	15,000
Lead (dissolved)	1
Phenols	20
Benzene	370
Toluene	2
Ethylbenzene	90

7. The Licensee shall provide at least ten (10) days' notice to an Inspector, of the intent to discharge Effluent from the Old Sewage Disposal Facility or the Landfarm Facility.

8. The Effluent under Part D, Item 7 shall be discharged at a minimum distance of thirty-one (31) metres from the ordinary High Water Mark of any water body and where direct or indirect flow into a water body is not possible and no additional impacts are created.

9. The Licensee shall, prior to the removal of any treated soil for future use, confirm with the Government of Nunavut, Environmental Protection Service that the soils have been treated to meet all legislatively-required Treatment Objectives for its intended use.

10. The Licensee shall dispose of all Solid Wastes in such a manner as to prevent the deposition of such waste in to water.

11. The Licensee shall not open burn plastics, wood treated with preservatives, electric wire, Styrofoam, asbestos or painted wood to prevent the deposition of Waste materials of incomplete combustion and/or leachate from contaminated ash residual, from impacting any surrounding Waters, unless otherwise approved by the Board in writing.

12. The Licensee shall segregate and store all hazardous materials and/or Hazardous Waste in such a manner as to prevent the deposit of Waste into Water, until such time that the material have been removed for proper disposal at an approved facility.

PART E: CONDITIONS APPLYING TO MODIFICATIONS AND CONSTRUCTION

1. The Board has, with the issuance of this Licence, approved the amendment to the Water Supply Facility.

2. The Licensee shall submit to the Board for approval in writing, for-construction design drawings, stamped and signed by a qualified Engineer registered in Nunavut, at least sixty (60) days prior to the construction of any dams, dykes or structures intended to

contain, withhold, divert or retain Water or Wastes.

3. The Licensee may, without written consent from the Board, carry out Modifications to the Water Supply Facility and Waste Disposal Facilities provided that such Modifications are consistent with the conditions and scope of this Licence and the following requirements are met:

   a. the Licensee has notified the Board in writing of such proposed Modifications at least sixty (60) days prior to beginning the Modifications;
   b. such Modifications do not place the Licensee in contravention of the Licence or the *Act*;
   c. the Board has not, during the sixty (60) days following notification of the proposed Modifications, informed the Licensee that review of the proposal will require more than sixty (60) days; and
   d. the Board has not rejected the proposed Modifications.

4. The Modifications for which all of the conditions referred to in Part E, Item 3, have not been met, may only be carried out upon written approval from the Board.

5. The Licensee shall, within ninety (90) days of completion of Modification or Construction of facilities and/or infrastructure associated with the project, submit to the Board a Construction Summary Report along with stamped as-built plans and drawings, providing explanation to reflect any deviations from the for construction drawings, taking into account construction and field decisions and how they may affect the performance of engineered facilities.

6. The Licensee shall submit to the Board for approval in writing, at least sixty (60) days prior to the construction of the new Water Treatment Plant (WTP), for-construction design drawings of the new WTP, stamped and signed by a qualified Engineer.

7. The Licensee shall within ninety (90) days of completion of modifications of the Water Supply Facility, submit to the Board for review and written acceptance a Construction Summary Report along with as-built plans and drawings of the new Water Intake Facility and the new Water Treatment Plant, stamped and signed by a qualified Engineer.

8. All activities shall be conducted in such a way as to minimize impacts on surface drainage and the Licensee shall immediately undertake any corrective measures in the event of any impacts on surface drainage.

9. The Licensee shall implement and maintain sediment and erosion control measures prior to and during activities carried out under this Part, to prevent negative impacts to Water resulting from the release of sediment and to minimize erosion.

10. With respect to earthworks, the Licensee shall not deposit debris or sediment into or onto any Water body. These materials shall be disposed of at a distance of at least thirty-one (31) metres from the ordinary High Water Mark in such a fashion that they do not enter

the Water.

11. The Licensee shall only use material that is free of contaminants, for construction, operation, and maintenance activities and that is obtained from approved sources, demonstrated not to be potentially acid generating and metal leaching.

PART F: CONDITIONS APPLYING TO OPERATION AND MAINTENANCE

1. The Licensee shall submit to the Board for approval in writing, within ninety (90) days of issuance of the Licence, an updated Sewage Treatment Facility Operation and Maintenance Manual. The updated Manual shall include:

    a. a Monitoring Program, which reflects the current operating and monitoring conditions of the Licenced Facilities;
    b. the Temperature Monitoring Program for the Sewage Lagoon Dyke; and
    c. the GPS coordinates of the Monitoring Stations.

2. The Board has approved the "Spill Contingency Plan" (SCP), dated November 28, 2014, which was submitted as additional information with the Application. The Licensee shall submit to the Board for review within ninety (90) day of the date of Licence issuance an addendum to the SCP to include:

    a. a detailed description of the secondary containment used as spill prevention measure during fuel or hazardous substance transfer at the Licenced Facilities.

3. The Licensee shall submit to the Board for approval in writing, within ninety (90) days of issuance of the Licence, an updated Solid Waste Facility Operation and Maintenance Plan prepared in accordance with the "Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories" (1996). The updated Plan shall take into consideration the comments received during the renewal application review process for expired Licence No. 3BM-KUG0914 including the following information:

    a. SWF Monitoring Plan: updated sampling locations, parameters and timing required
    b. a plan for the inspection, management and monitoring for the sewage sludge, which also identifies the remediation objectives for sewage sludge treated in the Landfarm Facility

4. The Licensee shall submit to the Board for approval in writing, within ninety (90) days of beginning operations, a Water Supply Facility (WSF) Operation and Maintenance Manual. The WSF Operation and Maintenance Manual should include an Operations and Maintenance Manual for the updated Water Treatment Facility and also include the " Kugluktuk Water Intake Operations and Maintenance (O&M) Manual" dated October 2014 and submitted as additional information with the Application.

5. An inspection of all engineered facilities related to the management of Water and Waste shall be carried out by an Engineer at a minimum of once annually, and before commissioning any engineered facility related to the management of Water and Waste. The Engineer's report shall be submitted to the Board within sixty (60) days of the inspection, including a cover letter from the Licensee outlining an implementation plan to address each of the Engineer's recommendations.

6. An inspection of all engineered facilities related to the management of Water and Waste shall be conducted by a Geotechnical Engineer in accordance with the *Canadian Dam Safety Guidelines*, at least one (1) year prior to the expiry of the Licence, during the open Water period (June/July/August). The Geotechnical Engineer's report shall be submitted to the Board for review within sixty (60) days of the inspection, including a cover letter from the Licensee outlining an implementation plan to address the Engineer's recommendations.

7. The Licensee shall perform more frequent inspections of the engineered facilities at the request of an Inspector.

8. If during the period of this Licence, an unauthorized discharge of Waste occurs, or if such a discharge is foreseeable, subject to the Act and the Nunavut adopted *Consolidated Spill Contingency Planning and Reporting Regulations* (R- 068-93), the Licensee shall:

    a. employ the appropriately approved Spill Contingency Plan for the Hamlet of Kugluktuk. Take whatever steps are immediately practicable to protect human life, health and the environment;
    b. report the incident immediately via the NWT/NU 24-Hour Spill Reporting Line at (867) 920-8130 and to the AANDC Manager of Field Operations at (867) 975-4295; and
    c. for each spill occurrence, submit to the Inspector not later than thirty (30) days after initially reporting the event, a detailed report that provides the necessary information on the location (including the GPS coordinates), amount and type of spilled product, initial response action, remediation/clean-up, status of response (ongoing, complete), proposed disposal options for dealing with contaminated materials and any preventative measures to be implemented.

9. The Licensee shall, in addition to Part F, Item 9, regardless of the quantity of releases of harmful substances, report to the NWT/NU Spill Line if the release is near or into a Water body.

PART G: CONDITIONS APPLYING TO ABANDONMENT AND RESTORATION

1. The Licensee shall submit to the Board for approval in writing, within ninety (90) days following the date of issuance of this Licence, an updated Abandonment and Restoration Plan for the Old Sewage Lagoon. The Plan shall include, but not be limited to:

    a. an implementation schedule for the Plan;

b. sludge treatment method and disposal options;
c. Effluent treatment and disposal;
d. Monitoring Program; and
e. Schedule of inspection and checklist.

2. The Licensee shall submit to the Board, for approval, an Abandonment and Restoration Plan, at least six (6) months prior to abandoning any facilities or upon submission of the final design drawings for the construction of new facilities to replace existing ones. Where applicable, the Plan shall include information on the following:

a. Water intake facilities;
b. the Water treatment and Waste disposal sites and facilities;
c. abandoned Water and Waste facilities;
d. petroleum and chemical storage areas;
e. any site affected by Waste spills;
f. leachate prevention;
g. an implementation schedule;
h. maps delineating site facilities;
i. consideration of altered drainage patterns;
j. type and source of cover materials;
k. future area use;
l. Hazardous Wastes; and
m. a proposal identifying measures by which restoration costs will be financed by the Licensee upon abandonment related to Water use, Waste deposit to Water, or appurtenant undertakings related to Water use and/or deposit of Waste to Water, subject to the act and regulations.

3. The Licensee shall complete all restoration work within the time schedule specified in the Plan, or as subsequently revised and approved by the Board.

4. The Licensee shall carry out progressive reclamation of any components of the project no longer required for the Licensee's operations.

5. In order to promote growth of vegetation and the needed microclimate for seed deposition, all disturbed surfaces shall be prepared by ripping, grading, or scarifying the surface to conform to the natural topography.

6. Areas that have been contaminated by hydrocarbons shall be reclaimed to meet objectives as outlined in the Government of Nunavut's *Environmental Guideline for Site Remediation* (Revised January 2009). The use of reclaimed soils for the purpose of back fill or general site grading may be carried out only upon consultation and approval by the Government of Nunavut, Department of Environment and an Inspector.

PART H: CONDITIONS APPLYING TO THE MONITORING PROGRAM

1. The Licensee shall maintain Monitoring Program Stations at the following locations:

Monitoring Program Station Identification	Description	Status
KUG-1	Raw Water Supply Intake at Coppermine River	Active (Volume)
KUG-2	Effluent discharge from the Water Retention Area in the Solid Waste Disposal Facilities	Active (Quality)
KUG-3	Effluent discharge end-of-pipe at Final Discharge Point from the Sewage Lagoon to the Wetland Treatment Area	Active (Quality)
KUG-4	Outfall area for the Wetland Treatment Area	Active (Quality)
KUG-5	Effluent discharge and run-off from the Landfarm Facility (controlled discharge)	Active (Quality)
KUG-6	Effluent discharge (controlled discharge)from the Old Sewage Lagoon	New/Active (Quality)
KUG-7	Thermistor readings in accordance with approved Temperature Monitoring Program for the Sewage Lagoon Dyke under Part F Item 2b	New/Active (Temperature)

2. The Licensee shall measure and record, in cubic metres, the daily, monthly, and annual quantities of Water extracted for all purposes at Monitoring Program Station KUG-1.

3. The Licensee shall sample monthly at Monitoring Program Station KUG-2, KUG-3 and KUG-4 during periods of observed flow and annual discharges.

4. All Samples obtained at KUG-2, KUG-3, KUG-4 and KUG-6 shall be analyzed for the following parameters:

Biological Oxygen Demand (BOD_5)	Fecal Coliforms
pH	Conductivity
Total Suspended Solids	Oil and Grease (visual)
Nitrate-Nitrite	Ammonia Nitrogen
Chloride	Sulphate
Sodium	Potassium
Magnesium	Calcium
Total Hardness	Total Alkalinity

Total Arsenic
Total Cadmium
Total Cobalt
Total Copper
Total Lead
Total Mercury
Total Zinc
Total Phenols
Total Aluminum
Total Chromium
Total Iron
Total Manganese
Total Nickel
Carbonaceous Biochemical Oxygen Demand (CBOD)

5. The Licensee shall sample monthly at Monitoring Program Station KUG-3, during periods of observed flow and annual discharges to verify compliance with effluent quality criteria under Part D Item 2.

6. The Licensee shall carry out inspections at Monitoring Program Stations KUG-2, KUG-3 and KUG-4, weekly from May to October inclusive, to determine Effluent or water flow in order to fulfill the monitoring requirements of Part H, Item 4 and 5. A record of inspections shall be retained and made available to an Inspector upon request.

7. The Licensee shall sample prior to discharge at Monitoring Program Station KUG-5, to verify compliance with Effluent quality criteria under Part D, Item 6.

8. All samples obtained at KUG-5 shall be analyzed for the following parameters:

pH
Total Suspended Solids
Total Hardness
Oil and Grease (visual)
Total Petroleum Hydrocarbons (TPH)
Polycyclic Aromatic Hydrocarbons (PAH)
BTEX:
Benzene
Toluene
Ethylbenzene
Xylene
Conductivity
Total Copper
Total Mercury
Total Zinc
Total Chromium
Total Lead
Nickel
Total Arsenic
Total Cadmium
PCB (Polychlorinated biphenyls

9. The Licensee shall sample prior to discharge at Monitoring Program Station KUG-6, to verify compliance with Effluent quality criteria under Part D, Item 2.

10. Additional monitoring stations, sampling and analysis may be requested by an Inspector.

11. The Licensee shall submit to the Board for review, within ninety (90) days of the date of issuance of the Licence, a Quality Assurance/Quality Control Plan based on the guidance document entitled *Quality Assurance (QA) and Quality Control (QC) Guidelines For Use by Class "B" Licences in Collecting Representative Water Samples in the Field and for Submission of a QAQC Plan* INAC (1996). The submitted Plan shall include a cover letter from an accredited laboratory confirming acceptance of the Plan for the monitoring

and analyses to be performed under the Licence.

12. The Licensee shall conduct all sampling, sample preservation and analyses in accordance with methods prescribed in the current edition of *Standard Methods for the Examination of Water and Wastewater*, or by such other methods approved by a laboratory certified by the Canadian Association for Laboratory Accreditation (CALA) or otherwise approved by the Board.

13. All analyses shall be performed in a laboratory accredited according to ISO/IEC Standard 17025. The accreditation shall be current and in good standing.

14. The Licensee shall monitor temperature at Monitoring Station(s) KUG-7 a minimum of twice annually, in early spring and mid to late fall or in accordance with the Sewage Lagoon Dyke Monitoring Program requested under Part F, Item 1b and 1c.

15. The Licensee shall provide the temperature readings at different depths at Monitoring Station(s) KUG-7 within the annual report, due no later than March 31. An annual evaluation of the geothermal data of the Sewage Disposal Facility shall be provided as an addendum to the Annual Report.

16. The Licensee shall include all of the data and information of the Monitoring Program, as required under Part B, Item 1(a), or as requested by an Inspector.

17. Modifications to the Monitoring Program including the Monitoring Program Stations and parameters may be made only upon written approval of the Board.

Appendix: B-1

Effluent Samples Results: Taiga Lab

Water Licence 3BM KUG 1520

Hamlet of Kugluktuk, NU

Taiga Environmental Laboratory
4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9
Tel: (867)-765-6645 Fax: (867)-873-2652

Taiga Batch No.: 150746

- FINAL REPORT -

Prepared For: Hamlet of Kugluktuk

Address: P.O. Box 271
Kugluktuk, NU,X0B 0E0

Attn: George Egotak **Facsimile:** 867-982-3060

Final report has been reviewed and approved by:

Glen Hudy
Quality Assurance Officer

NOTES:

- Test methods and data are validated by the laboratory's Quality Assurance Program. Taiga Environmental Laboratory is accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) to ISO/IEC 17025 as a testing laboratory for specific tests registered with CALA.
- Routine methods are based on recognized procedures from sources such as
  - Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF;
  - Environment Canada
  - USEPA
- Samples shall be kept for thirty (30) days after the final report is issued. All microbiological samples shall be disposed of immediately upon completion of analysis to minimize biohazardous risks to laboratory personnel. Please contact the laboratory if you have any special requirements.
- Final results are based on the specific tests at the time of analysis and do not represent the conditions during sampling.

ReportDate: Tuesday, September 08, 2015
Print Date: *Tuesday, September 08, 2015*

Taiga Environmental Laboratory
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Tel: (867)-765-6645 Fax: (867)-873-2652

Taiga Batch No.: 150746

- CERTIFICATE OF ANALYSIS -

Client Sample ID: KUG-2 **Taiga Sample ID:** 001

Client Project:
Sample Type: Water
Received Date: 25-Aug-15
Sampling Date: 24-Aug-15
Sampling Time: 11:00
Location: Kugluktuk
Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Nutrients						
Ammonia as Nitrogen	0.008	0.005	mg/L	27-Aug-15	SM4500-NH3:G	
Biochemical Oxygen Demand	3	2	mg/L	26-Aug-15	SM5210:B	
CBOD	3	2	mg/L	26-Aug-15	SM5210:B	
Inorganics - Physicals						
Alkalinity, Total (as CaCO3)	312	0.4	mg/L	25-Aug-15	SM2320:B	
Conductivity, Specific (@25C)	714	0.4	µS/cm	25-Aug-15	SM2510:B	
pH	7.97		pH units	25-Aug-15	SM4500-H:B	
Solids, Total Suspended	3	3	mg/L	27-Aug-15	SM2540:D	
Major Ions						
Calcium	79.2	0.1	mg/L	25-Aug-15	SM4110:B	
Chloride	45.6	0.7	mg/L	25-Aug-15	SM4110:B	
Hardness	356	0.7	mg/L	25-Aug-15	SM4110:B	
Magnesium	38.4	0.1	mg/L	25-Aug-15	SM4110:B	
Nitrate as Nitrogen	0.09	0.01	mg/L	25-Aug-15	SM4110:B	

ReportDate: Tuesday, September 08, 2015
Print Date: ***Tuesday, September 08, 2015***

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Taiga Batch No.: 150746

- CERTIFICATE OF ANALYSIS -

Client Sample ID: KUG-2 **Taiga Sample ID:** 001

Nitrite as Nitrogen	0.01	0.01	mg/L	25-Aug-15	SM4110:B
Potassium	0.5	0.1	mg/L	25-Aug-15	SM4110:B
Sodium	25.2	0.1	mg/L	25-Aug-15	SM4110:B
Sulphate	8	1	mg/L	25-Aug-15	SM4110:B
Microbiology					
Coliforms, Fecal	7	1	CFU/100mL	25-Aug-15	SM9222:D
Organics					
Oil and Grease, visible	Non-visible			31-Aug-15	Visual Exam
Trace Metals, Total					
Aluminum	114	5	µg/L	04-Sep-15	EPA200.8
Arsenic	0.5	0.2	µg/L	04-Sep-15	EPA200.8
Cadmium	0.2	0.1	µg/L	04-Sep-15	EPA200.8
Chromium	0.5	0.1	µg/L	04-Sep-15	EPA200.8
Cobalt	< 0.1	0.1	µg/L	04-Sep-15	EPA200.8
Copper	7.6	0.2	µg/L	04-Sep-15	EPA200.8
Iron	114	5	µg/L	04-Sep-15	EPA200.8
Lead	0.2	0.1	µg/L	04-Sep-15	EPA200.8
Manganese	13.4	0.1	µg/L	04-Sep-15	EPA200.8
Nickel	0.9	0.1	µg/L	04-Sep-15	EPA200.8
Zinc	8.9	5	µg/L	04-Sep-15	EPA200.8

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Taiga Batch No.: 150746

- CERTIFICATE OF ANALYSIS -

Client Sample ID: KUG-3 **Taiga Sample ID:** 002

Client Project:
Sample Type: Water
Received Date: 25-Aug-15
Sampling Date: 24-Aug-15
Sampling Time: 11:00
Location: Kugluktuk
Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Nutrients						
Ammonia as Nitrogen	21.5	0.005	mg/L	27-Aug-15	SM4500-NH3:G	
Biochemical Oxygen Demand	61	2	mg/L	26-Aug-15	SM5210:B	
CBOD	54	2	mg/L	26-Aug-15	SM5210:B	
Inorganics - Physicals						
Alkalinity, Total (as CaCO3)	150	0.4	mg/L	25-Aug-15	SM2320:B	
Conductivity, Specific (@25C)	507	0.4	µS/cm	25-Aug-15	SM2510:B	
pH	7.25		pH units	25-Aug-15	SM4500-H:B	
Solids, Total Suspended	62	3	mg/L	27-Aug-15	SM2540:D	
Major Ions						
Calcium	9.6	0.1	mg/L	25-Aug-15	SM4110:B	
Chloride	39.1	0.7	mg/L	25-Aug-15	SM4110:B	
Hardness	41.9	0.7	mg/L	25-Aug-15	SM4110:B	
Magnesium	4.3	0.1	mg/L	25-Aug-15	SM4110:B	
Nitrate as Nitrogen	0.13	0.01	mg/L	25-Aug-15	SM4110:B	
Nitrite as Nitrogen	0.01	0.01	mg/L	25-Aug-15	SM4110:B	
Potassium	16.1	0.1	mg/L	25-Aug-15	SM4110:B	

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Taiga Batch No.: 150746

- CERTIFICATE OF ANALYSIS -

Client Sample ID: KUG-3 **Taiga Sample ID:** 002

Sodium	36.9	0.1	mg/L	25-Aug-15	SM4110:B
Sulphate	13	1	mg/L	25-Aug-15	SM4110:B
Microbiology					
Coliforms, Fecal	55000	1000	CFU/100mL	25-Aug-15	SM9222:D
Organics					
Oil and Grease, visible	Non-visible			31-Aug-15	Visual Exam
Trace Metals, Total					
Aluminum	196	5	µg/L	04-Sep-15	EPA200.8
Arsenic	0.5	0.2	µg/L	04-Sep-15	EPA200.8
Cadmium	0.2	0.1	µg/L	04-Sep-15	EPA200.8
Chromium	0.6	0.1	µg/L	04-Sep-15	EPA200.8
Cobalt	0.4	0.1	µg/L	04-Sep-15	EPA200.8
Copper	30.9	0.2	µg/L	04-Sep-15	EPA200.8
Iron	578	5	µg/L	04-Sep-15	EPA200.8
Lead	0.5	0.1	µg/L	04-Sep-15	EPA200.8
Manganese	33.9	0.1	µg/L	04-Sep-15	EPA200.8
Nickel	1.9	0.1	µg/L	04-Sep-15	EPA200.8
Zinc	29.2	5	µg/L	04-Sep-15	EPA200.8

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Tel: (867)-765-6645 Fax: (867)-873-2652

Taiga Batch No.: 150746

- CERTIFICATE OF ANALYSIS -

Client Sample ID: KUG-4 **Taiga Sample ID:** 003

Client Project:
Sample Type: Water
Received Date: 25-Aug-15
Sampling Date: 24-Aug-15
Sampling Time: 11:00
Location: Kugluktuk
Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Nutrients						
Ammonia as Nitrogen	0.662	0.005	mg/L	27-Aug-15	SM4500-NH3:G	
Biochemical Oxygen Demand	7	2	mg/L	26-Aug-15	SM5210:B	
CBOD	2	2	mg/L	26-Aug-15	SM5210:B	
Inorganics - Physicals						
Alkalinity, Total (as CaCO3)	115	0.4	mg/L	25-Aug-15	SM2320:B	
Conductivity, Specific (@25C)	745	0.4	µS/cm	25-Aug-15	SM2510:B	
pH	7.50		pH units	25-Aug-15	SM4500-H:B	
Solids, Total Suspended	5	3	mg/L	27-Aug-15	SM2540:D	
Major Ions						
Calcium	29.5	0.1	mg/L	25-Aug-15	SM4110:B	
Chloride	146	0.7	mg/L	25-Aug-15	SM4110:B	
Hardness	176	0.7	mg/L	25-Aug-15	SM4110:B	
Magnesium	24.7	0.1	mg/L	25-Aug-15	SM4110:B	
Nitrate as Nitrogen	1.76	0.01	mg/L	25-Aug-15	SM4110:B	
Nitrite as Nitrogen	0.08	0.01	mg/L	25-Aug-15	SM4110:B	
Potassium	4.1	0.1	mg/L	25-Aug-15	SM4110:B	

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Print Date: ***Tuesday, September 08, 2015***

Taiga Environmental Laboratory
4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9
Tel: (867)-765-6645 Fax: (867)-873-2652

Taiga Batch No.: 150746

- CERTIFICATE OF ANALYSIS -

Client Sample ID: KUG-4 **Taiga Sample ID:** 003

Sodium	78.9	0.1	mg/L	25-Aug-15	SM4110:B
Sulphate	27	1	mg/L	25-Aug-15	SM4110:B
Microbiology					
Coliforms, Fecal	13	1	CFU/100mL	25-Aug-15	SM9222:D
Organics					
Oil and Grease, visible	Non-visible			31-Aug-15	Visual Exam
Trace Metals, Total					
Aluminum	40.2	5	µg/L	04-Sep-15	EPA200.8
Arsenic	0.5	0.2	µg/L	04-Sep-15	EPA200.8
Cadmium	0.2	0.1	µg/L	04-Sep-15	EPA200.8
Chromium	0.4	0.1	µg/L	04-Sep-15	EPA200.8
Cobalt	0.4	0.1	µg/L	04-Sep-15	EPA200.8
Copper	6.3	0.2	µg/L	04-Sep-15	EPA200.8
Iron	838	5	µg/L	04-Sep-15	EPA200.8
Lead	< 0.1	0.1	µg/L	04-Sep-15	EPA200.8
Manganese	293	0.1	µg/L	04-Sep-15	EPA200.8
Nickel	3.3	0.1	µg/L	04-Sep-15	EPA200.8
Zinc	< 5.0	5	µg/L	04-Sep-15	EPA200.8

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Taiga Batch No.: 150746

- CERTIFICATE OF ANALYSIS -

Client Sample ID: KUG-5 **Taiga Sample ID:** 004

Client Project:
Sample Type: Water
Received Date: 25-Aug-15
Sampling Date: 24-Aug-15
Sampling Time: 11:00
Location: Kugluktuk
Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Physicals						
pH	7.65		pH units	25-Aug-15	SM4500-H:B	
Organics						
Hexane Extractable Material	< 2.0	2.0	mg/L	28-Aug-15	EPA1664A	
Subcontracted Organics						
Benzene		0.0005	mg/L		EPA 5021	111
Ethylbenzene		0.0005	mg/L		EPA 5021	111
Phenols, Total	0.0045	0.001	mg/L	31-Aug-15	AB ENV.06537	
Polychlorinated Biphenyls	< 0.00005	0.00005	mg/L	31-Aug-15	EPA3510	
Toluene		0.0005	mg/L		EPA 5021	111
Xylenes		0.0005	mg/L		EPA 5021	111
Trace Metals, Dissolved						
Cadmium	0.15	0.05	µg/L	04-Sep-15	EPA200.8	
Chromium	0.2	0.1	µg/L	04-Sep-15	EPA200.8	
Cobalt	0.3	0.1	µg/L	04-Sep-15	EPA200.8	
Copper	1.5	0.2	µg/L	04-Sep-15	EPA200.8	
Lead	< 0.1	0.1	µg/L	04-Sep-15	EPA200.8	

ReportDate: Tuesday, September 08, 2015
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Tel: (867)-765-6645 Fax: (867)-873-2652

Taiga Batch No.: 150746

- CERTIFICATE OF ANALYSIS -

Client Sample ID: KUG-5 **Taiga Sample ID:** 004

Nickel	6.2	0.1	µg/L	04-Sep-15	EPA200.8
Trace Metals, Total					
Arsenic	0.9	0.2	µg/L	04-Sep-15	EPA200.8
Mercury	0.03	0.01	µg/L	04-Sep-15	EPA200.8

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Tel: (867)-765-6645 Fax: (867)-873-2652

Taiga Batch No.: 150746

- CERTIFICATE OF ANALYSIS -

Client Sample ID: KUG-5 **Taiga Sample ID:** 004

- DATA QUALIFERS -

Data Qualifier Descriptions:

111 *Vial contained air bubble, analysis not possible*

*** Taiga analytical methods are based on the following standard analytical methods**

SM - Standard Methods for the Examination of Water and Wastewater

EPA - United States Environmental Protection Agency

Appendix: B-2

Effluent Samples Results: ALS Lab

Water Licence 3BM KUG 1520

Hamlet of Kugluktuk, NU

Stantec Consulting Ltd.
ATTN: KEN JOHNSON
10160 112 Street
7/FL North Tower
Edmonton AB T5K 2L6

Date Received: 09-JUL-15
Report Date: 15-JUL-15 15:34 (MT)
Version: FINAL

Client Phone: 780-969-1022

Certificate of Analysis

Lab Work Order #: L1640150

Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers: 14-440330
Legal Site Desc:

Jessica Spira, Env. Tech. DIPL
Senior Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1640150-1 KUGLUKTUK LAGOON							
Sampled By: CLIENT on 08-JUL-15 @ 12:00							
Matrix: GRAB							
Miscellaneous Parameters							
Ammonia, Total (as N)	39.3		0.050	mg/L		15-JUL-15	R3225958
Biochemical Oxygen Demand	72.8		2.0	mg/L		10-JUL-15	R3225952
MPN - Fecal Coliforms	3000	DLA	100	MPN/100mL		10-JUL-15	R3223971
Total Suspended Solids	61.5		3.0	mg/L		13-JUL-15	R3225121
L1640150-2 KUGLUKTUK LAGOON							
Sampled By: CLIENT on 09-JUL-15 @ 09:00							
Matrix: GRAB							
Miscellaneous Parameters							
Ammonia, Total (as N)	36.6		0.050	mg/L		15-JUL-15	R3225958
Biochemical Oxygen Demand	82.9		2.0	mg/L		10-JUL-15	R3225952
MPN - Fecal Coliforms	4500	DLA	100	MPN/100mL		10-JUL-15	R3223971
Total Suspended Solids	71.1		3.0	mg/L		13-JUL-15	R3225121

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Qualifiers for Individual Samples Listed:

Sample Numbe	Client ID	Qualifier	Description
L1640150-1	KUGLUKTUK LAGOON	MBHT	FCOLI-MPN-ED - The APHA 30 hour hold time was exceeded for microbiological testing. Samples processed within 48 hours from time of sampling may be valid in some cases (refer to Health Canada guidance).
L1640150-2	KUGLUKTUK LAGOON	MBHT	FCOLI-MPN-ED - The APHA 30 hour hold time was exceeded for microbiological testing. Samples processed within 48 hours from time of sampling may be valid in some cases (refer to Health Canada guidance).

Sample Parameter Qualifier Key:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BOD-ED	Water	Biochemical Oxygen Demand (BOD)	APHA 5210 B-5 day Incub.-O2 electrode
FCOLI-MPN-ED	Water	Thermotolerant Coliforms by MPN	APHA 9223B, 2004 Enzyme Substrate Method
Analysis is carried out using procedures adapted from APHA 9223 "Enzyme Substrate Coliform Test". Fecal Coliform (Thermotolerant) bacteria are determined by mixing sample with a mixture of hydrolyzable substrates and then sealed in a multi-well packet. The packet is incubated for 18-24 hours and the number of wells exhibiting a positive response are counted. The final result is obtained by comparing the positive responses to a probability table.			
NH3-CFA-ED	Water	Ammonia in Water by Colour	APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out using procedures adapted from APHA Method 4500 NH3 "NITROGEN (AMMONIA)". Ammonia is determined using the automated phenate colourimetric method.			
SOLIDS-TOTSUS-ED	Water	Total Suspended Solids	APHA 2540 D-Gravimetric
Gravimetric determination of solids in waters by filtration and drying filter at 104 degrees Celsius.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA

Chain of Custody Numbers:

14-440330

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

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

Quality Control Report

Workorder: L1640150 Report Date: 15-JUL-15

Client: Stantec Consulting Ltd.
10160 112 Street 7/FL North Tower
Edmonton AB T5K 2L6
Contact: KEN JOHNSON

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BOD-ED	**Water**							
Batch R3225952								
WG2126273-2 LCS								
Biochemical Oxygen Demand			87.4		%		85-115	10-JUL-15
WG2126273-3 MB								
Biochemical Oxygen Demand			<2.0		mg/L		2	10-JUL-15
FCOLI-MPN-ED	**Water**							
Batch R3223971								
WG2126227-1 MB								
MPN - Fecal Coliforms			<1		MPN/100mL		1	10-JUL-15
NH3-CFA-ED	**Water**							
Batch R3225958								
WG2128982-15 LCS								
Ammonia, Total (as N)			104.2		%		85-115	15-JUL-15
WG2128982-2 LCS								
Ammonia, Total (as N)			101.4		%		85-115	15-JUL-15
WG2128982-5 LCS								
Ammonia, Total (as N)			104.4		%		85-115	15-JUL-15
WG2128982-1 MB								
Ammonia, Total (as N)			<0.050		mg/L		0.05	15-JUL-15
WG2128982-13 MB								
Ammonia, Total (as N)			<0.050		mg/L		0.05	15-JUL-15
WG2128982-6 MB								
Ammonia, Total (as N)			<0.050		mg/L		0.05	15-JUL-15
SOLIDS-TOTSUS-ED	**Water**							
Batch R3225121								
WG2127372-2 LCS								
Total Suspended Solids			95.0		%		85-115	13-JUL-15
WG2127372-5 LCS								
Total Suspended Solids			94.8		%		85-115	13-JUL-15
WG2127372-8 LCS								
Total Suspended Solids			100.2		%		85-115	13-JUL-15
WG2127372-1 MB								
Total Suspended Solids			<3.0		mg/L		3	13-JUL-15
WG2127372-4 MB								
Total Suspended Solids			<3.0		mg/L		3	13-JUL-15
WG2127372-7 MB								
Total Suspended Solids			<3.0		mg/L		3	13-JUL-15

Quality Control Report

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Quality Control Report

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Bacteriological Tests							
Thermotolerant Coliforms by MPN							
	1	08-JUL-15 12:00	10-JUL-15 10:30	30	47	hours	EHTR

Legend & Qualifier Definitions:

EHTR-FM:	Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR:	Exceeded ALS recommended hold time prior to sample receipt.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1640150 were received on 09-JUL-15 22:07.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here
(lab use only)

COC Number: 14 - 440330

Page 1 of 1

Report To	KEN JOHNSON	**Report Format / Distribution**	**Select Service Level Below** (Rush Turnaround Time (TAT) is not available for all tests)
Company:	STANTEC	Select Report Format: ☑ PDF ☐ EXCEL ☐ EDD (DIGITAL)	R ☑ Regular (Standard TAT if received by 3pm)
Contact:	SAME	Quality Control (QC) Report with Report ☑ Yes ☐ No	P ☐ Priority (2-4 business days if received by 3pm)
Address:	EDMONTON	☑ Criteria on Report - provide details below if box checked	E ☐ Emergency (1-2 business days if received by 3pm)
Phone:	780 984 9095	Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	E2 ☐ Same day or weekend emergency if received by 10am – contact ALS for surcharge.
		Email 1 or Fax KENNETH.JOHNSON@STANTEC.COM	Specify Date Required for E2,E or P:
Invoice To	Same as Report To ☑ Yes ☐ No	**Invoice Distribution**	**Analysis Request**
	Copy of Invoice with Report ☐ Yes ☐ No	Select Invoice Distribution: ☐ EMAIL ☐ MAIL ☐ FAX	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below
Company:		Email 1 or Fax	
Contact:		Email 2	
Project Information		**Oil and Gas Required Fields (client use)**	
ALS Quote #:		Approver ID:	Cost Center:
Job #:		GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)	L1640150	**ALS Contact:**	**Sampler:**

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	BOD	TSS	AMMONIA	FECAL COL	Number of Containers
	KUGLUKTUK LAGOON	16JUL15	NOON	GRAB	✓	✓	✓	✓	
	KUGLUKTUK LAGOON	29JUL15	9AM	GRAB	✓	✓	✓	✓	

L1640150-COFC

Drinking Water (DW) Samples[1] (client use)	**Special Instructions / Specify Criteria to add on report (client Use)**	**SAMPLE CONDITION AS RECEIVED (lab use)**
Are samples taken from a Regulated DW System? ☐ Yes ☑ No		Frozen ☐ SIF Observations Yes ☐ No ☐
Are samples for human drinking water use? ☐ Yes ☑ No		Ice packs Yes ☐ No ☐ Custody seal intact Yes ☐ No ☐
		Cooling Initiated ☐
		INITIAL COOLER TEMPERATURES °C: 10.7°C / FINAL COOLER TEMPERATURES °C:

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by: RJ	Date: 29/07/15	Time: 10:07pm	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM-0326e v08 Front/03 October 2013

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

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