DILLON CONSULTING

GOVERNMENT OF NUNAVUT – DEPARTMENT OF COMMUNITY AND GOVERNMENT SERVICES

Rankin Inlet Wastewater Effluent Study

Final SOA 2013-33

March 2020 – 18-8483

March 31, 2020

DILLON CONSULTING

4920 47th Street
Suite 303
Yellowknife
Northwest Territories
Canada
X1A 2P1
Telephone
867.920.4555
Fax
867.873.3328

Department of Community and Government Services
Government of Nunavut, Kivalliq Region
P.O. Box 490
Rankin Inlet, NU
X0C 0G0

Attention: Sarah Collins, Municipal Planning Engineer
Megan Lusty, Project Manager

Rankin Inlet Wastewater Effluent Study Report - Final

Please find the final Rankin Inlet Wastewater Effluent Study report.

We trust this meets your requirements. Please contact us if you have any questions please contact myself at (506) 633-5000 ext. 5411.

Sincerely,

DILLON CONSULTING LIMITED

REGISTERED PROFESSIONAL ENGINEER
K.R. MACINTYRE
LICENSEE
NT/NU

Kyle MacIntyre

Digitally signed by Kyle MacIntyre
DN: cn=Kyle MacIntyre, c=CA, o=Dillon Consulting, ou=Engineering, email=kmacintyre@dillon.ca
Date: 2020.06.16 10:26:20 -03'00'

Alexander Williams, P.Eng.
Project Manager, Associate

THE ASSOCIATION OF PROFESSIONAL ENGINEERS, GEOLOGISTS and GEOPHYSICISTS OF THE NORTHWEST TERRITORIES
PERMIT NUMBER
P 010
DILLON CONSULTING LIMITED

Table of Contents

Figures

Tables

Appendices

Acronyms, Units, Definitions

Acronyms

ADF	Average Daily Flow
ASTM	American Society for Testing and Materials
CBOD5	5 day Carbonaceous Biochemical Oxygen Demand
CCME	Canadian Council of Ministers of the Environment
CEQG	Canadian Environmental Quality Guidelines
CGS	Department of Community and Government Services
COD	Chemical Oxygen Demand
CORMIX	Cornell Mixing Zone
CTD	Conductivity, Temperature, Depth
DFO	Fisheries and Oceans Canada (Department of)
DO	Dissolved Oxygen
ECCC	Environment and Climate Change Canada
EDO	Effluent Discharge Objective
EEM	Environmental Effects Monitoring
EQO	Environmental Quality Objective
ERA	Environmental Risk Assessment
ERRIS	Effluent Regulatory Reporting Information System
FWAL	Fresh Water Aquatic Life (guideline)
GN	Government of Nunavut
GPS	Global Positioning System
HDPE	High Density Polyethylene
IMZ	Initial Mixing Zone
LC50	Lethal Concentration for 50% mortality
MAL	Marine Aquatic Life (guideline)
NPS	National Performance Standards
NWB	Nunavut Water Board
NWTWB	Northwest Territories Water Board
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated biphenyl
PS	Pump Station
PSU	Practical Salinity Units
RFQ	Request for Quote
QA/QC	Quality Assurance/Quality Control
SARA	*Species At Risk Act*
SCC	Standards Council Canada
SOPC	Substance of Potential Concern
STF	Sewage Treatment Facility

TIN	Total Inorganic Nitrogen
TKN	Total Kjeldahl Nitrogen
TOG	Total Oil and Grease
TP	Total Phosphorus
TRC	Total Residual Chlorine
TSS	Total Suspended Solids
USEPA	United States Environmental Protection Agency
VEC	Valued Ecosystem Component
VFD	Variable Frequency Drive
VOC	Volatile Organic Compound
WET	Whole Effluent Toxicity
WSER	Wastewater Systems Effluent Regulations
WWE	Wastewater effluent
WWTF	Wastewater Treatment Facility

Units

CFU	Colony Forming Unit
dL	deci-liter
km	kilometers
Lpcd	liters per capita per day
m	meters
mg/L	milligram per liter
ug/L	micrograms per liter
mm	millimeters
m^3/d	meters cubed per day
MGD	Million gallons per day
MPN	Most Probable Number

Definitions

Anadromous – Fish that live in marine environments but enter freshwater to spawn.

Deleterious substance (*Fisheries Act* Definition) – Substance that would degrade or alter the quality of water so that it is rendered deleterious to fish or fish habitat or to the use of fish by people.

Discharge Objectives – Objectives developed to specify the concentration/loads of substances in the effluent discharge that will result in achieving the corresponding Environmental Quality Objectives in the receiving environment, at the edge of the allocated mixing zone, when there is one.

Mixing Zone (allocated) – The *Canada-wide Strategy for Management of Municipal Wastewater* defines a mixing zone for the purposes of calculating assimilative capacity for the effluent discharge. It is defined as “the area contiguous with a point source or a delimited non-point source where the discharge mixes

the ambient water and where concentrations of some substances may not comply with water quality guidelines or objectives". A series of criteria are applied, including:

- Conditions within the mixing zone should not cause acute toxicity to aquatic organisms;
- A zone of passage for mobile aquatic organisms must be maintained; and
- The zones dimensions are restricted (e.g., 100 m in length and 25-33% of stream flow).

Substances of Potential Concern – Substances identified as potentially of concern, for initial characterization for a particular sized facility, including a list of priority substances plus additional associated with local industry.

Executive Summary

The Rankin Inlet wastewater effluent study (the Study) was requested by the Government of Nunavut (GN), Department of Community and Government Services (CGS). The specific Study objectives were identified in the Request for Quote (RFQ) (July 2018) as:

- To conduct a municipal wastewater effluent characterization for the Rankin Inlet wastewater; and
- To assess the extent of impact of the municipal wastewater effluent discharge on the marine environment in Rankin Inlet.

The wastewater characterization was conducted based on effluent water chemistry collected monthly by GN-CGS from 2017 to August 2019. This data was supplemented by two sets of manual 24 hour composite effluent samples collected by Dillon Consulting Limited (Dillon) on October 16 and 17, 2018 and February 21, 2019. During the Dillon effluent sampling water was also collected for toxicity testing (rainbow trout LC50 as per Environmental Protection Series Biological Test Method EPS/1/RM/13). During the October 2018 field visit, Dillon conducted a qualitative dye study (as per the Request for Proposal) to assist with review of receiving water conditions.

Wastewater characterization from sampling completed by Dillon identified that Total Suspended Solids (TSS) and Biochemical Oxygen Demand (CBOD5) exceed guidance established under the *Canada-wide Strategy for Management of Municipal Wastewater*. As well, additional parameters exceeded the applicable Canadian Environmental Quality Guidelines (CEQG) for the marine receiving environment. Based on available effluent chemistry for toxicity testing and review of receiving environment CEQG, potential contaminants of concern are identified as: TSS and CBOD5 (in relation to Dissolved Oxygen), un-ionized ammonia, copper, zinc, and potentially total phenols and Total Oil and Grease (TOG).

Historic and October 2018 background samples from the receiving environment also had concentrations of some metals (e.g., copper, iron, lead) exceed CEQG. Potential marine receptors include fish and marine mammals in the larger receiving environment of Prairie Bay.

It is understood that as part of the on-going discussion between the territories and the federal agencies, further direction is pending on potential effluent criteria for the North. Effluent treatment design requirements for Rankin Inlet will be identified at that time. The data collected during this wastewater characterization study will contribute to future design criteria.

1.0 Introduction

The Rankin Inlet wastewater effluent study (the Study) was requested by the Government of Nunavut (GN), Department of Community and Government Services (CGS). The specific Study objectives were identified in the Request for Quote (RFQ) (July 2018) as:

- To conduct a municipal wastewater effluent characterization for the Rankin Inlet wastewater; and
- To assess the extent of impact of the municipal wastewater effluent discharge on the marine environment in Rankin Inlet.

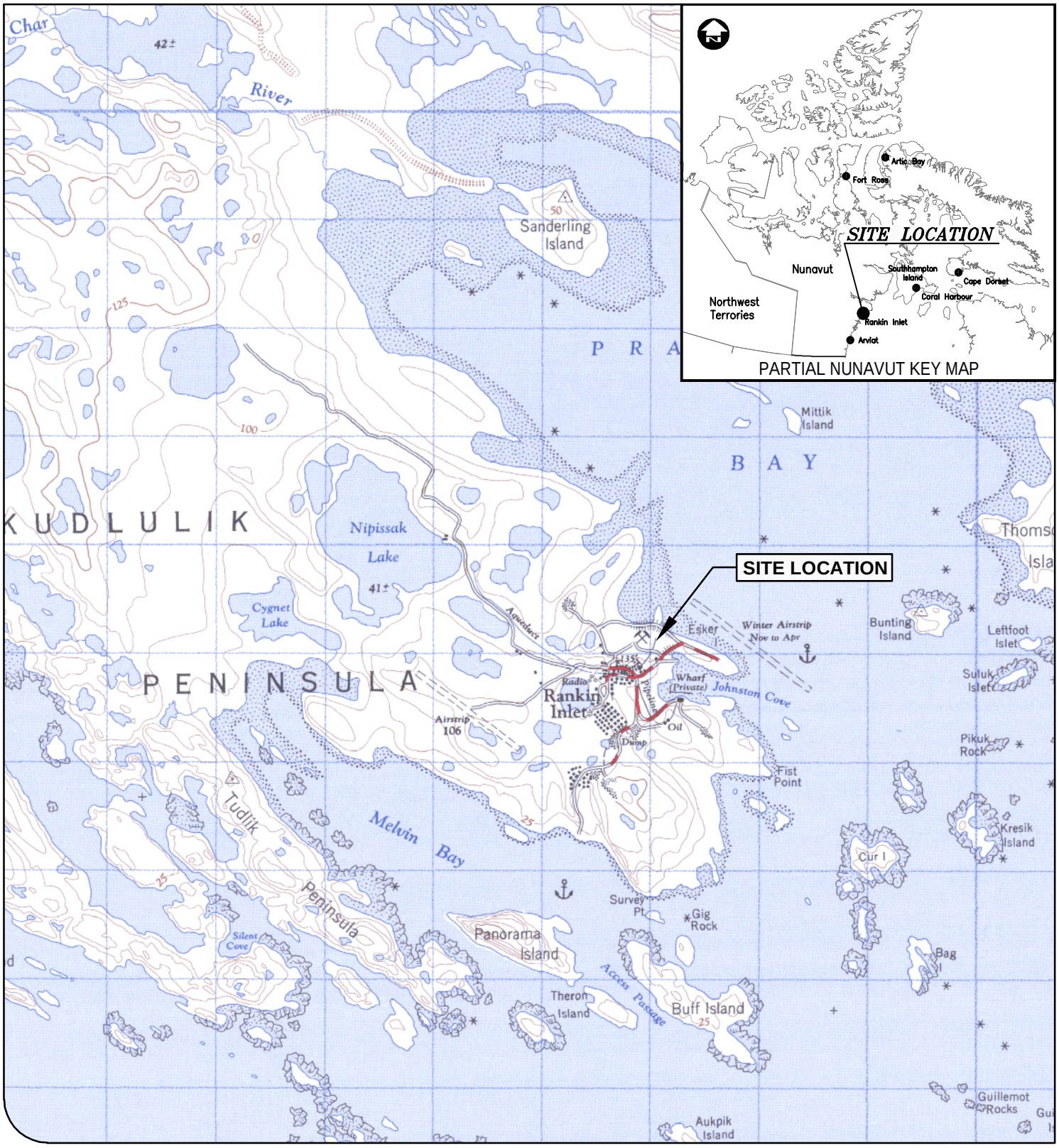
1.1 Background

The Rankin Inlet wastewater facility is located within the community of Rankin Inlet, Nunavut on the northwest coast of Hudson Bay, as shown in Figure 1. Currently, the community of Rankin Inlet consists of a population of approximately 2,900 and has water and wastewater infrastructure that is operated by CGS.

The existing wastewater collection system includes two gravity catchments that feed two lift stations, Nuvuk Lift Station and Johnson Cove Lift Station. These two lift stations have the ability to accept trucked sewage from the few resident/commercial locations that are not on the existing collection system. Wastewater from the entire community is then conveyed from these lift stations to the wastewater treatment facility (WWTF), the location of which is identified in Figures 2 and 3. The WWTF consists of; a splitter tank which diverts flows to either one of two screening channels; an in-channel vertical grinder, an in-channel auger-screen to remove large solids, and a discharge tank where self-priming pumps are installed to operate during unusually high tide conditions. Solids collected from the screening systems are transported to the Rankin Inlet Landfill.

During the winter months, bleeders are used in the collection system to prevent freezing of both the potable water and sanitary gravity lines throughout the utilidor, resulting in dilution of the wastewater. A small amount of water is also added to the system to wash the auger brushes.

Effluent is discharged through a diffuser into Prairie Bay (Hudson Bay, Arctic Ocean) via a 300mm diameter buried insulated High Density Polyethylene (HDPE) outfall pipe. The outfall extends approximately 320 m seaward from the shoreline and discharges at a water depth of approximately 8 m. A diffuser (3 ports) was installed at the point of discharge initially in 1995. The outfall pipe was repaired in 2012 and the diffuser replaced in 2013 (GN-GCS 2015b).



GOVERNMENT OF NUNAVUT

RANKIN INLET WASTE WATER EFFLUENT STUDY
RANKIN INLET, NUNAVUT

SITE LOCATION MAP
FIGURE 1

DILLON CONSULTING

MAP/DRAWING INFORMATION
Toporama map 55K/16 (1:50K) by Natural Resources Canada. Publication date: 1967.

CREATED BY: TLR
CHECKED BY: MAB
DESIGNED BY: KRM

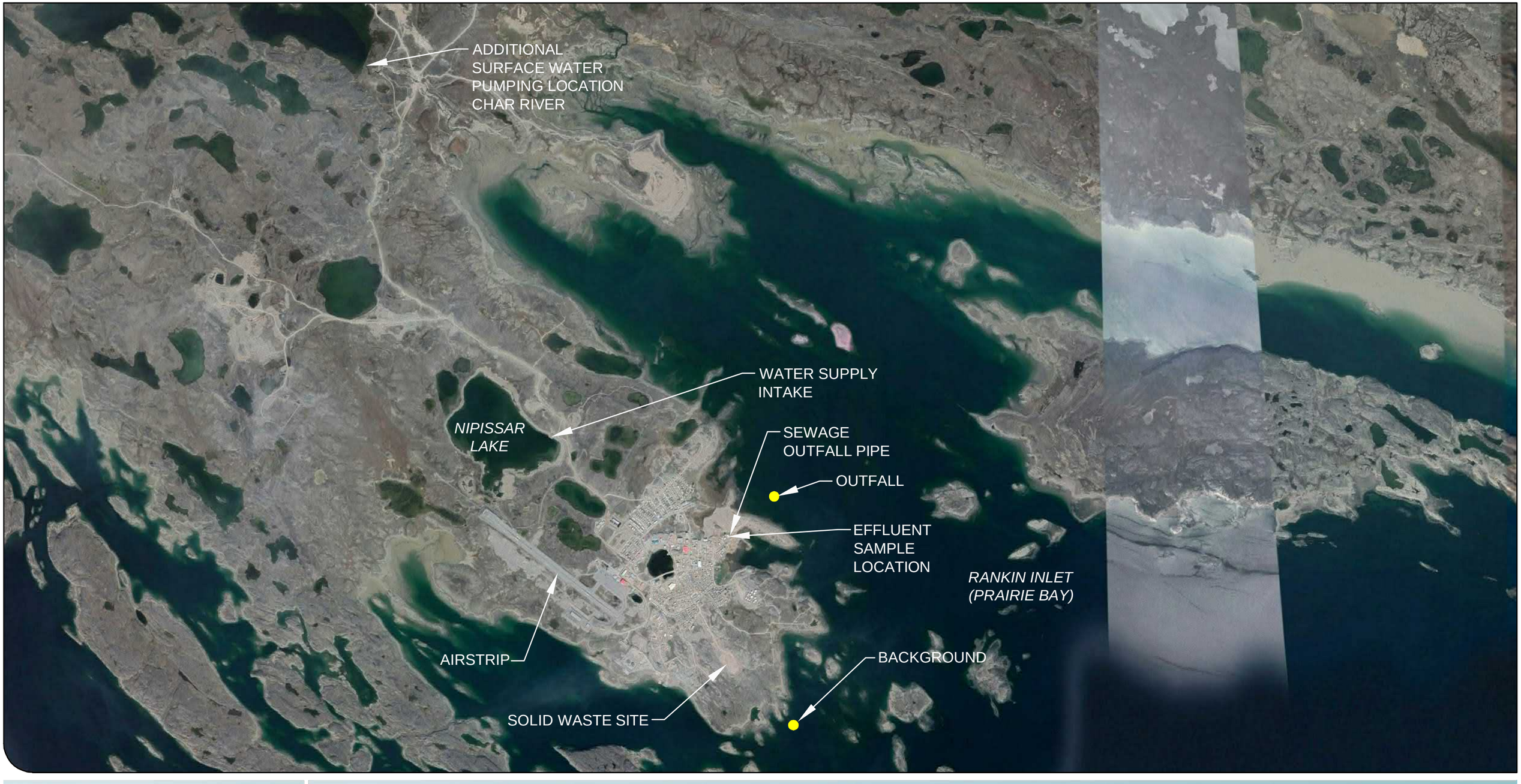
File Location:
c:\projectwise\working directory\projects 2018\50tlr\dms49361\188483-05-03-fig1.dwg
September, 10, 2019 3:30 PM

SCALE 1:50,000
0 250 500 1000m

N
W E
S

PROJECT: 18-8483

DATE: SEPTEMBER 2019



GOVERNMENT OF NUNAVUT
RANKIN INLET WASTE WATER EFFLUENT STUDY
RANKIN INLET, NUNAVUT

OVERALL SITE PLAN
FIGURE 2

File Location:
c:\projectwise\working directory\projects 2018\50tlr\dms49361\188483-05-03-fig 2.dwg
September, 10, 2019 4:38 PM

MAP/DRAWING INFORMATION
Dillon Consulting Limited, Rankin Inlet Utilidor System drawing, December 2017 and Google Earth Pro. Drawing information is approximate only, this is not a legal survey.

CREATED BY: TLR
CHECKED BY: MAB
DESIGNED BY: KRM

500 0 500
SCALE 1:30,000 METRES

N
W E
S

DILLON CONSULTING

PROJECT: 18-8483
DATE: SEPTEMBER 2019

GOVERNMENT OF NUNAVUT

RANKIN INLET WASTE WATER EFFLUENT STUDY
RANKIN INLET, NUNAVUT

OUTFALL LOCATION PLAN

FIGURE 3

File Location:
c:\projectwise\working directory\projects 2018\50tlr\dms49361\188483-05-03-fig 3.dwg
September, 10, 2019 4:46 PM

MAP/DRAWING INFORMATION
Dillon Consulting Limited, Rankin Inlet Utilidor System drawing, December 2017 and Google Earth Pro. Drawing information is approximate only, this is not a legal survey.

CREATED BY: TLR
CHECKED BY: MAB
DESIGNED BY: KRM

100 0 100
SCALE 1:4,000 METRES

N
W E
S

DILLON CONSULTING

PROJECT: 18-8483
DATE: SEPTEMBER 2019

In 2017 Environmental and Climate Change Canada (ECCC) issued a Direction to GN-CGS after determining that the effluent being deposited into Prairie Bay was deleterious and therefore in violation of the *Fisheries Act*. The Direction required the completion of a wastewater effluent characterization study and adherence to deadlines outlined in the Direction.

The RFQ outlined work required to meet the Direction requirement which is provided in this report.

1.2 Regulatory Framework

Land based disposal of municipal waste is authorized under the Nunavut Waters and Nunavut Surface Rights Tribunal Act, by the Nunavut Water Board (NWB). For discharge to a marine environment, the federal Department of Fisheries and Oceans Canada (DFO) and ECCC have jurisdiction under the *Fisheries Act*. The GN Department of Health has authority for wastewater effluent in relation to public health.

Guidance on wastewater discharge quality has been historically provided by the "Guidelines for the Discharge of Treated Municipal Wastewater in the Northwest Territories" (Northwest Territories Water Board- NWTWB 1992). A Canadian Council of Ministers of the Environment (CCME) national municipal wastewater strategy (the *Canada-wide Strategy*) was developed in 2009 and is implemented through the *Fisheries Act* Wastewater Systems Effluent Regulations (WSER) since 2012. The WSER (2012) do not currently apply to wastewater systems located in Nunavut. The *Canada-wide Strategy* noted that further collaboration was required between governments of the Far North and the federal government to develop performance standards and that current authorization requirements would apply in the interim. A working group is currently assessing a wide range of discharge objectives with respect to wastewater treatment in the north.

1.2.1 NWTWB Guidelines

The NWTWB Guidelines include receiving water quality objectives as noted in Table 1-1.

Table 1-1: NWTWB Receiving Water Quality Objectives

Parameter	Water Quality Objective* (for the Receiving Water Body, outside the Initial Mixing Zone - IMZ)
Dissolved Oxygen (DO)	Decrease not to exceed 10% of background (more stringent criteria may be applied based on sensitivity of environment)
Residual Chlorine	< 0.1 mg/L
Nutrients	Nuisance condition to be avoided
Coliforms	Geometric mean limit: Shellfish waters fecal coliform 14 count/dL All waters fecal coliform 100 count/dL All waters total coliform 1000 count/dL

Parameter	Water Quality Objective* (for the Receiving Water Body, outside the Initial Mixing Zone - IMZ)
Toxicity	Not permitted based on 96hr fish toxicity test
Suspended Solids (SS)	Not to increase above background by more than 10 mg/L
Floatable Solids and Scum	No observable increase
Oil and Grease	None visible on water surface and not >5mg/L
Metals	Increase not to exceed 10% of background

Note: The NWTWB Guidance states that more stringent criteria or additional parameters can be applied for protection of receiving water

The Guidelines for the discharge of treated municipal wastewater in the Northwest Territories (NWTWB 1992) applies a 100 m distance from the outfall as the Initial Mixing Zone (IMZ) (assuming not intruding on drinking water intakes, shellfish beds, recreational areas and biologically sensitive areas) and also permits untreated marine discharges (free of floatables and larger particles) but provides additional guidelines related to potential impacts on commercial and recreational endeavors. No condition is permitted within the IMZ that results in sudden fish kills and mortality of organisms passing through the zone or, that results in bio-concentration of toxic materials.

Guidelines for municipal effluent quality are also identified in the NWTWB document based on the wastewater flow, season and receiving environment. For the Rankin Inlet WWTF, the guidelines for 150-600 liters per capita per day (Lcpd) of effluent flowing into a marine receiving environment (Bay), are most relevant, and are identified in Table 1-2.

Table 1-2: NWTWB Marine Receiving Environment Guidelines for 150-600 Lcpd Effluent Flow

Parameter	Suggested Limit (mg/L)
Biochemical Oxygen Demand (BOD)	120
Suspended Solids (SS)	180
pH	within 6-9 units range

Additional parameter limits may be set if industrial or commercial components are a significant portion of the effluent discharge. Suggested limits (which may be adjusted based on background conditions) are noted in Table 1-3 below.

Table 1-3: NWTWB Additional Parameters and Suggested Limits (mg/L)

Parameter	Max. Conc.	Parameter	Max. Conc.	Parameter	Max. Conc.
Aluminum (total)	2	Cyanide (total)	0.1	Nickel (dissolved)	0.3
Arsenic (total)	0.05	Fluoride (dissolved)	5	Selenium (total)	0.05
Barium (dissolved)	1	Iron (dissolved)	0.3	Silver (total)	0.1

Parameter	Max. Conc.	Parameter	Max. Conc.	Parameter	Max. Conc.
Boron (dissolved)	5	Lead (dissolved)	0.05	Sulphate (dissolved)	500
Cadmium (dissolved)	0.005	Manganese(dissolved)	0.05	Sulphide (dissolved)	0.5
Chromium (total)	0.1	Mercury (total)	0.0006	Tin (total)	5
Cobalt (dissolved)	0.1	Methylene Blue Active Substances (MBAS)	5	Zinc (total)	0.5
Copper (dissolved)	0.2	Molybdenum (total)	0.2	-	-

Max. maximum

1.2.2 Territorial Water Licence

The Rankin Inlet WWTF operates under a water licence (No. 3AM-GRA1624) which specifies monitoring requirements. The monitoring requirements for GRA-3 state:

"*The Licensee shall sample at least once during a Calendar Quarter at Monitoring Program Station GRA-3 and analyze for the following parameters: cbod 5 Faecal Coliforms ph Conductivity Total Suspended Solids Ammonia Nitrogen Nitrate Nitrite Sulphate Total Phenols Potassium Sodium Calcium Magnesium Chloride Total Arsenic Total Cadmium Total Chromium Total Copper Total Iron Total Lead Total Mercury Total Nickel Total Zinc Total Cobalt Oil and Grease Total Petroleum Hydrocarbons (TPH) with using method that measures mineral sources of hydrocarbons (e.g. ASTM D7678 PHC test or other)*".

1.2.3 *Fisheries Act* Requirements

The *Fisheries Act* does apply to Rankin Inlet's municipal wastewater discharge to the marine environment. Section 35 prohibits, without prior authorization, the harmful alteration, disruption or destruction of fish habitat. Section 36 prohibits pollution of water frequented by fish.

As noted in the RFQ, Section 36(3) of the *Fisheries Act* states:

"no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish or in any place under any conditions where the deleterious substance or any other deleterious substance that results from the deposit of the deleterious substance may enter any such water."

Under the Fisheries Protection and Pollution Prevention Section 34 (1) deleterious substance is defined as:

"(a) any substance that, if added to any water, would degrade or alter or form part of a process of degradation or alteration of the quality of that water so that it is rendered or is likely to be rendered deleterious to fish or fish habitat or to the use by man of fish that frequent that water, or

(b) any water that contains a substance in such quantity or concentration, or that has been so treated, processed or changed, by heat or other means, from a natural state that it would, if added to any other water, degrade or alter or form part of a process of degradation or alteration of the quality of that water so that it is rendered or is likely to be rendered deleterious to fish or fish habitat or to the use by man of fish that frequent that water,"

In addition, the Marine Mammal Regulations under the *Fisheries Act*, prohibit disturbance of marine mammals.

2.0 Study Methodology

Following a review of background information, field investigation and wastewater characterization plans were developed based on guidance provided in the *Canada-wide Strategy*, the RFQ requirements, and on discussions with GN-CGS.

2.1 Sampling Protocols and Quality Assurance/Control

Sample collection (undertaken by Dillon) followed standard Environmental Field Procedures based on American Society for Testing and Materials (ASTM) standards and on laboratory requirements, which include use of laboratory supplied bottles, chain of custody, documentation of sampling events, including time and flow rates and photographs of the sampling location, short term storage within coolers with ice, transport to certified laboratory within hold times and appropriate Quality Assurance/Quality Control (QA/QC). Composite samples included primary and duplicate (Back-up) sample sets. Marine environment samples also included at least one duplicate.

GN-CGS sampling is undertaken in accordance with the *Environmental Monitoring Program and Quality Assurance/Quality Control (QA/QC) Plan* developed as part of the Water Licence.

Samples were analyzed at a Standards Council of Canada or equivalent accredited laboratory.

Metered water parameter measurements were made with an instrument provided and calibrated by the equipment supplier (Hoskin Scientific). The calibration certificate is included in Appendix A-1.

2.2 Wastewater Sampling

Wastewater sampling is undertaken on a monthly basis by GN-CGS using a grab sample methodology. Samples are analyzed at ALS Environmental. This report incorporates samples collected by GN-CGS from 2017 to August 2019. The program was extended to include the summer 2019 wastewater data on discussion between GN-CGS and ECCC (January 2019), in relation to characterizing the wastewater at a time when bleeder water is not present.

Supplementary 24 hour manual composite wastewater sampling was undertaken by Dillon on two occasions:

- October 17-18, 2018 (initiated at 1500); and
- February 20-21, 2019 (initiated at 1100).

Sampling during Dillon site visits was undertaken using a composite sampling methodology as requested by ECCC. It was determined that an automated composite sampling device was not suitable for sampling due to the effluent flow variability. Effluent flow at the Rankin facility is non-continuous and based on pumped flow from two lift stations. Automated compositing based on pre-defined times could result in sampling during a period of no flow. A manual protocol consistent with CCME was proposed and adopted. A manual compositing technique was undertaken based on the CCME technical direction for "continuous" discharges for small facilities (CCME 2009). Manual composites consist of grab samples taken at equally spaced time intervals or proportional to streamflow (based on flow records). Flow proportional samples may be taken over a 24 hour period as a minimum of 8 grabs taken at equally (modified as required depending on site-specific conditions/pumping) and combined in proportion to the flow. Sampling occurred every 3 hours for the duration of the 24 hour period for both the 'primary' and the 'back-up' composites. To achieve a 24 hour composite sample the Dillon team manually collected 1 liter samples of wastewater approximately every three hours. Care was taken to ensure both pumping/lift stations were actively pumping during the collection of the sub-samples so that flow volume for each sub-sample was approximately equivalent. Flow meter readings were recorded. Each time a 1 liter sub-sample was collected it was added to the ongoing composite sample and kept chilled on ice in a cooler.

Compositing is not appropriate for some parameters, e.g. for parameters with short hold times such as volatile and bacteriological parameters. These parameters were collected as grabs.

Dillon samples were analyzed by Bureau Veritas (formerly known as Maxxam Analytics).

2.2.1 Wastewater Sample Location

The sample location is intended to provide a representative sample from an area that has thorough mixing with no excessive turbulence and away from walls. Wastewater sampling was conducted at the established discharge monitoring point (GRA-3 valve) in the Sewage Treatment Facility (STF) building. See Figure 2 in Section 1 for the WWTF location.

2.2.2 Sample Parameters and Sampling Frequency

Wastewater sampling parameters and frequency as identified by GN and based on the ECCC direction (ECCC 2017) collected during the site visits are listed in Table 2-1 below.

Table 2-1: Wastewater Characterization Parameters and Sampling Frequency

Parameters	Detail^	Frequency
Physical/ Chemical	Total Suspended Solids (TSS), Total Biochemical Oxygen Demand (BOD_5), Carbonaceous Biochemical Oxygen Demand ($CBOD_5$), Hardness, Alkalinity, Conductivity, pH	Monthly (including two Dillon Sampling Events)
Major Ions	Calcium, Chloride, Fluoride, Magnesium, Potassium, Sodium, Sulphate (SO_4)	Monthly (including two Dillon Sampling Events)
Nutrients	Ammonia (-N Total), Total Phosphorous (TP), Total Nitrogen, Total Organic Carbon (TOC), Nitrate-N (NO_3-N), Nitrite-N (NO_2-N)	Monthly (including two Dillon Sampling Events)
Metals (Total)+	Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Cesium, Chromium, Cobalt, Copper, Iron, Lead, Lithium, Manganese, Molybdenum, Nickel, Rubidium, Selenium, Silver, Strontium, Thallium, Titanium, Uranium, Vanadium, Zinc	Quarterly and no less than 60 days between samples (including two Dillon Sampling Events)
Other	Total Phenols*, Oil and Grease, Total Petroleum Hydrocarbons (TPH, assumed BTEX/F1 and F2-F4)*	Monthly (including two Dillon Sampling Events)
Bacteriological	Fecal Coliforms, (CFU/100ml) * Total Coliforms, *E. coli* (MPN/100ml) *	Monthly (including two Dillon Sampling Events)

Notes:
*Samples not composited during Dillon sampling due to either hold time requirement or potential for degradation
+ Total mercury was included in Dillon February 2019 sample set
^ Standard detection limits
Dillon samples labeling:
- October 2018 COMP (and Duplicate – FD1) for the composites and GRAB (and Duplicate – FD2)
- February 2019 COMP (and Duplicate – FD) for the composite and G-1 (grab for bioassay chemistry)

2.2.3 *Canada-wide Strategy* Wastewater Characterization Methodology

Although the *Canada-wide Strategy* National Performance Standards (NPS) are not currently applicable to northern environments, the Strategy does identify an approach to effluent characterization. The effluent sampling undertaken for this report generally follows the guidelines and methodology provided in Technical Supplements (primarily #3) of the *Canada-wide Strategy*. The requirements for substances and test groups for the initial wastewater characterization (monitored over one year) are identified in the Strategy based on facility size as indicated by average daily flow (ADF). It is noted that the Rankin Inlet wastewater facility has ADF that would be identified in the Strategy as small (effluent flow >500 to 2500 m^3/day without industrial input). Technical Supplement #3 outlines a list of Substances of Potential Concern for small facilities, which includes CBOD5, TSS, pathogens, and nutrients. Sampling undertaken at the facility generally exceeds the requirements under the Strategy. In addition to the small facility parameters completed monthly, analysis is undertaken for hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), phenol, oil and grease, additional general chemistry parameters and metals. The Strategy also identified quarterly sampling for acute and chronic toxicity. For the Rankin Inlet Wastewater Characterization, acute toxicity samples were collected (on two occasions, see Section 2.4). Chronic toxicity was not assessed.

2.3 Effluent Flow Measurement

Effluent volumes including from the two lift stations, was estimated based on population, water usage records, number of bleeders, and wash water contribution and compared to cumulative measured flows at the WWTP. Flow meters for each lift station are located inside the WWTP and cumulative flows were recorded during 2018/2019 Dillon site visits.

Estimates of bleeder and auger wash water were made based on the previous investigations of approximate number of bleeders that are used and a visual inspection of a representative sample to determine the volume of bleeder water (Dillon 2018).

2.4 Bioassay

Samples were collected of the wastewater for rainbow trout bioassays on two occasions as part of the study; October 18, 2018 and February 21, 2019. It was originally requested that bioassay would only be collected annually (Site Visit 1), however, based on discussion with ECCC (January 2019), it was decided that bioassay and an additional water chemistry data set for the bioassay water would also be collected for Site Visit 2. Effluent for bioassay was collected in laboratory provided containers as a grab at the completion of the composite sampling from the GRA-3 location. Separate bioassay chemistry was not completed during Site Visit 1. For Site Visit 2, an additional water chemistry data set was collected for the bioassay sample as a grab at the time of the bioassay sample collection.

The sample was collected and shipped to the analytical laboratory, Bureau Veritas. The bioassay test was undertaken as per Environment Canada Environmental Protection Series Biological Test Method EPS/1/RM/13 July 1990. Both a single concentration bioassay and a multiple concentration test were completed for Site Visit 1. For Site Visit 2, only the multiple concentration was completed.

2.5 Dye Tracing

A dye tracing study was undertaken on October 18, 2018. The methodology was generally based on the ECCC Technical Guidance for Plume Delineation Studies (JWEL & Natech 2003) and on methodology employed in the Nunavut Water Quality Impact study (CWRS 2015). Fluorescent dye (Rhodamine WT) was injected into the effluent stream and tracked within the marine environment using a fluorimeter. The “non-continuous” nature of the effluent discharge meant that the dye tracing targeted a general understanding of plume movement at the time of the assessment. As equilibrium conditions were not established, the assessment of the mixing in the marine receiving environment was qualitative.

Due to the configuration of the wastewater treatment system, effluent flow depends on sufficient buildup and pumping from the pumping stations, and is not constant or uniform. The dye tracing occurred over several short (~10 minute) distinct effluent discharge periods. Both lift stations were manually operated to ensure flow from each station was contributing to the effluent flow and to control the effluent discharge rate. The generalized procedure included turning on both lift station pumps and

injection of the dye at a continuous rate proportional to the incoming lift station pumped flow. An initial base dye concentration was established and further diluted to an appropriate level as required to be observed/detected in the marine environment. Dosing rate and effluent flow rate were recorded for the duration of the dye tracing.

The location and extent of dye concentrations in the marine environment was measured by Dillon personnel aboard a boat equipped with an on-board fluorimeter and GPS. The edge of the plume was followed over 1 km from the outfall using a fluorimeter sonde. The ECCC plume monitoring guidance (JWEL & Natech 2003) was followed to the extent possible, targeting the outfall location and transects radiating from the outfall along the assumed plume. Visual observation of the plume was only possible in the immediate vicinity of the outfall location. Conditions at the time of the survey (ice build-up restricting boat movement) limited plume delineation and transecting the plume became increasingly difficult with increasing distance from the outfall location. A second sonde was not able to be deployed as a stationary reference at the outfall location due to equipment malfunction.

2.5.1 Physical Assessment

An initial assessment of the plume direction was based on wind and tidal conditions. A rough estimate of surface flow direction was obtained by the release and recapture of neutral density indicators (drogues). Two drogues were deployed during the day prior to the dye test to provide preliminary observations of surface current flow characteristics in relation to weather and tidal condition. The on-board fluorimeter was also equipped to record field meter measurements for depth, temperature, salinity, pH, conductivity and dissolved oxygen throughout its deployment during the dye test. As well, a series of vertical profiles (Temperature/Salinity/Depth) were conducted at the outfall location on the day prior to the dye test to determine the background characteristics.

2.5.2 Marine Water Chemistry Sampling

Additional water chemistry samples were collected as surface (0.5 m below) grabs within the marine environment. This included a marine water sample within the area of plume surfacing (OUTFALL) and a “BACKGROUND” outside the area of the identified plume as recommended in the field plan. Sample locations are noted on Figure 2. Parameters were generally consistent with those collected for wastewater characterization. However, the “BACKGROUND” sample was taken within a 20L carboy (laboratory provided) and therefore was not suitable for analysis of volatiles or bacteria.

2.5.3 Limitations of the Dye Assessment

As stated previously, Rankin Inlets’ wastewater facility has a “non-continuous” and fairly low flow discharge. As the discharge occurs in batches, equilibrium was not reached within the receiving environment during the dye test period. This complicates the linkage between dye discharge and understanding whether the variability in receiving environment concentration is related to mixing/dilution or to changing feed conditions.

It is noted that a dye study provides only an assessment of conditions at the time of the study (tidal, wind, current, effluent discharge quality and flow conditions). It provides a preliminary look at mixing conditions in the environment but may or may not reflect overall assimilative capacity, potential worst case or even an average condition. As such the assessment of dilution rates cannot be used directly for design of treatment. Dye tracing studies have been used in relation to several wastewater treatment facilities within Nunavut (CWRS 2016) for the purpose of informing the assessment of risk to marine water quality. Dye tracing used in conjunction with mixing models such as CORMIX may assist in validation of model findings and provide an assessment of plausible worst case conditions which can inform treatment design; however plume modelling was not identified within the scope of this assessment.

3.0 Effluent Characterization

The laboratory Certificates of Analysis from the Dillon wastewater sampling are located in Appendix A-2. Laboratory Certificates of Analysis for historic GN-CGS monitoring are provided in Nunavut Water Board reports located on the Water Board web site (http://www.nwb-oen.ca/). Appendix A-3 provides the 2018/2019 bioassay results.

Summary tables for GN-CGS data and the Dillon wastewater sampling are located in Appendix B.

3.1 Review of GN Data

Key parameters from GN 2017, 2018, and 2019 wastewater quality data (GRA-3 Station) are summarized in Table 3-1 below.

For most cases, the minimum TSS and CBOD5 results occurred in the same month, along with the maximum TSS and CBOD5 results. The minimum TSS result for 2017 occurred in October; however, the minimum CBOD5 result for 2017 occurred in May. The maximum TSS and CBOD5 results for 2017 occurred in March. For 2018, the minimum TSS and CBOD5 occurred in October, while the maximum TSS and CBOD5 occurred in November. For 2019, the minimum TSS occurred in June, and the minimum CBOD5 occurred in August. The maximum TSS occurred in February, and the maximum CBOD5 occurred in July. The results shown for 2019 exclude the months September – December.

Table 3-1: Summary of GRA-3 Wastewater Effluent Data Sampled by GN

Parameter	Unit	2017				2018				2019*			
		No. of Samples	Avg.	Min	Max	No. of Samples	Avg.	Min	Max	No. of Samples	Avg.	Min	Max
TSS	mg/L	11	145	56	575	11	199	54.7	765	9	75	36.5	134
CBOD5	mg/L	11	132	47	390	11	224	45	1460	9	64	13.8	114
pH	pH Units	11	na	6.47	7.17	10	na	6.69	7.3	9	na	6.8	7.29
Fecal Coliforms	MPN/100 mL	9	43,267	24,200	110,000	9	21,780	2,420	24,200	7	2,500,000	>24,200	13,000,000
Total Ammonia (as N)	mg/L	11	7.3	3.6	13.5	11	16.7	3.1	74.0	9	5.4	1.9	10.9
Nitrate (as N)	mg/L	11	0.03	0.02	0.06	11	0.02	0.02	0.06	9	0.06	0.02	0.17
Total Phosphorus	mg/L	11	2.65	1.05	6.16	11	2.64	0.82	11.10	9	2.1	0.48	3.94

*2019 data from January – August 12

Note: for fecal and nitrate averages – the average was calculated by dropping the qualifier sign and just using the number when qualifiers were present.

3.2 Review of Dillon Wastewater Sampling Results

Table 3-2 below provides a summary of key parameters from Dillon sampling.

Table 3-2: Summary of Dillon Sampling Results

Parameter	Unit	October 2018 (Site Visit 1)	February 2019 (Site Visit 2)	
		Composite	Composite	Grab
TSS	mg/L	87	26	63
CBOD5	mg/L	130	89	150
pH	pH Units	7.34	7.13	7.28
Fecal Coliforms	MPN/100 mL	-	-	>1,100,000
Total Ammonia (as N)	mg/L	12	7.9	17
Nitrate (as N)	mg/L	<0.020	0.059	<0.050
Total Phosphorus	mg/L	3.0	2.0	4.6

A comparison of the grab versus composite results is provided in Appendix C. In a phone meeting with GN and Dillon (January 18, 2019), ECCC agreed with the manual approach to composites.

3.3 Effluent Flow Data

Cumulative flows from flow meters were recorded during the site visit. Tables 3-3 and 3-4 below provide the flow readings:

Table 3-3: Lift Station Flow Readings 2018

Time Frame (2018)	J.C. Flow (m^3)	Nuvuk Flow (m^3)	Total Flow (m^3)
Oct 17 15:03 to 18:02	161	49	210
Oct 17 18:02 to 20:56	172	57	229
Oct 17 20:56 to 23:49	156	47	203
Oct 17/18 23:49 to 02:59	132	39	171
Oct 18 02:59 to 05:50	128	33	161
Oct 18 05:50 to 08:57	151	50	201
Oct. 18 08:57 to 12:33	214	64	278
Oct. 18 12:33 to 14:57	131	41	172
Cumulative	1,245	380	1,625

Table 3-4: Lift Station Flow Readings 2019

Time Frame (2019)	J.C. Flow (m^3)	Nuvuk Flow (m^3)	Total Flow (m^3)
Feb 20 11:10 to 14:03	195	63	258
Feb 20 14:03 to 17:15	238	63	301
Feb 20 17:15 to 20:10	176	54*	230
Feb 20/21 20:10 to 23:05	193	54*	247
Feb 21 11:05 to 02:05	174	46	220
Feb 21 02:05 to 05:05	163	36	199
Feb 21 05:05 to 08:05	179	50	229
Feb 21 08:05 to 09:30	112	29	141
Cumulative	1,430	395	1,825

* Averaged between 17:15 and 23:05 as Nuvuk flow reading not recorded at 20:10

3.3.1 Assessment of Bleeder and Auger Water Contribution

Supplementary bleeder is used throughout the system to prevent freezing of water and sewer mains. Bleeder water use may be anticipated except in summer months. Auger water is added as part of the WWTP operations. Bleeder and auger water is sourced from the potable water source and is expected to meet drinking water criteria. In general, the copper concentration in the potable source water is at or below the 2 ug/L lower limit FWAL limit. A previous investigation (Dillon 2019) identified that supplementary potable water may make-up between 15 and 40% of the WWTF flow.

4.0 Bioassay Results

Bioassays (rainbow trout LC50) of effluent (prior to entering the marine environment), were conducted prior to the wastewater characterization study by ECCC and two (2) times during the course of the wastewater characterization. Results included:

- 2016, July 19 ECCC event – a single concentration bioassay failed (the 100% concentration of effluent was lethal to 50% of the rainbow trout within the 96 hour exposure period) (ECCC 2017);
- 2018, October 18 event - a single concentration bioassay failed. To provide additional information, a multiple concentration test was initiated. The multiple concentration bioassay resulted in a pass at 50% (and lower) effluent concentration. Single concentration and multi-concentration data is attached in Appendix A-3; and
- 2019, February 21 event - the multiple concentration bioassay resulted in a pass at 25% (and lower) effluent concentration. Multi-concentration data is attached in Appendix A-3.

5.0 Comparison of Effluent with Guidelines/Criteria

Following the general CCME *Canada-wide Strategy* approach, effluent data were examined to identify Substances of Potential Concern. Table 5-1 provides a data table comparing the data provided by GN-CGS and results from the Dillon 2018/2019 field visits to CCME Canadian Environmental Quality Guidelines (CEQG) for the Protection of Aquatic Life – Marine. In addition, for reference purposes only and although not currently applicable to GN, the CCME *Canada-wide Strategy for Management of Municipal Wastewater* Effluent National Performance Standards (NPS), and the *Fisheries Act* – Wastewater Systems Effluent Regulations (WSER) limits are also noted. Full data summary tables are included in Appendix B.

Table 5-1: Sample Results Compared to CEQG (Marine) Guidelines and Wastewater Criteria

Parameter	Unit	2017 Avg	2018 Avg	2019 Avg	Site Visit 1 Composite	Site Visit 2 Composite	CEQG (Marine)^		NPS	WSER	NWT WB (based on flow)
							Short Term	Long Term			
TSS	mg/L	145	199	75	87	26	*BG ±25*	*BG ±5*	*25*	*25*	*180*
CBOD5	mg/L	132	224	64	130	89	-	-	*25*	*25*	*120*
pH	pH Units	7.00	7.00	7.01	7.34	7.13	-	*7.0 to 8.7*	-	-	-
Fecal Coliforms	MPN/ 100 mL	43,267	21,780	2,500,000	>1,100,000*	>1,100,000*	-	-	-	-	*Recep-tor Based*
Total Ammonia (as N)	mg/L	7.3	16.7	5.4	12	7.9	-	-	-	-+	-
Nitrate (as N)	mg/L	0.03	0.02	0.06	<0.020	0.059	*1500 [NO3]*	*200 [NO3]*	-	-	-
TP	mg/L	2.65	2.64	2.1	3.0	2.0	-	-	-	-	-

* Site Visit 1 and 2 Fecal Coliforms samples were grab samples.
+ Clear Flow: Maximum
^ TSS Marine Aquatic Life (MAL) Guideline Maximum 25 mg/L increase short term from background (BG), 5 long term; or 10% if BG >250
pH and Nitrate MAL as noted
Fecal coliform CEQG related to water use – no swimming or aquaculture noted in area; secondary contact Health Canada GL 1000 count/100 ml
Ammonia CEQG for un-ionized ammonia, total value related to pH and Temperature;
+WSER guideline for un-ionized ammonia 1.25 mg/L (as N @15oC)
Avg Average; MPN Most Probable Number

For the data provided by GN-CGS, the majority of monthly TSS samples exceeded the CEQG for the Protection of Aquatic Life – Marine short term guideline limit of ±25 mg/L. Aside from the June 4, 2019 CBOD5 sample, monthly samples for TSS and CBOD5 exceeded the NPS and WSER limit of 25mg/L.

The CEQG for the Protection of Aquatic Life – Marine states that the pH of marine waters should fall within the range of 7.0 – 8.7 units unless it can be demonstrated that such a pH is a result of natural processes. It also states that within this range, pH should not vary by more than 0.2 pH units from the natural pH expected at that time. According to the GN-CGS data, the pH dropped below this range for five (5) samples in 2017, three (3) samples in 2018, and five (5) samples in 2019. The recommended laboratory hold time for pH is 0.25 hours, so samples shipped from Rankin Inlet to the ALS Laboratory in Winnipeg would have exceeded this hold time. It is possible for the pH to decrease during this transport time. Dillon field pH measurements were within the recommended range of 7.0 – 8.7.

Aside from the parameters indicated above, there was one (1) sample in September 2017 that was detected above the CEQG arsenic limit of 12.5 ug/L, and one (1) total chromium sample in February 2019 that was detected above the CEQG hexavalent chromium limit of 1.5 ug/L, As this guideline is for hexavalent chromium and it is unlikely that the percentage of total chromium is high, it is anticipated that this guideline is overly conservative and is not exceeded. These two concentrations are inconsistent with historical data. There were three (3) samples in 2019 where total mercury was detected above the CEQG mercury limit of 0.016 ug/L.

For sample data collected by Dillon, the TSS and CBOD5 samples exceeded the applicable CEQG guidelines. Additionally, there was one (1) sample from Site Visit 2 that was detected above the CEQG cadmium limit of 0.12 ug/L.

5.1 Review of Effluent Quality in Relation to Toxicity Tests

Table 5-2 provides the effluent water quality data in relation to the toxicity tests undertaken.

Table 5-2: Effluent Sample Results Associated with Toxicity Tests Compared to Guidelines

Parameter	Unit	June 22, 2016 ECCC LC50 and Effluent Chem. Grab	Oct. 18, 2018 LC50 (S&M) and Composite Effluent Chem.	Feb. 21, 2019 LC50 (M) and Effluent Chem. Grab	CEQG^ (Marine)		CEQG^ (FWAL)		NPS	WSER	NWT WB (at IMZ)
					Short Term	Long Term	Short Term	Long Term			
100% Effluent	-	Fail	Fail (100% mortality within first 24 hr)	Fail (100% mortality within first 24 hr)	-	-	-	-	-	-	-
DO at start of test (100% effluent)	mg/L	Unknown	1.3 (s) – 3.7 (m)	2.3	-	*>8*	-	*>9.5*	-	-	*+10% BG*
50% Effluent	-	-	Pass (0% mortality)	Fail (100% mortality within 48 hrs)	-	-	-	-	-	-	-
DO at start of test (50% effluent)	mg/L	-	7.1	5.4	-	*>8*	-	*>9.5*	-	-	*+10% BG*
0-25% Effluent	-	-	Pass (0% mortality)	Pass (0% mortality)	-	-	-	-	-	-	-
DO at start of test (0-25% effluent)	mg/L	Unknown	8-9	8.1-9.1	-	*>8*	-	*>9.5*	-	-	*10% BG*
Conductivity	uS/cm	Unknown	333	532	-	-	-	-	-	-	-
TSS	mg/L	32	87	63	*BG~ ±25*	*BG~ ±5*	*BG~ ±25*	*BG~ ±5*	*25*	*25*	*BG~ +10%*
CBOD5	mg/L	Unknown	130	150	-	-	-	-	*25*	*25*	-
Hardness	mg/L	Unknown	65	95.7	-	-	-	-	-	-	-
pH	pH Units	6.9-7.5	6.7	7	-	*7.0 to 8.7*	-	*6.5-9*	-	-	-
Fecal Coliforms	MPN/ 100 mL	Unknown	>1100000	>1100000	-	-	-	-	-	-	*Recep-tor Based*
Total Ammonia (as N)	mg/L	10.6	12	17	-	-	-	*1.8-5.3*	-	-	-
Calculated un-ionized Ammonia-N	mg/L	0.091	0.015	0.046	-	-	-	*0.016*	-	*1.25*	-

Parameter	Unit	June 22, 2016 ECCC	Oct. 18, 2018 LC50 (S&M)	Feb. 21, 2019 LC50	CEQG^ (Marine)		CEQG^ (FWAL)		NPS	WSER	NWT WB (at
Nitrite (as N)	mg/L	Unknown	<0.01	<0.02	-	-	-	*0.06*	-	-	-
TP	mg/L	Unknown	3	4.6	*Guidance Framework*				-	-	-
Chloride	mg/L	Unknown	50	75	-	-	*640*	*120*	-	-	-
Aluminum	ug/L	398	147	144	-	-	-	*100*	-	-	*+10% BG*
Arsenic	ug/L	Unknown	0.79	0.93	-	*12.5*	-	*5*	-	-	*+10% BG*
Copper	ug/L	193	130	254	-	-	-	*2*			*+10% BG*
Iron	ug/L	Unknown	223	186	-	-	-	*300*	-	-	*+10% BG*
Lead	ug/L	Unknown	1.85	1.8	-	-	-	*1.84*	-	-	*+10% BG*
Mercury	ug/L	Unknown	-	0.012	-	*0.016*	-	*0.026*	-	-	*+10% BG*
Zinc	ug/L	107	76.3	107	-	-	*37*	*15*	-	-	*+10% BG*
Total phenols	mg/L	Unknown	0.029	0.077	-	-	-	*0.004*	-	-	-
O&G	mg/L	Unknown	41	9.1	-	-	-	-	-	-	*5*

Notes:
+ Clear Flow: Maximum
^ TSS Marine Aquatic Life (MAL) Guideline Maximum 25 mg/L increase short term from background (BG), 5 long term; or 10% if BG >250
Notes continued:
pH FWAL based on early life stage. See Section 6 – A single TSS sample at a BG location had a TSS of 6mg/L.
Fecal coliform CEQG related to water use – no swimming or aquaculture noted in area; secondary contact Health Canada GL 1000 count/100 ml
Ammonia CEQG for un-ionized ammonia, total value related to pH and Temperature; assumed conservative pH7, temperature of test 16oC
Phenol FWAL for mono and di hydric forms not total
Lead FWAL based on Hardness 65
+WSER guideline for un-ionized ammonia 1.25 mg/L (as N @15oC)

Based on available effluent chemistry for the toxicity test and CEQG, potential contaminants of concern are TSS/CBOD (in relation to DO), un-ionized ammonia, and copper and zinc and potentially total phenols and O&G. Although above CEQG, aluminum (total) is expected to largely be bound with sediment and have reduced biologically availability, and, is generally not toxic (LC50) at the levels observed. Further discussion on these parameters with respect to toxicity literature data is provided below.

TSS/CBOD (DO) – Elevated CBOD, TSS and parameters that contribute to organic load may be correlated with reduced DO concentrations. It is noted that the toxicity test failures, directly corresponded with low starting concentrations of DO. It is recognized that salmonids including rainbow trout are sensitive

to low DO and typically earlier life stages are more sensitive that adults. A literature review (Barton and Taylor 1994) found that DO concentrations of between 1 and 3 mg/L results in mortality for most adult fish species, and that lethal hypoxia typically occurred with between one to three hours. It is also noted that reduction in DO changes the toxicity of un-ionized ammonia, with the toxicity doubling as DO decreases from 9 to 3 mg/L. Similar although less profound effects can occur with the addition of contaminants such as metals (copper, zinc) which may impair oxygen uptake in the gills and compound low DO effects.

Un-Ionized Ammonia - For ammonia, pH is an important factor and a correlation between toxicity and ammonia was developed by EC (2004). This relationship indicates that at the maximum pH typical of most of the effluent at the WWTF (pH of 7.5) toxicity may occur at total ammonia-N values of over 67 mg/L. Un-ionized ammonia concentrations observed in the effluent were below those associated with acute toxicity in rainbow trout (USEPA EcoTox Search accessed September 2019). This assessment is consistent with ECCC review of the 2016 LC50 test (DFO 2017).

Metals – Copper, zinc and aluminum are elevated above CEQG for freshwater. The USEPA EcoTox dataset was searched with respect to concentrations of these metals associated with mortality effects (accessed September 2019). The EcoTox searches were undertaken for LC50s for rainbow trout only, as most relevant to the testing undertaken. There is a large range in the concentrations identified in EcoTox as resulting in mortality reflecting a variety of research approaches. Zinc and aluminum levels observed in the Rankin Inlet WWTF effluent at the time of the toxicity tests were below those generally associated with acute toxicity (LC50) in rainbow trout (USEPA EcoTox Search accessed September 2019 and Gundogdu 2008). However, copper concentrations in the effluent exceeded several of the levels associated with acute toxicity tests in EcoTox (USEPA EcoTox Search accessed September 2019 and Gundogdu 2008). As noted by ECCC (DFO 2017) it is anticipated that these metals are likely a contributing factor in LC50 results. However, it is noted that the multiple concentration toxicity test passed at a 50% effluent concentration (October 2018) and at 25% (February 2019). Applying similar dilution to the copper concentrations would result in toxicity test passes at the equivalent to 65 and 63 ug/L copper, respectively. It is noted (see Section 5.2) that at least one background sample had copper concentrations above that observed in the effluent toxicity test samples.

5.2 Comparison of August 2019 Sample and Guidelines/Criteria

As discussed with ECCC, the wastewater sampling program was extended to August 2019 to capture current effluent quality under a condition of minimal to no bleeder water. Table 5-3 provides August effluent chemistry for select general parameters and those with guidelines/criteria exceedances.

Table 5-3: August 12, 2019 Effluent Sample Results Compared to Guidelines/Criteria

Parameter	Unit	Aug, 12, 2019 GN Effluent Grab	Sep 2018 – Aug 2019 Max (month)	CEQG^ (Marine)		CEQG^ (FWAL)		NPS	WSER	NWT WB (at IMZ)
				Short Term	Long Term	Short Term	Long Term			
Conductivity	uS/cm	241	578 (Sep)	-	-	-	-	-	-	-
TSS	mg/L	43.5	765 (Nov)	*BG~ ±25*	*BG~ ±5*	*BG~ ±25*	*BG~ ±5*	*25*	*25*	*BG~ +10%*
CBOD5	mg/L	13.8	1460 (Nov)	-	-	-	-	*25*	*25*	-
Hardness	mg/L	63.8	127 (May)	-	-	-	-	-	-	-
pH	pH Units	7.27	7.29 (Jul)	-	*7.0 to 8.7*	-	*6.5-9*	-	-	-
Fecal Coliforms	MPN/ 100 mL	677000	13000000 (Jul)	-	-	-	-	-	-	*Receptor Based*
Total Ammonia (as N)	mg/L	1.99	38.6 (Nov)	-	-	-	*pH,T dpd*	-	-	-
TP	mg/L	0.482	3.94 (Jul)	*Guidance Framework*				-	-	-
Chloride	mg/L	35.8	77.2 (May)	-	-	*640*	*120*	-	-	-
Aluminum	ug/L	84.1	678 (Nov)	-	-	-	*100*	-	-	*+10% BG*
Arsenic	ug/L	0.76	24.8 (Nov)	-	*12.5*	-	*5*	-	-	*+10% BG*
Cadmium	ug/L	0.02	0.596 (Nov)	-	*0.12*	*1.3-2.7*	*0.11-0.19*	-	-	-
Chromium	ug/L	0.37	4.16 (Nov)	-	*1.5 (Hex, 56 (Tri)*		*1 (Hex), 8.9 (Tri)*	-	-	-
Copper	ug/L	54.9	346 (Nov)	-	-	-	*2-2.9*			*+10% BG*
Iron	ug/L	126	1130 (Sep)	-	-	-	*300*	-	-	*+10% BG*
Lead	ug/L	1.09	5.56 (Sep)	-	-	-	*1.8-4.3*	-	-	*+10% BG*
Mercury	ug/L	<0.005	0.61 (Jul)	-	*0.016*	-	*0.026*	-	-	*+10% BG*
Selenium	ug/L	-	1.54 (Nov)	-	-	-	*1*	-	-	-
Zinc	ug/L	26.5	316 (Nov)	-	-	*37*	*7*	-	-	*+10% BG*
Total phenols	mg/L	0.0021	0.084 (Nov)	-	-	-	*0.004*	-	-	-
O&G	mg/L	7.4	78 (Nov)	-	-	-	-	-	-	*5*

Notes:
+ Clear Flow: Maximum
^ TSS Marine Aquatic Life (MAL) Guideline Maximum 25 mg/L increase short term from background (BG), 5 long term; or 10% if BG >250

Notes continued:
pH FWAL based on early life stage. See Section 6 – A single TSS sample at a BG location had a TSS of 6mg/L.
Fecal coliform CEQG related to water use – no swimming or aquaculture noted in area; secondary contact Health Canada GL 1000 count/100 ml
Ammonia CEQG for un-ionized ammonia, total value related to pH and Temperature; assumed conservative pH7, temperature of test 16oC.
Cadmium, Copper, Lead based on Hardness
Phenol FWAL for mono and di hydric forms not total
+WSER guideline for un-ionized ammonia 1.25 mg/L (as N @15oC)

The contaminant concentrations in the August effluent (no bleeder water) appeared in general to be more dilute than effluent in the spring or fall. It appears that either the bleeder water component does not constitute a significant proportion to the overall effluent to result in a diluted effluent and/or the stormwater component (or inflow/infiltration) has high levels of contaminants that may contribute to toxicity.

It is noted that the copper concentration in the August effluent sample still present above receiving environment guidelines suggesting it remains a potential contaminant of concern even at times of low bleeder water. However, the copper concentration in the August sample was below that identified as theoretically not being toxic in the diluted effluent in multiple concentration toxicity testing in October 2018 and November 2019. The highest concentrations observed for most potential contaminants of concern was in November 2018.

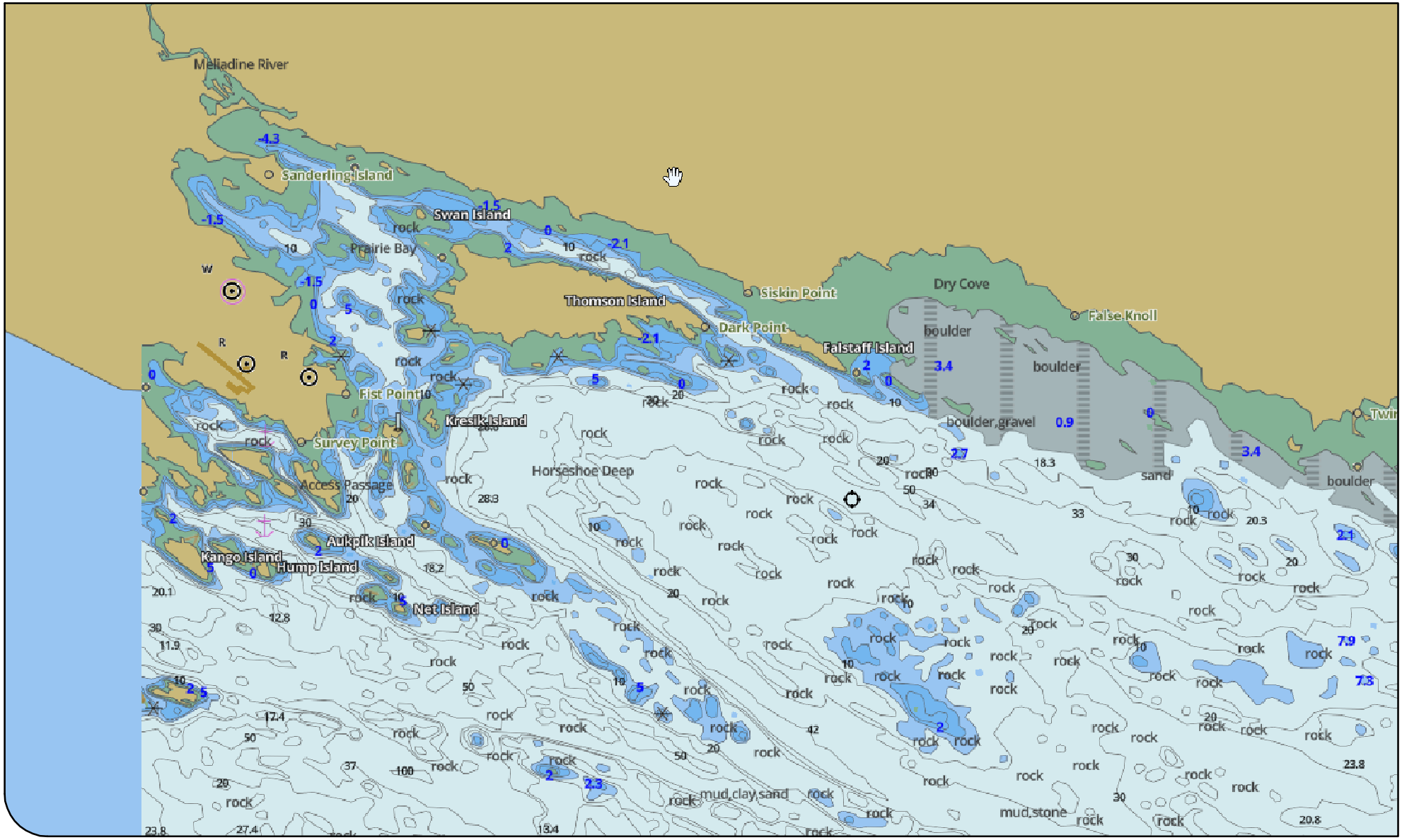
6.0 Background and Potential Receptors

Potential factors for impacts to the marine environment include the quality of the effluent discharge, background water quality and hydrodynamic conditions and sensitivity of the receiving environment.

6.1 Hydrological Background

The outfall is located within the marine environment of outer Prairie Bay. The Meliadine River inputs to the Bay occur approximately 5 km to the northwest, at the head of the bay. At the location of the outfall, the width of the bay is restricted by Thomson Island approximately 2.5 km to the north. Water depth at the outfall is around 8 m. Water depth within the bay varies up to 15 m with a few places over 20 m depth. The bay opens into the Guillemot Bank area approximately 3.5 km to the southeast of the outfall where water depth increases to typically 20-40 m. A second portion of the bay is located to the west of Rankin Inlet and also receives a river flow (Dianna River) at its head. Figure 4 illustrates the marine setting.

Movement of water is typically related to both tidally and wind influenced currents. A tidal station is located in the vicinity of the outfall and provides a good record of tidal condition (Rankin Inlet Tidal Station #5100 https://www.waterlevels.gc.ca/eng/station?sid=5100). The tidal cycle in the bay occurs over 6 hours with a typical range of 2.5 m and a maximum recorded range of 4.54 m.



GOVERNMENT OF NUNAVUT
RANKIN INLET WASTE WATER EFFLUENT STUDY
RANKIN INLET, NUNAVUT

MARINE SETTING
FIGURE 4

DILLON CONSULTING

MAP/DRAWING INFORMATION
NOAA RNC, GPS Nautical Charts.

CREATED BY: TLR
CHECKED BY: MAB
DESIGNED BY: KLM

File Location:
c:\projectwise\working directory\projects 2018\50tlr\dms49361\188483-05-03-fig 4.dwg
September, 10, 2019 5:18 PM

PROJECT: 18-8434

DATE: SEPTEMBER 2019

Devices designed to detect currents (drogues) were deployed to identify currents within the top 2 m of the water column in September 2010 at four locations (Worley Parsons 2011) and in October 2018 dropped at the outfall location. In 2010, currents were identified as linked to tidal forcing, flowing generally to the north (into the Bay) on the flood tide and southeast out of the bay on the ebb tide. Current speeds were reported as less than 0.15 m/s and anticipated to travel less than 1 km within a 6 hour tidal cycle. As a result, there is potential for recirculation within the bay. In addition, the drogues tracked shoreward toward the intertidal zone. The October 2018 drogues were deployed on an incoming to high tide and the wind was away from the shore (WNW).

Winds may influence surface water movement during the ice-free period. Sea ice break up typically occurs in mid-July with freeze-up in late October (https://www.canada.ca/en/environment-climate-change/services/ice-forecasts-observations/latest-conditions/educational-resources/sea/where-sea-ice-is-found.html#hudson). The predominant average hourly wind direction in Rankin Inlet is from the north throughout the year (NavCan 2001). Strong north-westerlies occur in the winter, while north-easterlies often occur in the spring. Winds tend to be less strong in the summer. Fall storms may start as south-easterlies and finish as north-westerlies.

Mixing conditions are also a reflection of gradients in physical parameters such as temperature and salinity. Water column profiles were obtained at nine stations (five near the outfall and 4 clear reference areas) in September 2010 and April 2011 (Worley Parsons 2011), and at stations near the outfall and a reference in October 2018. Appendix D provides the 2018 field data.

The 2010 study identified lower salinity in the surface water of Prairie Bay, likely associated with the river discharge.

6.2 Background Water Quality

Background water quality data was collected in September 2010 and April 2011 (Worley Parsons 2011) and during the 2018 October dye tracing study. Figure 5 below provides the background locations.

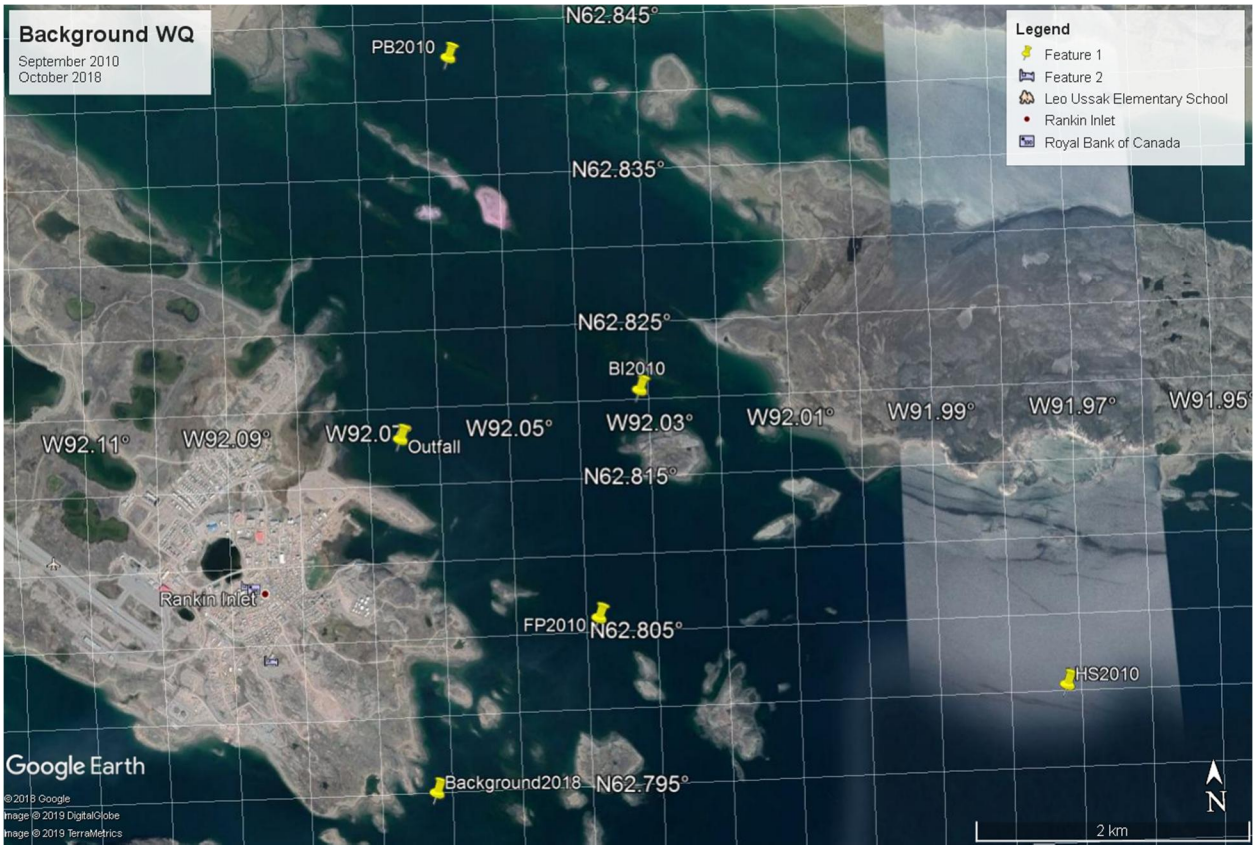


Figure 5: Background Locations 2018 points: Outfall and Background; 2010 points: PB – Prairie Bay, BI-Bunting Island, FP – Fist Point, HS – Horseshoe Deep

Table 6-1 provides a summary of key parameters for the background data.

Table 6-1: Background Water Chemistry (S surface, M mid-depth, B bottom)

Parameter	Unit	Oct. 2018 Background (S)	Sept. 2010 Prairie Bay (S,M,B)	Feb. 2011 Prairie Bay (PB) (S,M,B)	Sept. 2010 Bunting Island (S,M,B)	Feb. 2011 Bunting Island (S,M,B)
TSS	mg/L	6.0	-	-	-	<5(B)-7(S)
BOD5	mg/L	<3	-	-	-	<1
CBOD5	mg/L	<3	-	-	-	-
Conductivity	uS/cm	48200	-	-	-	-
pH	unit	7.85	-	-	-	-
Fecal Coliform	CFU/100mL	-	<1(S) – 24(B)	-	<1(S) – 1B)	<3(S)-4(B)
Fecal Enterococci	CFU/100mL	-	<1(S) – 4(B)	-	<1	<1(B)-2(S)
Total Ammonia-N	mg/L	0.89 (1)	0.29-0.31	-	0.14(S)-1.17(M)	<0.5

Parameter	Unit	Oct. 2018 Background (S)	Sept. 2010 Prairie Bay (S,M,B)	Feb. 2011 Prairie Bay (PB) (S,M,B)	Sept. 2010 Bunting Island (S,M,B)	Feb. 2011 Bunting Island (S,M,B)
Nitrate-N [NO3-N] Dissolved	mg/L	<0.020	-	-	-	-
Nitrite-N [NO2-N] Dissolved	mg/L	<0.010	-	-	-	-
Total Kjeldahl Nitrogen	mg/L	0.15	0.2(S) – <0.2(B)	-	<0.2(S) – 0.7(B)	<0.2
Total Organic Carbon (TOC)	mg/L	73 (1)	-	-	-	-
Total Phosphorus	mg/L	<0.030 (3)	0.02	-	0.02(S)-1(B)	0.012(B)-0.054(M)
Nitrate plus Nitrite (N) Dissolved	mg/L	<0.020	-	-	-	-
Nitrate plus Nitrite (N)	mg/L	<0.022	<0.020	-	<0.020	<7.1
Aluminum (Al)	ug/L	<150	<60(S)-89(B)	-	<60	<100
Antimony (Sb)	ug/L	<25	<10	-	<10	<10
Arsenic (As)	ug/L	<5.0	<2	-	<2	<80
Barium (Ba)	ug/L	<50	<20	-	<20	6.5(S)-7.9(B)
Beryllium (Be)	ug/L	<5.0	<2	-	<2	<50
Cadmium (Cd)	ug/L	<0.50	0.4(S)-0.8(M)	-	0.5(S)-0.8(M)	<5
Cesium (Cs)	ug/L	<10	-	-	-	-
Chromium (Cr)	ug/L		<20	-	<20	<50
Cobalt (Co)	ug/L	<10	<10	-	<10	<10
Copper (Cu)	ug/L	<25	<2(S)-374(B)	-	<4(B)-5(S)	<10
Iron (Fe)	ug/L	<500	<100(B)-358(S)	-	<100	<600
Lead (Pb)	ug/L	<10	<4	-	<4	6.7(B)-8.3(S)
Lithium (Li)	ug/L	143	150(S)-164(B)	-	147(B)-180(S)	<500
Manganese (Mn)	ug/L	<50	12(S)-<20	-	<20	<50
Molybdenum (Mo)	ug/L	<50	<20	-	<20	10.1(B)-11.9(S)
Nickel (Ni)	ug/L	<50	<20	-	<20	<50
Rubidium (Rb)	ug/L	102	-	-	-	-
Selenium (Se)	ug/L	<5.0	<2	-	<2	<300

Parameter	Unit	Oct. 2018 Background (S)	Sept. 2010 Prairie Bay (S,M,B)	Feb. 2011 Prairie Bay (PB) (S,M,B)	Sept. 2010 Bunting Island (S,M,B)	Feb. 2011 Bunting Island (S,M,B)
Silver (Ag)	ug/L	<1.0	<4	-	<4	<1
Strontium (Sr)	ug/L	6940	6350(S)-7200(M)	-	6460(B)-7490(S)	6410(B)-6940(S)
Thallium (Tl)	ug/L	<0.50	<1	-	<1	<10
Titanium (Ti)	ug/L	<250	<100	-	<100	<200
Uranium (U)	ug/L	<5.0	2	-	2(B)-3(S)	27(B)-29(S)
Vanadium (V)	ug/L	<250	<100	-	<100	<200
Zinc (Zn)	ug/L	<250	<100	-	<100	<100

The October 2018 background appears consistent with 2010 and 2011 data which included summer and winter samples. In general metals concentrations were below detection; however the detection limit was elevated in most cases likely due to the salinity of marine samples. It is noted that elevated copper and iron concentrations were observed in the Prairie Bay sample in September 2010. This sample is over 2 km from the outfall and expected to be influenced by the discharge from the Meliadine River. Tills in the Rankin Inlet area may be expected to have trace amounts of zinc, copper and nickel (Agriculture Canada 1979).

6.3 Potential Receptors

The wastewater facility outfall is located in the marine environment of outer Prairie Bay and has the potential to interact with both the benthic (ocean bottom) and pelagic (water column of open ocean) environment in its vicinity. At the location of the outfall, water depth was approximately 8 m. However, in some areas of the bay, water depth exceeds 20 m. The bay itself, and the areas immediately surrounding the outfall, may provide habitat for a number of species that are commercially important, are harvested as part of an Indigenous fishery, or for which recreational fishing occurs. The following sections provide additional detail on potential receptors.

6.3.1 Benthic Habitat

Current knowledge of invertebrates and their distribution within the Hudson Bay itself are poorly understood and, as Stewart and Lockhart (2005) suggest, may better reflect the research interests of individual scientists than the actual occurrence of invertebrate species due to the magnitude of the task of surveying this region. That said, many of the benthic invertebrate species are regarded as Arctic forms that penetrate southward into Hudson Bay, a reflection of their continuity with the primarily Arctic surface waters of the Canadian Arctic Archipelago and the surface of the Arctic Ocean (Stewart and Lockhart 2005). Generally, there are few benthic invertebrates that inhabit the intertidal zone including

clams, mussels, snails, barnacles, worms, sea anemones, amphipods and sea squirts, but ice scour can limit their abundance. As a result, most benthic invertebrates are thought to live below the ice scour zone. These include echinoderms, sea spiders, most polychaetes, clams and snails, shrimps and crabs, hydroids and bryozoans (Stewart and Lockhart 2005).

A seabed inspection was conducted in 2010/2011 using an underwater video camera (Worley Parsons 2011), both in the vicinity of the outfall, along the adjacent shoreline, and at a reference location near Bunting Island. It is noted that upgrades to the WWTF have occurred since the 2011 study, including diffuser and outfall replacement in 2013, as well as an auger installation in 2012.

Vegetation identified near the outfall (water depths 5 to 5.6 m) on a pebble, cobble, boulder and shell hash bottom, included small patches filamentous brown algae (species not identified) and 10-40% coverage of kelp (*Laminaria sp.*). The density of these plants increased to 100% cover at a distance from the outfall (water depths 2-7.5 m). Other organisms observed included occasional tubeworms (*Serpula sp.*), a tunicate, sea stars and jellyfish (species unconfirmed), and an Atlantic cod (*Gadus Morhua*). Areas of sand were noted in water depths 2- 13 m. These areas had lower seaweed abundance and similar occurrences of other organisms.

6.3.2 Fish and Fish Habitat

Knowledge of fishes in the Hudson Bay marine ecosystem is scant with the exception of harvested anadromous species (Stewart and Lockhart 2005). Most fish harvested in Hudson Bay are taken from estuarine or coastal waters during the open water season by Inuit food fisheries. Fish are harvested for the food they provide, and as a traditional social and cultural activity (Stewart and Lockhart 2005). Anadromous Arctic charr (*Salvenius aplinus)* are the fishes most sought after for subsistence by the Inuit because they are available at predictable times and locations, grow quickly to a large size, and are free of parasites that infect people (Stewart and Lockhart 2005). The Meliadine River, located at the head of Prairie Bay, supports a run of anadromous Arctic charr and has been the site of an important Inuit fishery for many generations (McGowan 1992). Recreational fishing also occurs for both Arctic charr and Arctic grayling (*Thymallus arcticus*) in this river. A commercial fishery for Arctic charr has existed historically (Stewart and Lockhart 2005) near Rankin Inlet; however, it is not currently known to have harvested charr from the Meliadine River. That said, the commercial fishery had to be halted and sport and subsistence fishing reduced in the nearby Diana River, immediately to the south of Rankin Inlet, to facilitate the recovery of the charr population (Stewart and Lockhart 2005).

The best available information regarding the subsistence harvest of fishes around Rankin Inlet is reported by Gamble (1988) and is summarized in the table below.

Table 6-2: Estimated mean annual subsistence harvests of fishes by Inuit around Rankin Inlet (1982-1985)

Fish Species	Estimated Number of Fish Harvested
Cod	12
Sculpin	13
Arctic charr	7361
Lake trout	354
Lake whitefish/ lake cisco	8

*Adapted from Stewart and Lockhart 2005 (see Table 14-1)

Of these known harvested species the cod, sculpin and Arctic charr, potential for impact from the outfall is most likely related to minor habitat alterations in the vicinity of the outfall if sediment deposition occurs. In general, these species are mobile and not anticipated to be affected by local water quality changes. Additionally, the location of the Meliadine River at the northern head of Prairie Bay likely limits interaction with migrating Arctic charr.

6.3.3 Marine Mammals

Marine mammals identified by DFO (2017) as present in Hudson Bay and the Arctic Ocean and are part of subsistence harvest by Inuit include Beluga (*Delphinapterus leucas*) (Special Concern Status), Ringed Seal (*Pusa hispida*), Bearded Seal (*Erignathus barbatus*) and Walrus (*Odobenus rosmarus*) (Special Concern Status). The whales, most seals, and perhaps even walruses can dive to the bottom to feed throughout most of the Hudson Bay (Stewart and Lockhart 2005). However, little is known of these species' diets or energetics in the region (Stewart and Lockhart 2005).

The traditional subsistence harvest of marine mammals that use the waters or ice of the Hudson Bay marine ecosystem are important to the Indigenous cultures and regional economy. These animals include belugas, narwhals, walruses and a number of species of seal (Stewart and Lockhart 2005). The populations of bowhead and beluga whales, harvested commercially during European exploration and colonization into the 1600s, have not recovered and remain depleted (Stewart and Lockhart 2005). The table below summarizes the subsistence harvest of marine mammals in Rankin Inlet.

Table 6-3: Mean Annual Subsistence Harvest of Marine Mammals in the Rankin Inlet Area (Various Years)

Marine Mammal	Year Range	Mean Annual Harvest
[1]Beluga Whale	1990-2001	41
[1]Narwhal	1990-2001	2.3
[2]Walrus	1993-2002	5.3
[3]Ring Seal	1982-1985	454
[3]Bearded Seal	1982-1985	23

Marine Mammal	Year Range	Mean Annual Harvest
[3]Harp Seal	1982-1985	2
[3]Harbour Seal	1982-1985	3

[1]Adapted from Stewart and Lockhart 2005 (see Table 14-3)
[2]Adapted from Stewart and Lockhart 2005 (see Table 14-8)
[3]Adapted from Stewart and Lockhart 2005 (see Table 14-9)

These species are mobile and likely not to rely on habitat near the outfall area. Lastly, informal personal communications with local fishermen during the 2018 dye study indicate most whale harvesting now occurs well offshore, generally around the shores of Marble Island, located approximately 43 kilometres east.

7.0 Dye Tracing Results

The dye tracing was undertaken on October 18, 2018 between approximately 0930-1130 CDT. Environmental data associated with the field visit is provided in Appendix D. The timing of the field data collection corresponds with a rising tide (high tide was predicted for approximately 1222 CDT). The outfall location was easily visible and buoyant plume conditions appeared to be present.

The data collected is a "snapshot" of conditions at the time of the assessment and does not represent the variety of environmental conditions (such as wind and tidal mixing or seasonal variability). Dilution observed at approximately 100 m of the outfall was over 200 times. However, it is noted that a reduced dilution (less than 75 times) was observed approximately 1.5 km along the plume in a shallower area with ice build-up at the time of the survey. Sources of uncertainty in the assessment included:

- Due to the non-continuous ("pulsing") nature of the discharge, the measurements at one point in time may not reflect maximum concentrations at that location.
- Field measurement occurred under a limited tidal and wind condition range.
- Full delineation of the plume was not possible due to field conditions at the time, therefore the plot is interpolated from incomplete data.

8.0 Summary

The work undertaken in this 2018/2019 study focused on understanding effluent quality and potential marine environment interactions specific to the Rankin Inlet WWTF. It is noted that further direction is pending on potential effluent criteria for the North and that effluent treatment design requires identification of effluent discharge objectives.

A key conclusion from the Recommendations for the Development of Nunavut Municipal Wastewater Management Standards (EXP October 2017) was: "It is recommended water quality based limitations more stringent than the technology based limitations be applied on a case-by-case basis, informed by the sensitivity and use of the receiving environment and applied at the edge of a mixing zone." Similarly, recent studies (CWRS 2016) of three municipal wastewater discharges to marine receiving water in the summer of 2013 including dye tracer studies also highlighted that the risk of water quality impacts was very site-specific.

Wastewater characterization from sampling completed by Dillon identified that TSS and CBOD5 exceed guidance established under the *Canada-wide Strategy for Management of Municipal Wastewater*, as well, additional parameters exceeded the CEQG that would be applicable to the receiving environment. Based on available effluent chemistry for toxicity testing and review of CEQG, potential contaminants of concern are TSS and CBOD5 (in relation to DO), un-ionized ammonia, copper, zinc, and potentially total phenols and Total Oil and Grease (TOG).

The review of the receiving environment identified background concentrations of some metals (e.g. copper, iron, lead) also exceed CEQG. Potential marine receptors include mobile fish and marine mammals in the larger receiving environment of Prairie Bay, that likely do not rely on the area in the vicinity of the outfall.

Based on a conservative estimate of dilution of 20:1 by 100 m from the outfall (noting that the observed dilution was an order of magnitude higher), the effluent metals concentrations outside of the mixing zone in the receiving environment are generally anticipated to be below CCME MAL guidelines/NWTWB guidelines and/or within the level observed in background marine water. The application of a mixing zone for parameters that degrade and are not acutely toxic is an acceptable practice in determining discharge requirements (CCME 2008). A more refined estimate of dilution would require application of a mixing model. The use of a mixing model may be considered as part of development of effluent discharge criteria, once direction on effluent discharge criteria for the North has been determined.

The *Fisheries Act* prohibits deposition of deleterious substance. Under the *Canada-wide Strategy* and the NWTWB guidelines, acute toxicity is not permitted in the mixing zone. Acute toxicity was observed in effluent testing. However, it is noted that organic loading (dissolved oxygen depletion) likely plays a primary role in the toxicity test outcome. The concentrations of some metals observed was generally below that identified in literature as acutely toxic, but copper levels in the effluent may be influencing the toxicity test outcomes. Within the *Canada-wide Strategy*, failure of toxicity testing requires further evaluation to identified and correct the cause of the toxicity. As the toxicity cause has not been definitively confirmed, it is suggested that additional investigations could include review of infiltration and associated contribution to water quality, and evaluation of the effects of dissolved oxygen levels.

9.0 References

Agriculture Canada. 1979. Minor Elements in Canadian Soils.

Barton, B.A. and B.R. Taylor. Northern River Basins Study Project Report No. 29. Dissolved Oxygen Requirements for Fish of the Peace, Athabasca and Slave River Basins.

Canadian Council of Ministers of the Environment (CCME). 2009. Canada-wide Strategy for the Management of Municipal Wastewater Effluent.

Canadian Council of Ministers of the Environment (CCME). 2008. Canada-wide Strategy for the Management of Municipal Wastewater Effluent. Technical Supplement 3.

Centre for Water Resources Studies (CWRS). 2015a. Assessment of Water Quality Impacts in Marine Environments Receiving Municipal Wastewater Effluent Discharges in Nunavut.

Centre for Water Resources Studies (CWRS). 2015b. Assessment of Arctic Community Wastewater Impacts on Marine Benthic Invertebrates.

Dillon Consulting Limited (Dillon). 2019. Water Consumption Review.

Dillon Consulting Limited (Dillon). 2018. Rankin Inlet Utilidor Assessment

Dillon Consulting Limited (Dillon). 2004-2011. Standard Environmental Field Procedures.

Environment and Climate Change Canada (ECCC). 2017. *Fisheries Act* Direction.

Environment Canada (ECCC). 2004. Guideline for the Release of Ammonia Dissolved in Water Found in Wastewater Effluents. Notice under the Canadian Environmental Protection Act. Canada Gazette 1, December 2004.

Environment Canada (ECCC). 2000. May 2007 and February 2016 amendments. Environmental Protection Series Biological Test Method EPS/1/RM/13.

Exp Services Inc. (Exp). 2017. Recommendations for the Development of Nunavut Municipal Wastewater Management Standards.

Gamble, R.L. 1988. Native harvest of wildlife in the Keewatin Region, Northwest Territories for the period October 1985 to March 1986 and a summary for the entire period of the harvest study from October 1981 to March 1986. Can. Data Rep. Fish. Aquat. Sci. 688: v + 85 p.

Government of Canada (GC). 2018. *Fisheries Act* and Wastewater Systems Effluent Regulations (WSER) https://lawslois.justice.gc.ca/eng/regulations/SOR-2012-139/FullText.html

Government of Nunavut Community & Government Services (GN-CGS). 2015a. Sewage Treatment Plant Upgrade Works – Phase 2 Rankin Inlet, Nunavut As Builts.

Government of Nunavut Community & Government Services (GN-CGS). 2015b. Operation and Maintenance (O&M) Plan Sewage Treatment Facility Hamlet of Rankin Inlet, Nunavut.

Gundogdu, A. 2008. Acute Toxicity of Zinc and Copper for Rainbow Trout. Journal of Fisheries Sciences 2(5):711-721.

Jacques Whitford Environment Limited (now Stantec) and Natech Environmental Services Inc. (JWEL&Natech). 2003. Final Report to Environment Canada on Revised Technical Guidance on How to Conduct Effluent Plume Delineation Studies.

McGowan, D.K. 1992. Data on Arctic charr, *Salvelinus alpinus* (L.), from the Meliadine River, Northwest Territories, 1990. Can. Data Rep. Fish. Aquat. Sci. 867: iv + 9 p.

Nunavut Water Board. Rankin Inlet Quarterly and Annual Reports on effluent quality. Environmental Monitoring Program and QAQC Plan; GRA-3 results – First Quarter Jan., Feb. 2018, 2015-2017 Annual Results

Northwest Territories Water Board (NWTWB). 1992. Guidelines for the discharge of treated municipal wastewater in the Northwest Territories.

Stewart, D.B., and Lockhart, W.L. 2005. An overview of the Hudson Bay marine ecosystem. Can. Tech. Rep. Fish. Aquat. Sci. 2586: vi + 487 p

Worley Parsons. 2011. Draft Rankin Inlet Wastewater Study Marine Discharge Assessment.

Appendix A

A-1 Flourimeter Calibration Certificates
A-2 2018/2019 Dillon Sample COAs
A-3 2018/2019 Bioassay Results

VERIFICATION WORK SHEET

Date of Calibration: October 9 2018 Technician: Troy

YSI Software update: no

Turbidity wiper changed? Yes Wiper parks ≈ 180° from optics? Yes Note: Change wiper if probe will not park correctly.
SN 12G104305

rhodamine wiper changed? Yes Wiper parks □ 180□ from optics? Yes Note: Change wiper if probe will not park correctly.
SN 12H100446

Record battery voltage: 12.1 Vdc

Record the following diagnostic numbers after calibration.

Diagnostic Numbers			**Sonde Parameters**	**Before Calibration**	**After calibration**
Conductivity Cell Constant	**4.84**	5.0 ±0.5	Spec. Cond. (**µS**)	**12869**	**12880**
pH mV @ 7.00	**-24.0**	0± 50mV	pH 7	**7.03**	**7**
pH mV @ 4.00	**152.7**	+177 from 7	pH4	**4.06**	**4**
pH mV @ 10.00	**-203.7**	–177 from 7	pH10	**10.05**	**10**
			ORP **(mV)**		**225**
DO gain	**1.1**	0.7 to 1.5	Depth **(m)**	**0.098**	**0**
Pressure Offset (non –vented)	**-13.05**	–14.7± 6	Turbidity **(0 NTU)**	**1.2**	**0**
Pressure Offset (vented)		0 ± 6	Turbidity **(126 NTU)**	**124.6**	**126**
ORP mV offset	**10.97**	0±100			
Reference Temp. .**ºC** **+/- 0.16 deg C**	**29.71**	29.862°C **Precision Thermometer**	DO **(%)** Sat.	**89.9**	**99.4**
			Rhodamine 0 ug/L	**2.2**	**0**
			Rhodamine 100ug/L	**131.3**	**100**

*** Span between pH 4 and pH 7 or pH 7 and 10 mV readings should be 165 to 180 mV approximately**.

Customer:
Model: 6600
Sn: 03B0427

VERIFICATION WORK SHEET

Date of Calibration: October 9 2018 Technician: Troy

YSI Software update: no

DO wiper changed? Yea Wiper parks ≈ 180° from optics? Yes Note: Change wiper if probe will not park correctly.
SN 12G104587

Turbidity wiper changed? Yes Wiper parks ≈ 180° from optics? Yes Note: Change wiper if probe will not park correctly.
SN 14A102304

rhodamine wiper changed? Yes Wiper parks □ 180□ from optics? Yes Note: Change wiper if probe will not park correctly.
SN 07K101631

Record battery voltage: 13.1 Vdc

Record the following diagnostic numbers after calibration.

Diagnostic Numbers			**Sonde Parameters**	**Before Calibration**	**After calibration**
Conductivity Cell Constant	**4.95**	5.0 ±0.5	Spec. Cond. (**µS**)	**12458**	**12880**
pH mV @ 7.00	**-13.8**	0± 50mV	pH 7	**6.96**	**7**
pH mV @ 4.00	**157.0**	+177 from 7	pH4	**4.04**	**4**
pH mV @ 10.00	**-185.7**	–177 from 7	pH10	**10.02**	**10**
			ORP **(mV)**	**245.3**	**225**
DO gain	**0.99**	0.7 to 1.5	Depth **(m)**	**0.028**	**0**
Pressure Offset (non –vented)	**-14.69**	–14.7± 6	Turbidity **(0 NTU)**	**0.4**	**0**
Pressure Offset (vented)		0 ± 6	Turbidity **(126 NTU)**	**124.6**	**126**
ORP mV offset	**6.96**	0±100			
Reference Temp. .**ºC** **+/- 0.16 deg C**	**29.87**	29.862°C **Precision Thermometer**	DO **(%)** Sat.	**99.3**	**99.4**
			Rhodamine 0 ug/L	**-1.3**	**0**
			Rhodamine 100ug/L	**132.0**	**100**

*** Span between pH 4 and pH 7 or pH 7 and 10 mV readings should be 165 to 180 mV approximately**.

Customer:
Model: 6600
Sn:06G2016AG

Maxxam
A Bureau Veritas Group Company

Success Through Science®

Site#: NUNAVUT
Your C.O.C. #: C#568630-01-01

Attention: Katie Whyte

DILLON CONSULTING LTD.
1558 Willson Place
Winnipeg, MB
CANADA R3T 0Y4

Report Date: 2018/11/02
Report #: R2644632
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B891584
Received: 2018/10/19, 08:05

Sample Matrix: Water
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity in Water by PC Titrator	4	N/A	2018/10/22	WIN SOP-00063	Based on SM-2320B
Carbonaceous BOD	4	2018/10/19	2018/10/19	WIN SOP-00018	Based on SM-5210B
Biochemical Oxygen Demand	4	2018/10/19	2018/10/19	WIN SOP-00018	Based on SM-5210B
F1-BTEX	3	N/A	2018/10/24	WIN SOP-00054	Auto Calc
BTEX/F1 in Water by HS GC/MS	3	N/A	2018/10/23	WINSOP-00054	EPA8260D/CCME PHCCWS
Chloride (Cl) and Sulphate (SO4) by IC (1)	2	N/A	2018/10/23	AB SOP-00026	SM 23 4110 B m
Chloride (Cl) and Sulphate (SO4) by IC (1)	2	N/A	2018/10/24	AB SOP-00026	SM 23 4110 B m
Total Coliforms (MTF)	2	N/A	2018/10/19	WIN SOP-00003	SM 23 9221 B m
E. coli (MTF)	2	N/A	2018/10/19	WIN SOP-00003	SM 23 9221 F m
Conductivity in Water by PC Titrator	4	N/A	2018/10/22	WIN SOP-00063	Based on SM-2510B
Fluoride (1)	3	N/A	2018/10/21	AB SOP-00005	SM 23 4500-F C m
Fluoride (1)	1	N/A	2018/10/31	AB SOP-00005	SM 23 4500-F C m
CCME Hydrocarbons (F2-F4 in water)	3	2018/10/22	2018/10/22	WIN SOP-00056	CCME PHC-CWS m
Fecal Coliforms (MTF)	2	N/A	2018/10/19	WIN SOP-00003	SM 23 9221 F m
Hardness (1)	3	N/A	2018/10/23	AB WI-00065	Auto Calc
Hardness (1)	1	N/A	2018/10/24	AB WI-00065	Auto Calc
Elements by ICP-Dissolved-Lab Filtered (1, 4)	4	N/A	2018/10/22	AB SOP-00042	EPA 6010d R4 m
Ion Balance (as Cations/Anions Ratio) (2)	4	N/A	2018/10/24	BBY WI-00033	Auto Calc
Ion Balance (1)	4	N/A	2018/10/22	AB WI-00065	Auto Calc
Elements by CRC ICPMS (total) (2)	4	2018/10/22	2018/10/23	BBY7SOP-00003 BBY7SOP-00002	EPA 6020b R2 m
Nitrogen (total), Calc. TKN, NO3, NO2 (1)	1	N/A	2018/10/29	AB WI-00065	Auto Calc
Nitrogen (total), Calc. TKN, NO3, NO2 (1)	3	N/A	2018/10/31	AB WI-00065	Auto Calc
Ammonia-N (Total) (1)	4	N/A	2018/10/23	AB SOP-00007	SM 23 4500 NH3 A G m
Nitrate + Nitrite-N (calculated) (1)	4	N/A	2018/10/23	AB WI-00065	Auto Calc
Nitrate (as N) (1)	4	2018/10/22	2018/10/22	AB WI-00065	Auto Calc
NO2 - NO2 + NO3 (N) by CFA (1)	4	N/A	2018/10/21	AB SOP-00082	IM 857-871m
Oil and Grease (Gravimetric, n-Hexane) (3)	1	2018/10/26	2018/10/26	EENVSOP-00093	SM 23 5520B m
Oil and Grease (Gravimetric, n-Hexane) (3)	2	2018/10/29	2018/10/29	EENVSOP-00093	SM 23 5520B m
pH in Water by PC Titrator (5)	4	N/A	2018/10/22	WIN SOP-00063	SM4500 H+B

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Site#: NUNAVUT
Your C.O.C. #: C#568630-01-01

Attention: Katie Whyte

DILLON CONSULTING LTD.
1558 Willson Place
Winnipeg, MB
CANADA R3T 0Y4

Report Date: 2018/11/02
Report #: R2644632
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B891584
Received: 2018/10/19, 08:05

Sample Matrix: Water
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Phenols (4-AAP) (1)	1	N/A	2018/10/24	CAL SOP-00067	EPA 9066 R0 m
Phenols (4-AAP) (1)	3	N/A	2018/10/25	CAL SOP-00067	EPA 9066 R0 m
Total Dissolved Solids (Calculated) (1)	4	N/A	2018/10/24	AB WI-00065	Auto Calc
Total Kjeldahl Nitrogen (1)	1	2018/10/29	2018/10/29	AB SOP-00008	EPA 351.1 R1978 m
Total Kjeldahl Nitrogen (1)	3	2018/10/31	2018/10/31	AB SOP-00008	EPA 351.1 R1978 m
Carbon (Total Organic) (1, 6)	4	N/A	2018/11/01	CAL SOP-00077	MMCW 119 1996 m
Total Phosphorus (1)	1	2018/10/25	2018/10/26	AB SOP-00024	SM 22 4500-P A,B,F m
Total Phosphorus (1)	3	2018/10/30	2018/10/30	AB SOP-00024	SM 22 4500-P A,B,F m
Total Hydrocarbons C6-C50 in Water Calc. (2)	3	N/A	2018/10/25	BBY WI-00033	Auto Calc
Rainbow Trout LC50 Multi-Concentration (3)	1	N/A	2018/10/23	EENVSOP-00160	EPS 1 RM13 2nd ed m
Rainbow Trout Single Concentration-100% (3)	1	N/A	2018/10/21	EENVSOP-00160	EPS 1 RM13 2nd ed m
Total Suspended Solids	4	N/A	2018/10/22	WIN SOP-00042	Based on SM2540 D

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.

Site#: NUNAVUT
Your C.O.C. #: C#568630-01-01

Attention: Katie Whyte

DILLON CONSULTING LTD.
1558 Willson Place
Winnipeg, MB
CANADA R3T 0Y4

Report Date: 2018/11/02
Report #: R2644632
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B891584

Received: 2018/10/19, 08:05

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) This test was performed by Maxxam Calgary Environmental
(2) This test was performed by Maxxam Vancouver
(3) This test was performed by Maxxam Edmonton Environmental
(4) Dissolved > Total Imbalance: When applicable, Dissolved and Total results were reviewed and data quality meets acceptable levels unless otherwise noted.
(5) The APHA Standard Method requires pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the APHA Standard Method holding time.
(6) TOC present in the sample should be considered as non-purgeable TOC.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Amanda Hung, B.Sc., Project Manager
Email: AHung@maxxam.ca
Phone# (204)772-7276 Ext:7062215

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B891584
Report Date: 2018/11/02

DILLON CONSULTING LTD.
Sampler Initials: KAW

TOTAL, FECAL COLIFORMS & E.COLI (MTF)

Maxxam ID		UO9724	UO9725		
Sampling Date		2018/10/18 13:00	2018/10/18 15:45		
COC Number		C#568630-01-01	C#568630-01-01		
	UNITS	**OUTFALL**	**GRAB**	**RDL**	**QC Batch**
Microbiological Param.					
E. coli (MTF)	MPN/100mL	240000	>1100000	3	9194319
Fecal Coliforms (MTF)	MPN/100mL	240000	>1100000	3	9194317
Total Coliforms (MTF)	MPN/100mL	240000	>1100000	3	9192018
RDL = Reportable Detection Limit					

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Maxxam Job #: B891584
Report Date: 2018/11/02

DILLON CONSULTING LTD.
Sampler Initials: KAW

ROUTINE WATER PACKAGE - LAB FILTERED (WATER)

Maxxam ID		UO9722		UO9723			UO9724		
Sampling Date		2018/10/17 15:00		2018/10/17 15:00			2018/10/18 13:00		
COC Number		C#568630-01-01		C#568630-01-01			C#568630-01-01		
	UNITS	**COMP**	**QC Batch**	**FD1**	**RDL**	**QC Batch**	**OUTFALL**	**RDL**	**QC Batch**
Calculated Parameters									
Hardness (CaCO3)	mg/L	65	9191010	66	0.50	9191010	5400	0.50	9191010
Ion Balance	N/A	0.93	9196232	0.94	0.010	9196232	0.97	0.010	9196232
Ion Balance (% Difference)	%	3.7	9191016	3.1	N/A	9191016	1.4	N/A	9191016
Dissolved Nitrate (N)	mg/L	<0.020	9194897	<0.020	0.020	9194897	<0.020	0.020	9194897
Nitrate plus Nitrite (N)	mg/L	<0.022	9191032	<0.022	0.022	9191032	<0.022	0.022	9191032
Calculated Total Dissolved Solids	mg/L	210	9191047	210	10	9191047	30000	10	9191047
Misc. Inorganics									
Alkalinity (Total as CaCO3)	mg/L	97.8	9192368	98.1	0.50	9192368	106	0.50	9192368
Conductivity	uS/cm	425	9192366	427	2.0	9192366	47700	2.0	9192366
pH	pH	7.34	9192365	7.34		9192365	7.73		9192365
Bicarbonate (HCO3)	mg/L	119	9192368	120	0.50	9192368	129	0.50	9192368
Carbonate (CO3)	mg/L	<0.50	9192368	<0.50	0.50	9192368	<0.50	0.50	9192368
Hydroxide (OH)	mg/L	<0.50	9192368	<0.50	0.50	9192368	<0.50	0.50	9192368
Anions									
Dissolved Chloride (Cl)	mg/L	50	9196939	50	0.50	9196939	17000 (1)	100	9196939
Dissolved Sulphate (SO4)	mg/L	23	9196939	22	0.50	9196939	2400 (2)	50	9196939
Nutrients									
Dissolved Nitrite (N)	mg/L	<0.010	9194972	<0.010	0.010	9194972	<0.010	0.010	9194972
Dissolved Nitrate plus Nitrite (N)	mg/L	<0.020	9194972	<0.020	0.020	9194972	<0.020	0.020	9194972
Lab Filtered Elements									
Dissolved Calcium (Ca)	mg/L	18	9195268	19	0.30	9195269	310	0.30	9195270
Dissolved Iron (Fe)	mg/L	<0.060	9195268	<0.060	0.060	9195269	<0.060	0.060	9195270
Dissolved Magnesium (Mg)	mg/L	4.6	9195268	4.7	0.20	9195269	1100 (1)	10	9195270
Dissolved Manganese (Mn)	mg/L	0.032	9195268	0.034	0.0040	9195269	<0.0040	0.0040	9195270
Dissolved Potassium (K)	mg/L	7.4	9195268	7.7	0.30	9195269	350	0.30	9195270
Dissolved Sodium (Na)	mg/L	27	9195268	28	0.50	9195269	9200 (1)	25	9195270

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.
(2) Detection limits raised due to matrix interference.

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Maxxam Job #: B891584
Report Date: 2018/11/02

DILLON CONSULTING LTD.
Sampler Initials: KAW

ROUTINE WATER PACKAGE - LAB FILTERED (WATER)

Maxxam ID		UO9727		
Sampling Date		2018/10/18 13:15		
COC Number		C#568630-01-01		
	UNITS	**BACKGROUND**	**RDL**	**QC Batch**
Calculated Parameters				
Hardness (CaCO3)	mg/L	5400	0.50	9191010
Ion Balance	N/A	0.95	0.010	9196232
Ion Balance (% Difference)	%	2.4	N/A	9191016
Dissolved Nitrate (N)	mg/L	<0.020	0.020	9194897
Nitrate plus Nitrite (N)	mg/L	<0.022	0.022	9191032
Calculated Total Dissolved Solids	mg/L	31000	10	9191047
Misc. Inorganics				
Alkalinity (Total as CaCO3)	mg/L	104	0.50	9192368
Conductivity	uS/cm	48200	2.0	9192366
pH	pH	7.85		9192365
Bicarbonate (HCO3)	mg/L	127	0.50	9192368
Carbonate (CO3)	mg/L	<0.50	0.50	9192368
Hydroxide (OH)	mg/L	<0.50	0.50	9192368
Anions				
Dissolved Chloride (Cl)	mg/L	18000 (1)	100	9196939
Dissolved Sulphate (SO4)	mg/L	2300 (2)	50	9196939
Nutrients				
Dissolved Nitrite (N)	mg/L	<0.010	0.010	9194972
Dissolved Nitrate plus Nitrite (N)	mg/L	<0.020	0.020	9194972
Lab Filtered Elements				
Dissolved Calcium (Ca)	mg/L	320	0.30	9195270
Dissolved Iron (Fe)	mg/L	<0.060	0.060	9195270
Dissolved Magnesium (Mg)	mg/L	1100 (1)	10	9195270
Dissolved Manganese (Mn)	mg/L	<0.0040	0.0040	9195270
Dissolved Potassium (K)	mg/L	360	0.30	9195270
Dissolved Sodium (Na)	mg/L	9200 (1)	25	9195270

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.
(2) Detection limits raised due to matrix interference.

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Maxxam Job #: B891584
Report Date: 2018/11/02

DILLON CONSULTING LTD.
Sampler Initials: KAW

BTEX/F1-F4 IN WATER (WATER)

Maxxam ID		UO9724	UO9725	UO9726		
Sampling Date		2018/10/18 13:00	2018/10/18 15:45	2018/10/18 15:45		
COC Number		C#568630-01-01	C#568630-01-01	C#568630-01-01		
	UNITS	**OUTFALL**	**GRAB**	**FD2**	**RDL**	**QC Batch**
Ext. Pet. Hydrocarbon						
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	0.16	0.10	9194215
F3 (C16-C34 Hydrocarbons)	mg/L	0.89	2.0	2.2	0.10	9194215
F4 (C34-C50 Hydrocarbons)	mg/L	<0.20	0.70	1.1	0.20	9194215
Volatiles						
Xylenes (Total)	ug/L	<0.89	<0.89	<0.89	0.89	9191790
F1 (C6-C10) - BTEX	ug/L	<100	<100	<100	100	9191790
Benzene	ug/L	<0.40	<0.40	<0.40	0.40	9195889
Toluene	ug/L	<0.40	0.47	0.49	0.40	9195889
Ethylbenzene	ug/L	<0.40	<0.40	<0.40	0.40	9195889
o-Xylene	ug/L	<0.40	<0.40	<0.40	0.40	9195889
m & p-Xylene	ug/L	<0.80	<0.80	<0.80	0.80	9195889
F1 (C6-C10)	ug/L	<100	<100	<100	100	9195889
Surrogate Recovery (%)						
1,4-Difluorobenzene (sur.)	%	99	108	107		9195889
4-Bromofluorobenzene (sur.)	%	96	93	95		9195889
D4-1,2-Dichloroethane (sur.)	%	110	94	98		9195889
O-TERPHENYL (sur.)	%	91	91	94		9194215
RDL = Reportable Detection Limit						

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Maxxam Job #: B891584
Report Date: 2018/11/02

DILLON CONSULTING LTD.
Sampler Initials: KAW

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		UO9722		UO9723			UO9724		
Sampling Date		2018/10/17 15:00		2018/10/17 15:00			2018/10/18 13:00		
COC Number		C#568630-01-01		C#568630-01-01			C#568630-01-01		
	UNITS	**COMP**	**QC Batch**	**FD1**	**RDL**	**QC Batch**	**OUTFALL**	**RDL**	**QC Batch**
Demand Parameters									
Biochemical Oxygen Demand	mg/L	130	9191549	130	30	9191549	5	3	9191549
Carbonaceous BOD	mg/L	130	9191557	180	30	9191557	5	3	9191557
Misc. Inorganics									
Total Organic Carbon (C)	mg/L	33 (1)	9209025	33 (1)	1.0	9209025	87 (1)	10	9209025
Anions									
Dissolved Fluoride (F)	mg/L	0.070	9193969	0.072	0.050	9193969	0.83	0.050	9193969
Nutrients									
Total Ammonia (N)	mg/L	12 (1)	9194628	12 (1)	0.15	9194628	0.90	0.015	9194628
Total Nitrogen (N)	mg/L	26	9192007	26	0.055	9192007	0.36	0.055	9192007
Total Phosphorus (P)	mg/L	3.0 (1)	9206300	2.9 (1)	0.030	9206284	0.11	0.0030	9206300
Total Total Kjeldahl Nitrogen	mg/L	26 (1)	9208097	26 (1)	1.0	9208097	0.36	0.050	9208097
Misc. Organics									
Extractable (n-Hex.) Oil and grease	mg/L						<2.0	2.0	9202106
Phenols	mg/L						0.031 (2)	0.020	9197588
Physical Properties									
Total Suspended Solids	mg/L	87.0	9194420	88.0	4.0	9194420	18.0	4.0	9194420

RDL = Reportable Detection Limit
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.
(2) Detection limits raised due to matrix interference.

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Maxxam Job #: B891584
Report Date: 2018/11/02

DILLON CONSULTING LTD.
Sampler Initials: KAW

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		UO9725			UO9726			UO9727		
Sampling Date		2018/10/18 15:45			2018/10/18 15:45			2018/10/18 13:15		
COC Number		C#568630-01-01			C#568630-01-01			C#568630-01-01		
	UNITS	**GRAB**	**RDL**	**QC Batch**	**FD2**	**RDL**	**QC Batch**	**BACKGROUND**	**RDL**	**QC Batch**
Demand Parameters										
Biochemical Oxygen Demand	mg/L							<3	3	9191549
Carbonaceous BOD	mg/L							<3	3	9191557
Misc. Inorganics										
Total Organic Carbon (C)	mg/L							73 (1)	10	9209025
Anions										
Dissolved Fluoride (F)	mg/L							0.76	0.050	9209036
Nutrients										
Total Ammonia (N)	mg/L							0.89	0.015	9194628
Total Nitrogen (N)	mg/L							0.15	0.055	9192007
Total Phosphorus (P)	mg/L							<0.030 (2)	0.030	9199793
Total Total Kjeldahl Nitrogen	mg/L							0.15	0.050	9204356
Misc. Organics										
Extractable (n-Hex.) Oil and grease	mg/L	41	2.0	9204727	32	2.0	9204727			
Phenols	mg/L	0.029	0.0020	9197588	0.029	0.0020	9197588	<0.020 (3)	0.020	9197588
Physical Properties										
Total Suspended Solids	mg/L							6.0	4.0	9194420
Rainbow Trout Bioassay										
Mortality	%	ATTACHED	N/A	9194107						

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.
(2) Detection limits raised due to sample matrix.
(3) Detection limits raised due to matrix interference.

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Maxxam Job #: B891584
Report Date: 2018/11/02

DILLON CONSULTING LTD.
Sampler Initials: KAW

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		UO9722	UO9723		UO9724	UO9727		
Sampling Date		2018/10/17 15:00	2018/10/17 15:00		2018/10/18 13:00	2018/10/18 13:15		
COC Number		C#568630-01-01	C#568630-01-01		C#568630-01-01	C#568630-01-01		
	UNITS	**COMP**	**FD1**	**RDL**	**OUTFALL**	**BACKGROUND**	**RDL**	**QC Batch**
Total Metals by ICPMS								
Total Aluminum (Al)	ug/L	147	156	3.0	<150	<150	150	9195462
Total Antimony (Sb)	ug/L	<0.50	<0.50	0.50	<25	<25	25	9195462
Total Arsenic (As)	ug/L	0.79	0.77	0.10	<5.0	<5.0	5.0	9195462
Total Barium (Ba)	ug/L	21.6	23.1	1.0	<50	<50	50	9195462
Total Beryllium (Be)	ug/L	<0.10	<0.10	0.10	<5.0	<5.0	5.0	9195462
Total Cadmium (Cd)	ug/L	0.060	0.065	0.010	<0.50	<0.50	0.50	9195462
Total Cesium (Cs)	ug/L	<0.20	<0.20	0.20	<10	<10	10	9195462
Total Chromium (Cr)	ug/L	<1.0	<1.0	1.0	<50	<50	50	9195462
Total Cobalt (Co)	ug/L	0.24	0.22	0.20	<10	<10	10	9195462
Total Copper (Cu)	ug/L	130	133	0.50	<25	<25	25	9195462
Total Iron (Fe)	ug/L	223	224	10	<500	<500	500	9195462
Total Lead (Pb)	ug/L	1.85	1.97	0.20	<10	<10	10	9195462
Total Lithium (Li)	ug/L	2.3	2.6	2.0	144	143	100	9195462
Total Manganese (Mn)	ug/L	35.9	37.7	1.0	<50	<50	50	9195462
Total Molybdenum (Mo)	ug/L	<1.0	1.0	1.0	<50	<50	50	9195462
Total Nickel (Ni)	ug/L	2.3	2.4	1.0	<50	<50	50	9195462
Total Rubidium (Rb)	ug/L	8.15	8.50	0.20	106	102	10	9195462
Total Selenium (Se)	ug/L	0.23	0.24	0.10	<5.0	<5.0	5.0	9195462
Total Silver (Ag)	ug/L	0.029	0.037	0.020	<1.0	<1.0	1.0	9195462
Total Strontium (Sr)	ug/L	88.6	88.1	1.0	6970	6940	50	9195462
Total Thallium (Tl)	ug/L	<0.010	<0.010	0.010	<0.50	<0.50	0.50	9195462
Total Titanium (Ti)	ug/L	9.4	10.3	5.0	<250	<250	250	9195462
Total Uranium (U)	ug/L	0.15	0.15	0.10	<5.0	<5.0	5.0	9195462
Total Vanadium (V)	ug/L	<5.0	<5.0	5.0	<250	<250	250	9195462
Total Zinc (Zn)	ug/L	76.3	81.6	5.0	<250	<250	250	9195462

RDL = Reportable Detection Limit

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Maxxam Job #: B891584
Report Date: 2018/11/02

DILLON CONSULTING LTD.
Sampler Initials: KAW

TOTAL PETROLEUM HYDROCARBONS (WATER)

Maxxam ID		UO9724	UO9725	UO9726		
Sampling Date		2018/10/18 13:00	2018/10/18 15:45	2018/10/18 15:45		
COC Number		C#568630-01-01	C#568630-01-01	C#568630-01-01		
	UNITS	**OUTFALL**	**GRAB**	**FD2**	**RDL**	**QC Batch**
Calculated Parameters						
Calculated C6-C50 Hydrocarbons	mg/L	0.89	2.7	3.5	0.26	9196208
RDL = Reportable Detection Limit						

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Maxxam Job #: B891584
Report Date: 2018/11/02

DILLON CONSULTING LTD.
Sampler Initials: KAW

TOXICOLOGY (WATER)

Maxxam ID		UO9725	
Sampling Date		2018/10/18 15:45	
COC Number		C#568630-01-01	
	UNITS	**GRAB**	**QC Batch**
Rainbow Trout Bioassay			
LC50	% vol/vol	ATTACHED	9196544

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Maxxam Job #: B891584
Report Date: 2018/11/02

DILLON CONSULTING LTD.
Sampler Initials: KAW

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	1.9°C
Package 2	5.5°C
Package 3	9.1°C

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER) Comments

Sample UO9724 [OUTFALL] Elements by CRC ICPMS (total): RDL raised due to concentration over linear range, sample dilution required.
Sample UO9727 [BACKGROUND] Elements by CRC ICPMS (total): RDL raised due to concentration over linear range, sample dilution required.

Results relate only to the items tested.

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Maxxam Job #: B891584
Report Date: 2018/11/02

DILLON CONSULTING LTD.
Sampler Initials: KAW

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
9191549	THN	Method Blank	Biochemical Oxygen Demand	2018/10/19	<1		mg/L	
9191549	THN	RPD	Biochemical Oxygen Demand	2018/10/19	9.1		%	20
9191557	THN	Method Blank	Carbonaceous BOD	2018/10/19	<1		mg/L	
9191557	THN	RPD	Carbonaceous BOD	2018/10/19	7.7		%	20
9192018	JWI	Method Blank	Total Coliforms (MTF)	2018/10/19	<3		MPN/100mL	
9192366	KMP	Spiked Blank	Conductivity	2018/10/22		100	%	90 - 110
9192366	KMP	Method Blank	Conductivity	2018/10/22	<2.0		uS/cm	
9192366	KMP	RPD	Conductivity	2018/10/22	0.73		%	20
9192368	KMP	Spiked Blank	Alkalinity (Total as CaCO3)	2018/10/22		90	%	80 - 120
9192368	KMP	Method Blank	Alkalinity (Total as CaCO3)	2018/10/22	<0.50		mg/L	
			Bicarbonate (HCO3)	2018/10/22	<0.50		mg/L	
			Carbonate (CO3)	2018/10/22	<0.50		mg/L	
			Hydroxide (OH)	2018/10/22	<0.50		mg/L	
9192368	KMP	RPD	Alkalinity (Total as CaCO3)	2018/10/22	11		%	20
			Bicarbonate (HCO3)	2018/10/22	11		%	20
			Carbonate (CO3)	2018/10/22	NC		%	20
			Hydroxide (OH)	2018/10/22	NC		%	20
9193969	TMU	Matrix Spike	Dissolved Fluoride (F)	2018/10/21		103	%	80 - 120
9193969	TMU	Spiked Blank	Dissolved Fluoride (F)	2018/10/21		101	%	80 - 120
9193969	TMU	Method Blank	Dissolved Fluoride (F)	2018/10/21	<0.050		mg/L	
9193969	TMU	RPD	Dissolved Fluoride (F)	2018/10/21	0.99		%	20
9194215	SPR	Matrix Spike	O-TERPHENYL (sur.)	2018/10/22		96	%	60 - 130
			F2 (C10-C16 Hydrocarbons)	2018/10/22		91	%	60 - 130
			F3 (C16-C34 Hydrocarbons)	2018/10/22		95	%	60 - 130
			F4 (C34-C50 Hydrocarbons)	2018/10/22		99	%	60 - 130
9194215	SPR	Spiked Blank	O-TERPHENYL (sur.)	2018/10/22		96	%	60 - 130
			F2 (C10-C16 Hydrocarbons)	2018/10/22		91	%	70 - 130
			F3 (C16-C34 Hydrocarbons)	2018/10/22		96	%	70 - 130
			F4 (C34-C50 Hydrocarbons)	2018/10/22		98	%	70 - 130
9194215	SPR	Method Blank	O-TERPHENYL (sur.)	2018/10/24		96	%	60 - 130
			F2 (C10-C16 Hydrocarbons)	2018/10/24	<0.10		mg/L	
			F3 (C16-C34 Hydrocarbons)	2018/10/24	<0.10		mg/L	
			F4 (C34-C50 Hydrocarbons)	2018/10/24	<0.20		mg/L	
9194215	SPR	RPD	F2 (C10-C16 Hydrocarbons)	2018/10/23	86 (1)		%	30
			F3 (C16-C34 Hydrocarbons)	2018/10/23	68 (1)		%	30
			F4 (C34-C50 Hydrocarbons)	2018/10/23	NC		%	30
9194420	THN	Spiked Blank	Total Suspended Solids	2018/10/22		97	%	80 - 120
9194420	THN	Method Blank	Total Suspended Solids	2018/10/22	<4.0		mg/L	
9194420	THN	RPD [UO9722-01]	Total Suspended Solids	2018/10/22	2.3		%	20
9194628	JLD	Matrix Spike	Total Ammonia (N)	2018/10/23		97	%	80 - 120
9194628	JLD	Spiked Blank	Total Ammonia (N)	2018/10/23		100	%	80 - 120
9194628	JLD	Method Blank	Total Ammonia (N)	2018/10/23	<0.015		mg/L	
9194628	JLD	RPD	Total Ammonia (N)	2018/10/23	0.70		%	20
9194972	HA4	Matrix Spike [UO9722-03]	Dissolved Nitrite (N)	2018/10/21		101	%	80 - 120
			Dissolved Nitrate plus Nitrite (N)	2018/10/21		110	%	80 - 120
9194972	HA4	Spiked Blank	Dissolved Nitrite (N)	2018/10/21		100	%	80 - 120
			Dissolved Nitrate plus Nitrite (N)	2018/10/21		110	%	80 - 120
9194972	HA4	Method Blank	Dissolved Nitrite (N)	2018/10/21	<0.010		mg/L	
			Dissolved Nitrate plus Nitrite (N)	2018/10/21	<0.020		mg/L	
9194972	HA4	RPD [UO9722-03]	Dissolved Nitrite (N)	2018/10/21	NC		%	20
			Dissolved Nitrate plus Nitrite (N)	2018/10/21	NC		%	20
9195268	MAP	Matrix Spike	Dissolved Calcium (Ca)	2018/10/22		93	%	80 - 120
			Dissolved Iron (Fe)	2018/10/22		94	%	80 - 120
			Dissolved Magnesium (Mg)	2018/10/22		96	%	80 - 120

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Maxxam Job #: B891584
Report Date: 2018/11/02

DILLON CONSULTING LTD.
Sampler Initials: KAW

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Manganese (Mn)	2018/10/22		94	%	80 - 120
			Dissolved Potassium (K)	2018/10/22		93	%	80 - 120
			Dissolved Sodium (Na)	2018/10/22		NC	%	80 - 120
9195268	MAP	Spiked Blank	Dissolved Calcium (Ca)	2018/10/22		98	%	80 - 120
			Dissolved Iron (Fe)	2018/10/22		97	%	80 - 120
			Dissolved Magnesium (Mg)	2018/10/22		99	%	80 - 120
			Dissolved Manganese (Mn)	2018/10/22		98	%	80 - 120
			Dissolved Potassium (K)	2018/10/22		93	%	80 - 120
			Dissolved Sodium (Na)	2018/10/22		92	%	80 - 120
9195268	MAP	Method Blank	Dissolved Calcium (Ca)	2018/10/22	<0.30		mg/L	
			Dissolved Iron (Fe)	2018/10/22	<0.060		mg/L	
			Dissolved Magnesium (Mg)	2018/10/22	<0.20		mg/L	
			Dissolved Manganese (Mn)	2018/10/22	<0.0040		mg/L	
			Dissolved Potassium (K)	2018/10/22	<0.30		mg/L	
			Dissolved Sodium (Na)	2018/10/22	<0.50		mg/L	
9195268	MAP	RPD	Dissolved Calcium (Ca)	2018/10/22	0.52		%	20
			Dissolved Iron (Fe)	2018/10/22	NC		%	20
			Dissolved Magnesium (Mg)	2018/10/22	0.26		%	20
			Dissolved Manganese (Mn)	2018/10/22	0.24		%	20
			Dissolved Potassium (K)	2018/10/22	1.2		%	20
			Dissolved Sodium (Na)	2018/10/22	1.1		%	20
9195269	MAP	Matrix Spike	Dissolved Calcium (Ca)	2018/10/22		NC	%	80 - 120
			Dissolved Iron (Fe)	2018/10/22		83	%	80 - 120
			Dissolved Magnesium (Mg)	2018/10/22		NC	%	80 - 120
			Dissolved Manganese (Mn)	2018/10/22		87	%	80 - 120
			Dissolved Potassium (K)	2018/10/22		90	%	80 - 120
			Dissolved Sodium (Na)	2018/10/22		NC	%	80 - 120
9195269	MAP	Spiked Blank	Dissolved Calcium (Ca)	2018/10/22		97	%	80 - 120
			Dissolved Iron (Fe)	2018/10/22		97	%	80 - 120
			Dissolved Magnesium (Mg)	2018/10/22		100	%	80 - 120
			Dissolved Manganese (Mn)	2018/10/22		97	%	80 - 120
			Dissolved Potassium (K)	2018/10/22		94	%	80 - 120
			Dissolved Sodium (Na)	2018/10/22		93	%	80 - 120
9195269	MAP	Method Blank	Dissolved Calcium (Ca)	2018/10/22	<0.30		mg/L	
			Dissolved Iron (Fe)	2018/10/22	<0.060		mg/L	
			Dissolved Magnesium (Mg)	2018/10/22	<0.20		mg/L	
			Dissolved Manganese (Mn)	2018/10/22	<0.0040		mg/L	
			Dissolved Potassium (K)	2018/10/22	<0.30		mg/L	
			Dissolved Sodium (Na)	2018/10/22	<0.50		mg/L	
9195269	MAP	RPD	Dissolved Calcium (Ca)	2018/10/22	0.35		%	20
			Dissolved Iron (Fe)	2018/10/22	2.7		%	20
			Dissolved Magnesium (Mg)	2018/10/22	0.25		%	20
			Dissolved Manganese (Mn)	2018/10/22	0.28		%	20
			Dissolved Potassium (K)	2018/10/22	0.55		%	20
			Dissolved Sodium (Na)	2018/10/22	0.46		%	20
9195270	MAP	Matrix Spike	Dissolved Calcium (Ca)	2018/10/22		NC	%	80 - 120
			Dissolved Iron (Fe)	2018/10/22		92	%	80 - 120
			Dissolved Magnesium (Mg)	2018/10/22		93	%	80 - 120
			Dissolved Manganese (Mn)	2018/10/22		89	%	80 - 120
			Dissolved Potassium (K)	2018/10/22		96	%	80 - 120
			Dissolved Sodium (Na)	2018/10/22		96	%	80 - 120
9195270	MAP	Spiked Blank	Dissolved Calcium (Ca)	2018/10/22		100	%	80 - 120
			Dissolved Iron (Fe)	2018/10/22		96	%	80 - 120
			Dissolved Magnesium (Mg)	2018/10/22		101	%	80 - 120
			Dissolved Manganese (Mn)	2018/10/22		99	%	80 - 120

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Maxxam Job #: B891584
Report Date: 2018/11/02

DILLON CONSULTING LTD.
Sampler Initials: KAW

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Potassium (K)	2018/10/22		97	%	80 - 120
			Dissolved Sodium (Na)	2018/10/22		98	%	80 - 120
9195270	MAP	Method Blank	Dissolved Calcium (Ca)	2018/10/22	<0.30		mg/L	
			Dissolved Iron (Fe)	2018/10/22	<0.060		mg/L	
			Dissolved Magnesium (Mg)	2018/10/22	<0.20		mg/L	
			Dissolved Manganese (Mn)	2018/10/22	<0.0040		mg/L	
			Dissolved Potassium (K)	2018/10/22	<0.30		mg/L	
			Dissolved Sodium (Na)	2018/10/22	<0.50		mg/L	
9195270	MAP	RPD	Dissolved Calcium (Ca)	2018/10/22	0.61		%	20
			Dissolved Iron (Fe)	2018/10/22	NC		%	20
			Dissolved Magnesium (Mg)	2018/10/22	0.47		%	20
			Dissolved Manganese (Mn)	2018/10/22	0.24		%	20
			Dissolved Potassium (K)	2018/10/22	0.047		%	20
			Dissolved Sodium (Na)	2018/10/22	0.83		%	20
9195462	MHM	Matrix Spike	Total Aluminum (Al)	2018/10/23		100	%	80 - 120
			Total Antimony (Sb)	2018/10/23		103	%	80 - 120
			Total Arsenic (As)	2018/10/23		104	%	80 - 120
			Total Barium (Ba)	2018/10/23		104	%	80 - 120
			Total Beryllium (Be)	2018/10/23		99	%	80 - 120
			Total Cadmium (Cd)	2018/10/23		99	%	80 - 120
			Total Cesium (Cs)	2018/10/23		103	%	80 - 120
			Total Chromium (Cr)	2018/10/23		96	%	80 - 120
			Total Cobalt (Co)	2018/10/23		94	%	80 - 120
			Total Copper (Cu)	2018/10/23		93	%	80 - 120
			Total Iron (Fe)	2018/10/23		94	%	80 - 120
			Total Lead (Pb)	2018/10/23		100	%	80 - 120
			Total Lithium (Li)	2018/10/23		NC	%	80 - 120
			Total Manganese (Mn)	2018/10/23		97	%	80 - 120
			Total Molybdenum (Mo)	2018/10/23		NC	%	80 - 120
			Total Nickel (Ni)	2018/10/23		97	%	80 - 120
			Total Rubidium (Rb)	2018/10/23		106	%	80 - 120
			Total Selenium (Se)	2018/10/23		98	%	80 - 120
			Total Silver (Ag)	2018/10/23		97	%	80 - 120
			Total Strontium (Sr)	2018/10/23		NC	%	80 - 120
			Total Thallium (Tl)	2018/10/23		100	%	80 - 120
			Total Titanium (Ti)	2018/10/23		104	%	80 - 120
			Total Uranium (U)	2018/10/23		101	%	80 - 120
			Total Vanadium (V)	2018/10/23		103	%	80 - 120
			Total Zinc (Zn)	2018/10/23		104	%	80 - 120
9195462	MHM	Spiked Blank	Total Aluminum (Al)	2018/10/23		101	%	80 - 120
			Total Antimony (Sb)	2018/10/23		101	%	80 - 120
			Total Arsenic (As)	2018/10/23		101	%	80 - 120
			Total Barium (Ba)	2018/10/23		101	%	80 - 120
			Total Beryllium (Be)	2018/10/23		99	%	80 - 120
			Total Cadmium (Cd)	2018/10/23		101	%	80 - 120
			Total Cesium (Cs)	2018/10/23		102	%	80 - 120
			Total Chromium (Cr)	2018/10/23		96	%	80 - 120
			Total Cobalt (Co)	2018/10/23		96	%	80 - 120
			Total Copper (Cu)	2018/10/23		95	%	80 - 120
			Total Iron (Fe)	2018/10/23		96	%	80 - 120
			Total Lead (Pb)	2018/10/23		103	%	80 - 120
			Total Lithium (Li)	2018/10/23		98	%	80 - 120
			Total Manganese (Mn)	2018/10/23		98	%	80 - 120
			Total Molybdenum (Mo)	2018/10/23		102	%	80 - 120
			Total Nickel (Ni)	2018/10/23		98	%	80 - 120

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Maxxam Job #: B891584
Report Date: 2018/11/02

DILLON CONSULTING LTD.
Sampler Initials: KAW

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Total Rubidium (Rb)	2018/10/23		102	%	80 - 120
			Total Selenium (Se)	2018/10/23		100	%	80 - 120
			Total Silver (Ag)	2018/10/23		101	%	80 - 120
			Total Strontium (Sr)	2018/10/23		103	%	80 - 120
			Total Thallium (Tl)	2018/10/23		103	%	80 - 120
			Total Titanium (Ti)	2018/10/23		100	%	80 - 120
			Total Uranium (U)	2018/10/23		104	%	80 - 120
			Total Vanadium (V)	2018/10/23		98	%	80 - 120
			Total Zinc (Zn)	2018/10/23		99	%	80 - 120
9195462	MHM	Method Blank	Total Aluminum (Al)	2018/10/23	<3.0		ug/L	
			Total Antimony (Sb)	2018/10/23	<0.50		ug/L	
			Total Arsenic (As)	2018/10/23	<0.10		ug/L	
			Total Barium (Ba)	2018/10/23	<1.0		ug/L	
			Total Beryllium (Be)	2018/10/23	<0.10		ug/L	
			Total Cadmium (Cd)	2018/10/23	<0.010		ug/L	
			Total Cesium (Cs)	2018/10/23	<0.20		ug/L	
			Total Chromium (Cr)	2018/10/23	<1.0		ug/L	
			Total Cobalt (Co)	2018/10/23	<0.20		ug/L	
			Total Copper (Cu)	2018/10/23	<0.50		ug/L	
			Total Iron (Fe)	2018/10/23	<10		ug/L	
			Total Lead (Pb)	2018/10/23	<0.20		ug/L	
			Total Lithium (Li)	2018/10/23	<2.0		ug/L	
			Total Manganese (Mn)	2018/10/23	<1.0		ug/L	
			Total Molybdenum (Mo)	2018/10/23	<1.0		ug/L	
			Total Nickel (Ni)	2018/10/23	<1.0		ug/L	
			Total Rubidium (Rb)	2018/10/23	<0.20		ug/L	
			Total Selenium (Se)	2018/10/23	<0.10		ug/L	
			Total Silver (Ag)	2018/10/23	<0.020		ug/L	
			Total Strontium (Sr)	2018/10/23	<1.0		ug/L	
			Total Thallium (Tl)	2018/10/23	<0.010		ug/L	
			Total Titanium (Ti)	2018/10/23	<5.0		ug/L	
			Total Uranium (U)	2018/10/23	<0.10		ug/L	
			Total Vanadium (V)	2018/10/23	<5.0		ug/L	
			Total Zinc (Zn)	2018/10/23	<5.0		ug/L	
9195462	MHM	RPD	Total Aluminum (Al)	2018/10/23	1.2		%	20
			Total Antimony (Sb)	2018/10/23	NC		%	20
			Total Arsenic (As)	2018/10/23	11		%	20
			Total Barium (Ba)	2018/10/23	1.2		%	20
			Total Beryllium (Be)	2018/10/23	NC		%	20
			Total Cadmium (Cd)	2018/10/23	NC		%	20
			Total Chromium (Cr)	2018/10/23	NC		%	20
			Total Cobalt (Co)	2018/10/23	0.12		%	20
			Total Copper (Cu)	2018/10/23	1.1		%	20
			Total Iron (Fe)	2018/10/23	0.012		%	20
			Total Lead (Pb)	2018/10/23	NC		%	20
			Total Lithium (Li)	2018/10/23	2.6		%	20
			Total Manganese (Mn)	2018/10/23	3.3		%	20
			Total Molybdenum (Mo)	2018/10/23	0.41		%	20
			Total Nickel (Ni)	2018/10/23	4.3		%	20
			Total Selenium (Se)	2018/10/23	4.4		%	20
			Total Silver (Ag)	2018/10/23	NC		%	20
			Total Strontium (Sr)	2018/10/23	0.049		%	20
			Total Thallium (Tl)	2018/10/23	0		%	20
			Total Titanium (Ti)	2018/10/23	NC		%	20
			Total Uranium (U)	2018/10/23	0.73		%	20

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Maxxam Job #: B891584
Report Date: 2018/11/02

DILLON CONSULTING LTD.
Sampler Initials: KAW

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Total Vanadium (V)	2018/10/23	NC		%	20
			Total Zinc (Zn)	2018/10/23	NC		%	20
9195889	KME	Matrix Spike	1,4-Difluorobenzene (sur.)	2018/10/23		97	%	50 - 140
			4-Bromofluorobenzene (sur.)	2018/10/23		93	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2018/10/23		98	%	50 - 140
			Benzene	2018/10/23		89	%	50 - 140
			Toluene	2018/10/23		86	%	50 - 140
			Ethylbenzene	2018/10/23		91	%	50 - 140
			o-Xylene	2018/10/23		92	%	50 - 140
			m & p-Xylene	2018/10/23		89	%	50 - 140
			F1 (C6-C10)	2018/10/23		82	%	60 - 140
9195889	KME	Spiked Blank	1,4-Difluorobenzene (sur.)	2018/10/23		98	%	50 - 140
			4-Bromofluorobenzene (sur.)	2018/10/23		90	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2018/10/23		93	%	50 - 140
			Benzene	2018/10/23		79	%	60 - 130
			Toluene	2018/10/23		77	%	60 - 130
			Ethylbenzene	2018/10/23		84	%	60 - 130
			o-Xylene	2018/10/23		70	%	60 - 130
			m & p-Xylene	2018/10/23		81	%	60 - 130
			F1 (C6-C10)	2018/10/23		98	%	60 - 140
9195889	KME	Method Blank	1,4-Difluorobenzene (sur.)	2018/10/23		108	%	50 - 140
			4-Bromofluorobenzene (sur.)	2018/10/23		93	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2018/10/23		90	%	50 - 140
			Benzene	2018/10/23	<0.40		ug/L	
			Toluene	2018/10/23	<0.40		ug/L	
			Ethylbenzene	2018/10/23	<0.40		ug/L	
			o-Xylene	2018/10/23	<0.40		ug/L	
			m & p-Xylene	2018/10/23	<0.80		ug/L	
			F1 (C6-C10)	2018/10/23	<100		ug/L	
9195889	KME	RPD	Benzene	2018/10/23	NC		%	40
			Toluene	2018/10/23	NC		%	40
			Ethylbenzene	2018/10/23	NC		%	40
			o-Xylene	2018/10/23	NC		%	40
			m & p-Xylene	2018/10/23	NC		%	40
			F1 (C6-C10)	2018/10/23	NC		%	40
9196939	SSO	Matrix Spike [UO9722-03]	Dissolved Chloride (Cl)	2018/10/23		NC	%	80 - 120
			Dissolved Sulphate (SO4)	2018/10/23		102	%	80 - 120
9196939	SSO	Spiked Blank	Dissolved Chloride (Cl)	2018/10/23		103	%	80 - 120
			Dissolved Sulphate (SO4)	2018/10/23		101	%	75 - 125
9196939	SSO	Method Blank	Dissolved Chloride (Cl)	2018/10/23	<0.50		mg/L	
			Dissolved Sulphate (SO4)	2018/10/23	<0.50		mg/L	
9196939	SSO	RPD [UO9722-03]	Dissolved Chloride (Cl)	2018/10/23	0.0042		%	20
			Dissolved Sulphate (SO4)	2018/10/23	0.43		%	20
9197588	TMU	Matrix Spike	Phenols	2018/10/24		94	%	80 - 120
9197588	TMU	Spiked Blank	Phenols	2018/10/24		99	%	80 - 120
9197588	TMU	Method Blank	Phenols	2018/10/24	<0.0020		mg/L	
9197588	TMU	RPD	Phenols	2018/10/24	NC		%	20
9199793	JLD	Matrix Spike [UO9727-10]	Total Phosphorus (P)	2018/10/26		93	%	80 - 120
9199793	JLD	QC Standard	Total Phosphorus (P)	2018/10/25		95	%	80 - 120
9199793	JLD	Spiked Blank	Total Phosphorus (P)	2018/10/25		98	%	80 - 120
9199793	JLD	Method Blank	Total Phosphorus (P)	2018/10/25	<0.0030		mg/L	
9199793	JLD	RPD [UO9727-10]	Total Phosphorus (P)	2018/10/26	NC		%	20
9202106	WX2	Spiked Blank	Extractable (n-Hex.) Oil and grease	2018/10/26		100	%	70 - 130

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Maxxam Job #: B891584
Report Date: 2018/11/02

DILLON CONSULTING LTD.
Sampler Initials: KAW

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
9202106	WX2	Method Blank	Extractable (n-Hex.) Oil and grease	2018/10/26	<2.0		mg/L	
9204356	JLD	Matrix Spike	Total Total Kjeldahl Nitrogen	2018/10/29		87	%	80 - 120
9204356	JLD	QC Standard	Total Total Kjeldahl Nitrogen	2018/10/29		96	%	80 - 120
9204356	JLD	Spiked Blank	Total Total Kjeldahl Nitrogen	2018/10/29		89	%	80 - 120
9204356	JLD	Method Blank	Total Total Kjeldahl Nitrogen	2018/10/29	<0.050		mg/L	
9204356	JLD	RPD	Total Total Kjeldahl Nitrogen	2018/10/29	NC		%	20
9204727	WX2	Spiked Blank	Extractable (n-Hex.) Oil and grease	2018/10/29		102	%	70 - 130
9204727	WX2	Method Blank	Extractable (n-Hex.) Oil and grease	2018/10/29	<2.0		mg/L	
9206284	JLD	Matrix Spike	Total Phosphorus (P)	2018/10/30		101	%	80 - 120
9206284	JLD	QC Standard	Total Phosphorus (P)	2018/10/30		96	%	80 - 120
9206284	JLD	Spiked Blank	Total Phosphorus (P)	2018/10/30		100	%	80 - 120
9206284	JLD	Method Blank	Total Phosphorus (P)	2018/10/30	<0.0030		mg/L	
9206284	JLD	RPD	Total Phosphorus (P)	2018/10/30	6.9		%	20
9206300	JLD	Matrix Spike	Total Phosphorus (P)	2018/10/30		87	%	80 - 120
9206300	JLD	QC Standard	Total Phosphorus (P)	2018/10/30		97	%	80 - 120
9206300	JLD	Spiked Blank	Total Phosphorus (P)	2018/10/30		100	%	80 - 120
9206300	JLD	Method Blank	Total Phosphorus (P)	2018/10/30	<0.0030		mg/L	
9206300	JLD	RPD	Total Phosphorus (P)	2018/10/30	NC		%	20
9208097	JLD	Matrix Spike	Total Total Kjeldahl Nitrogen	2018/10/31		99	%	80 - 120
9208097	JLD	QC Standard	Total Total Kjeldahl Nitrogen	2018/10/31		93	%	80 - 120
9208097	JLD	Spiked Blank	Total Total Kjeldahl Nitrogen	2018/10/31		90	%	80 - 120
9208097	JLD	Method Blank	Total Total Kjeldahl Nitrogen	2018/10/31	<0.050		mg/L	
9208097	JLD	RPD	Total Total Kjeldahl Nitrogen	2018/10/31	1.6		%	20
9209025	KGH	Matrix Spike	Total Organic Carbon (C)	2018/11/01		103	%	80 - 120
9209025	KGH	Spiked Blank	Total Organic Carbon (C)	2018/11/01		93	%	80 - 120
9209025	KGH	Method Blank	Total Organic Carbon (C)	2018/11/01	<0.50		mg/L	
9209025	KGH	RPD	Total Organic Carbon (C)	2018/11/01	3.0		%	20
9209036	IK0	Matrix Spike	Dissolved Fluoride (F)	2018/10/31		93	%	80 - 120
9209036	IK0	Spiked Blank	Dissolved Fluoride (F)	2018/10/31		93	%	80 - 120
9209036	IK0	Method Blank	Dissolved Fluoride (F)	2018/10/31	<0.050		mg/L	
9209036	IK0	RPD	Dissolved Fluoride (F)	2018/10/31	NC		%	20

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

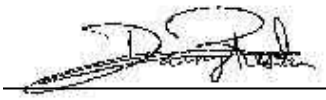
Maxxam Job #: B891584
Report Date: 2018/11/02

DILLON CONSULTING LTD.
Sampler Initials: KAW

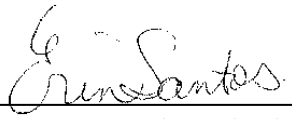
VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

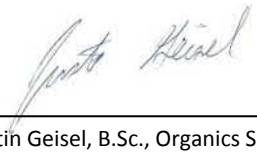
Chelsea Tessier, Team Leader



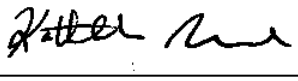
Daniel Reslan, cCT, QP, Organics Manager



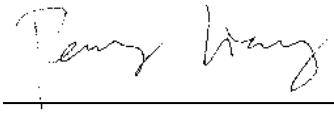
Erin Santos, Dip. Chemical and Biosciences, Laboratory Supervisor



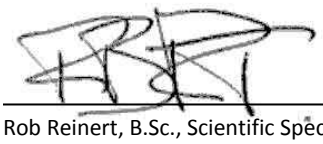
Justin Geisel, B.Sc., Organics Supervisor



Kathleah Manuel, B.Sc, Analyst



Harry (Peng) Liang, Senior Analyst



Rob Reinert, B.Sc., Scientific Specialist

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Maxxam
A Bureau Veritas Group Company

Maxxam Analytics International Corporation o/a Maxxam Analytics
D 675 Berry Street, Winnipeg, Manitoba Canada R3H 1A7 Tel:(204) 772-7276 Toll-free:800 563-6266 Fax:(204) 772-2386 www.maxxam.ca

Chain Of Custody Record

Page 1 of 2

INVOICE TO:		Report Information		Project Information		Laboratory Use Only	
Company Name	#8815 DILLON CONSULTING LTD.	Company Name	Dillon Consulting Limited	Quotation #		Maxxam Job #	Bottle Order #:
Contact Name	ACCOUNTS PAYABLE	Contact Name	Katie Whyte	P.O. #		B891584	568830
Address	1558 Willson Place Winnipeg MB R3T 0Y4	Address		Project #		Chain Of Custody Record	Project Manager
Phone	(204) 453-2301 Fax: (204) 452-4412	Phone	(204) 453-2353 Ext: 4017 Fax:	Project Name		C#568630-01-01	Amanda Hung
Email	apwinnipeg@dillon.ca	Email	kwhyte@dillon.ca	Site #	Nunavut		
				Sampled By	KAW		

Regulatory Criteria

Special Instructions: No parameters field filtered. Dissolved metals preservative rinsed out before sampling

Note: For regulated drinking water samples - please use the Drinking Water Chain of Custody Form

Samples must be kept cool (< 10°C) from time of sampling until delivery to maxxam

Turnaround Time (TAT) Required

Please provide advance notice for rush projects

Regular (Standard) TAT ☑
(will be applied if Rush TAT is not specified)
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)
Date Required: _____ Time Required: _____
Rush Confirmation Number: _____ *(call lab for #)*

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Regulated Drinking Water ? (Y/N)	Metals Field Filtered ? (Y/N)	Total Suspended Solids	Biochemical Oxygen Demand	Carbonaceous BOD	Routine (Alk,pH,EC,Cl,SO4,NO3,NO2, Hard.,Diss. Ca,Mg,K,Na,Fe,Mn)	Fluoride	Ammonia-N (Total)	Total Phosphorus	Total Kjeldahl Nitrogen, Total Nitrogen	Carbon (Total Organic)	Total Metals (sub to Burnaby)	# of Bottles	Comments
1		COMP	18/10/17	15:00	SW	N	N	X	X	X	X	X	X	X	X	X	X	6	
2		FD1	18/10/17	15:00	SW	N	N	X	X	X	X	X	X	X	X	X	X	6	
3		OUTFALL	18/10/18	13:00	SW	N	N	X	X	X	X	X	X	X	X	X	X	13	
4		GRAB	18/10/18	15:45	SW	N	N											10	
5		FD2	18/10/18	15:45	SW	N	N											6	
6		BACKGROUND	18/10/18	13:15	SW	N	N	X	X	X	X	X	X	X	X	X	X	1	Filled 1 carboy. Sample Whatever possible from this carboy.
7																			
8																			
9																			
10																			

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted
Katie Whyte / Katie Whyte	18/10/19	11:04	BH Brookwmith	18/10/19	0805	

Lab Use Only: Time Sensitive ☐ | Temperature (°C) on Receipt: 2.6 0.8 2.4 | Custody Seal Intact on Cooler? ☐ Yes ☐ No

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO MAXXAM'S STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.MAXXAM.CA/TERMS.

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

White: Maxxam Yellow: Client

Ice Present

Maxxam Analytics International Corporation o/a Maxxam Analytics

Maxxam Analytics International Corporation o/a Maxxam Analytics
D-675 Berry Street, Winnipeg, Manitoba Canada R3H 1A7 Tel:(204) 772-7276 Toll-free:800-563-6266 Fax:(204) 772-2386 www.maxxam.ca

Chain Of Custody Record

Page 2 of 2

INVOICE TO:		Report Information		Project Information		Laboratory Use Only	
Company Name	#8815 DILLON CONSULTING LTD.	Company Name	Dillon Consulting Limited	Quotation #		Maxxam Job #	Bottle Order #:
Contact Name	ACCOUNTS PAYABLE	Contact Name	Katie Whyte	P.O. #			568630
Address	1558 Willson Place Winnipeg MB R3T 0Y4	Address		Project #		Chain Of Custody Record	Project Manager
Phone	(204) 453-2301 Fax: (204) 452-4412	Phone	(204) 453-2353 Ext: 4017 Fax:	Project Name		C#568630-01-02	Amanda Hung
Email	apwinnipeg@dillon.ca	Email	kwhyte@dillon.ca	Site #	Nunavut		
				Sampled By	KAW		

Regulatory Criteria

Special Instructions: No parameters field filtered. Dissolved metals preservative rinsed out before sampling.

Note: For regulated drinking water samples - please use the Drinking Water Chain of Custody Form

Samples must be kept cool (< 10°C) from time of sampling until delivery to maxxam

Turnaround Time (TAT) Required

Please provide advance notice for rush projects

Regular (Standard) TAT ✓
(will be applied if Rush TAT is not specified)
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)
Date Required: _____ Time Required: _____
Rush Confirmation Number _____ *(call lab for #)*

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Regulated Drinking Water ? (Y / N)	Metals Field Filtered ? (Y / N)	Phenols (4-AAP)	Oil and Grease (Gravimetric, n -Hexane)	BTEX/F1-F4 in Water, Total Hydrocarbons (calculated)	Total, Fecal Coliforms & E.coli (MTF)	Rainbow Trout LC50 Multi-Concentration	# of Bottles	Comments
1		COMP	18/10/17	15:00	SW	N	N						6	
2		FD1	18/10/17	15:00	SW	N	N						6	
3		OUTFALL	18/10/18	13:00	SW	N	N	X	X	X	X	[illegible]	13	No Rainbow Trout for OUTFALL
4		GRAB	18/10/18	15:45	SW	N	N	X	X	X	X	X	10	
5		FD2	18/10/18	15:45	SW	N	N	X	X	X			6	
6		BACKGROUND	18/10/18	13:15	SW	N	N	X	X	X	X		1	See Page 1 Comment.
7														
8														
9														
10														

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted	Lab Use Only: Time Sensitive	Temperature (°C) on Receipt	Custody Seal Intact on Cooler?
Katie Whyte / Katie Whyte	18/10/19	4:04	BA Brookmanth	18/10/19	0805		☐	2.6 0.8 2.4	☐ Yes ☐ No

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO MAXXAM'S STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.MAXXAM.CA/TERMS.

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

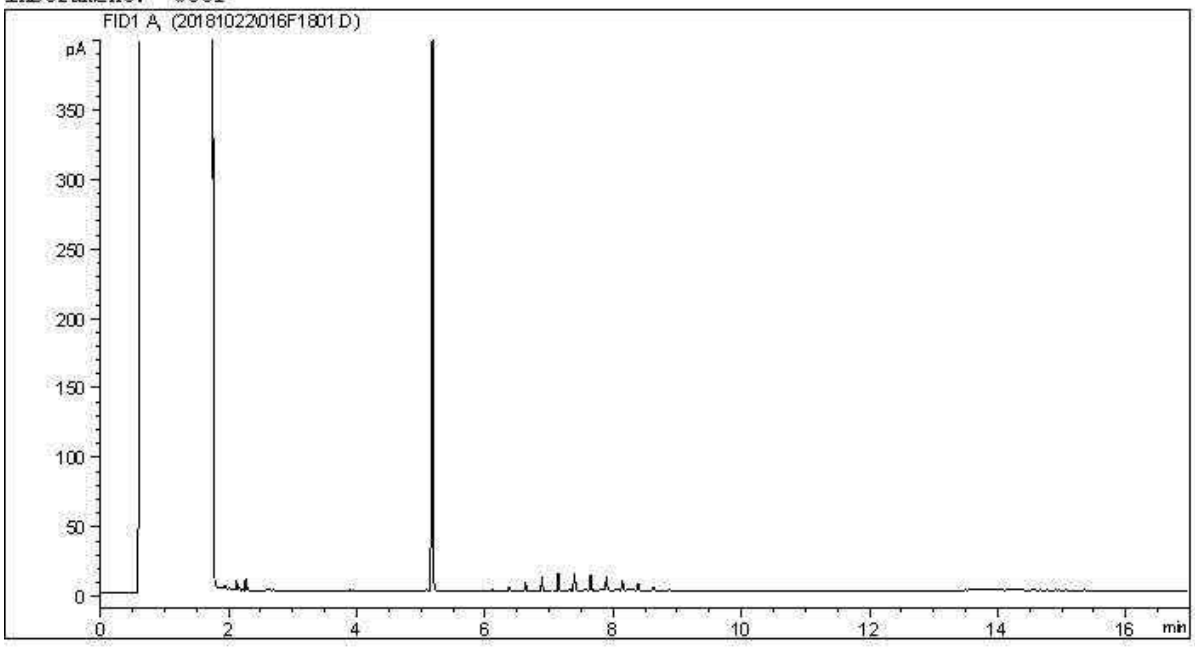
White: Maxxam Yellow: Client

For the RainbowTrout for 'GRAB' - only 1 cooler made it on flight. Two other coolers with full carboys should arrive tomorrow for the multi test.

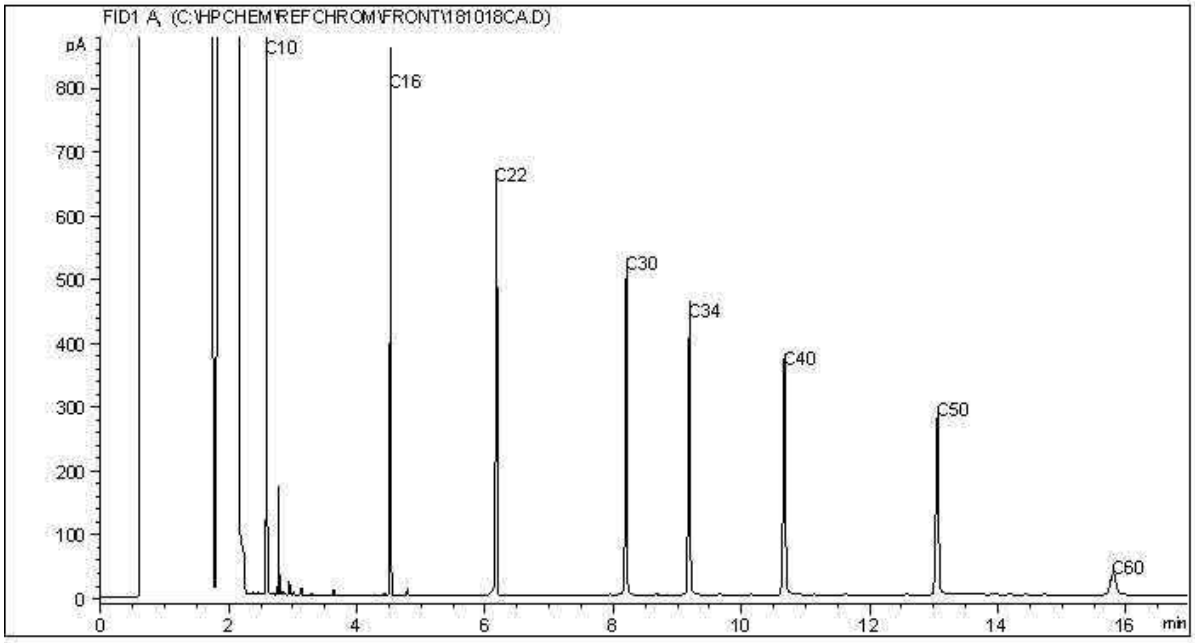
Maxxam Analytics International Corporation o/a Maxxam Analytics

CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: WGC1



Carbon Range Distribution - Reference Chromatogram



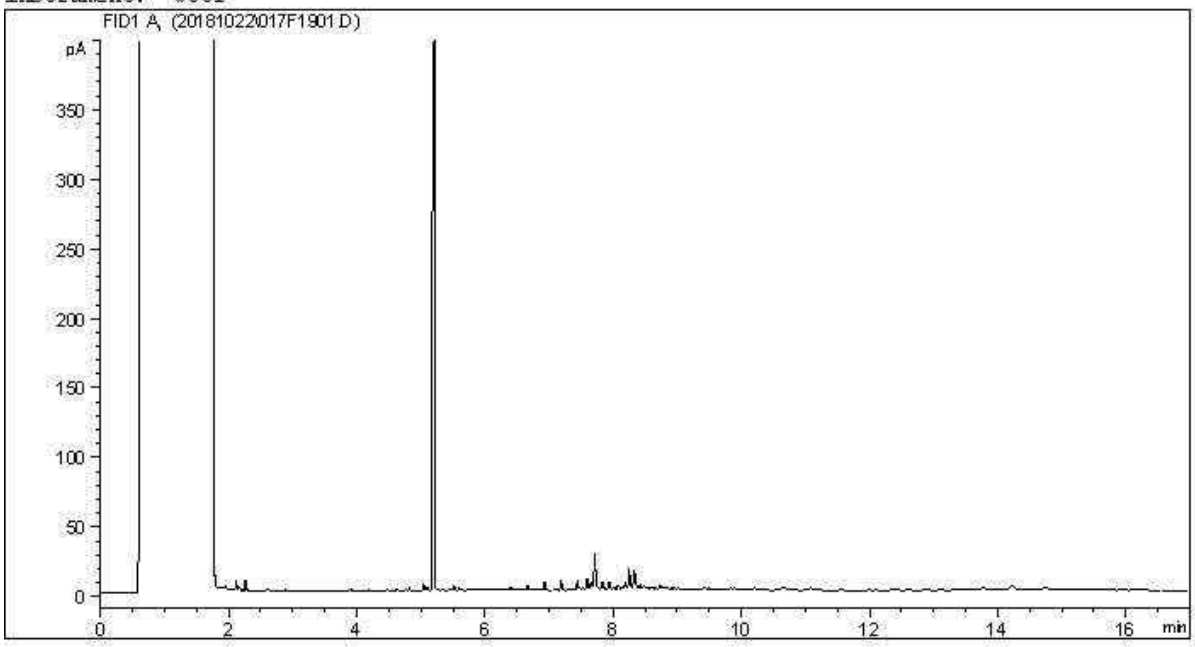
TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

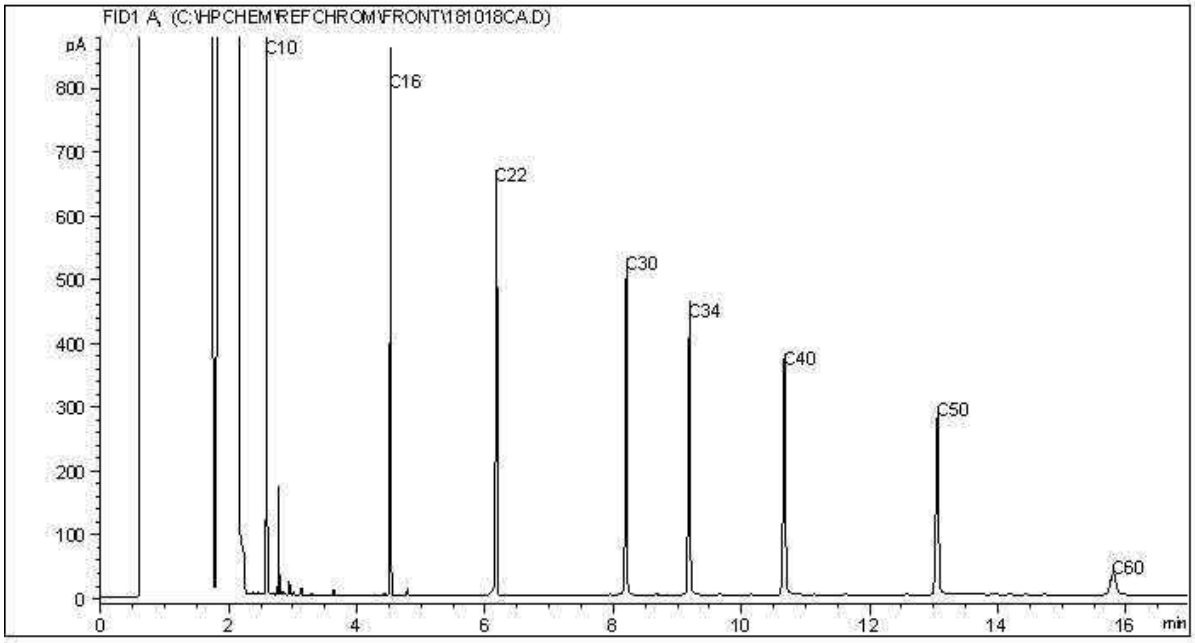
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: WGC1



Carbon Range Distribution - Reference Chromatogram



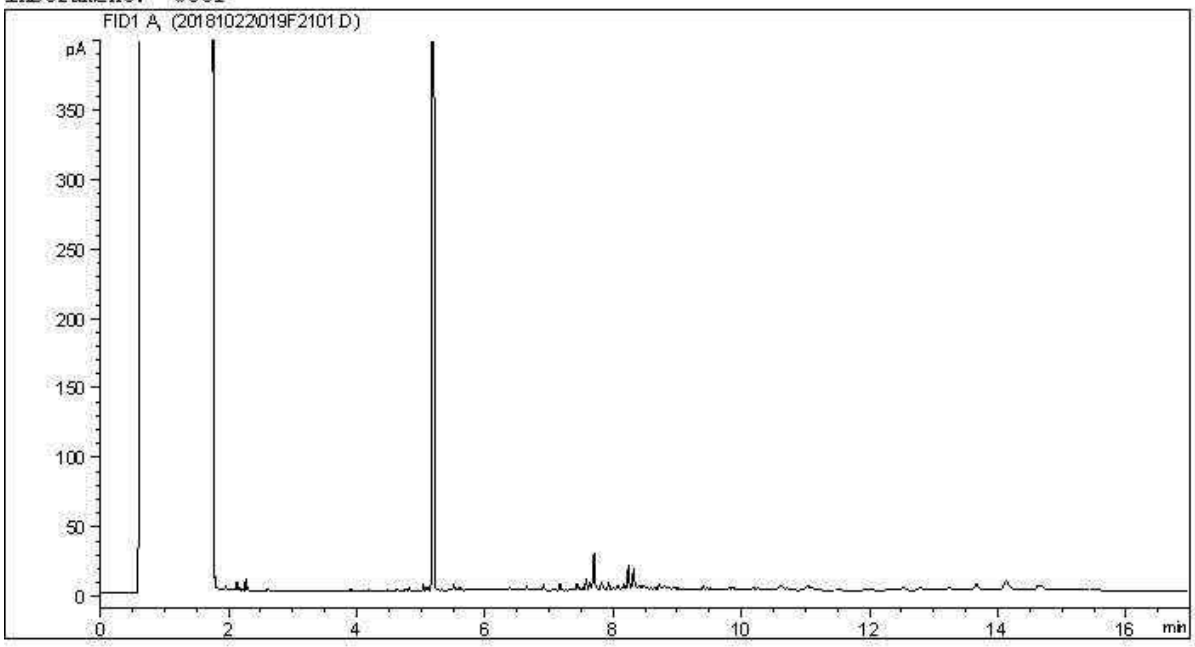
TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

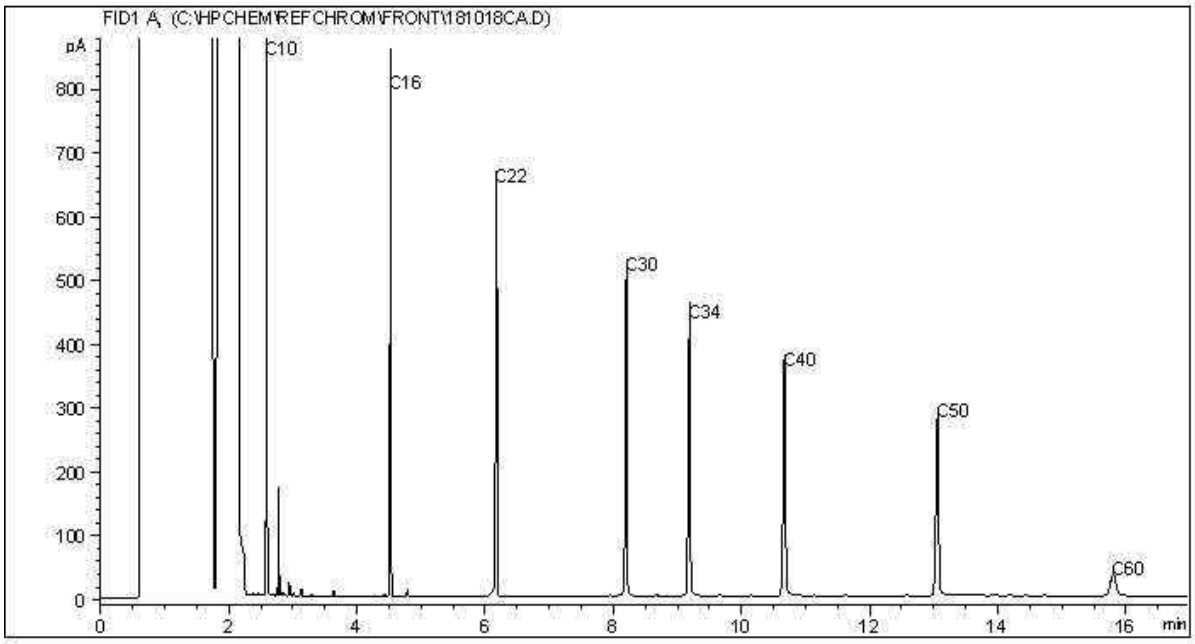
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: WGC1



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam
A Bureau Veritas Group Company

RESULTS OF RAINBOW TROUT SINGLE CONCENTRATION-100%

Success Through Science®

Client : 8815 DILLON CONSULTING LTD., WINNIPEG Job Number: B891584

Client Project Name & Number: -

Test Result:

96 hrs Mortality % 100 Statistical Method: Visual

Sample Name : GRAB Sample Matrix : Water

Description: Light brown, hazy Sample Number: UO9725-06

Sample Collected: Oct 18, 2018 03:45 PM Sampling Method : N/A Site Collection: N/A

Sample Collected By: KAW Volume Received: 20 L Temp.Upon Arrival: 6 °C Storage: 2-6°C

Sample Received: Oct 19, 2018 08:05 AM pH: 6.5 Dissolved Oxygen: 0.9 mg/L

Analysis Start : Oct 21, 2018 11:50 AM Temperature : 13 °C Sample Conductance: 310 µS/cm

Concentration	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)
% vol/vol	Start	Start	Start	Start	24 hrs	24 hrs	24 hrs	24 hrs	48 hrs	48 hrs	48 hrs	48 hrs
0	14	8.0	306	9.3	0	0	0	0	0	0	0	0
100	14	6.5	313	1.3	10	100	0	0	10	100	0	0

Concentration	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)
% vol/vol	72 hrs	72 hrs	72 hrs	72 hrs	96 hrs	96 hr	96 hrs	96 hrs	96 hrs	96 hrs	96 hrs	96 hrs
0	0	0	0	0	14	7.7	304	8.6	0	0	0	0
100	10	100	0	0	14	7.4	319	8.3	10	100	0	0

Comments : None

Culture/Control/Dilution Water City of Edmonton dechlorinated tap water

Hardness: 170 mg/L $CaCO_3$ Other parameters available on request.

Test Conditions Test concentration : 0,100 (% vol/vol)

Organisms per Vessel :	10	Test Temperature :	15 ± 1 °C	Solution Depth :	>15 cm
Total # of Organisms Used :	20	Pre-aeration Time :	120 min.	Rate of Aeration	6.5±1 mL/min/L
Test Volume :	20 L	Vessel Volume :	38L	Test pH Adjusted:	No
Loading Density :	0.2 g/L	Photoperiod :	16:8 (light: dark)		

Test Organism : Rainbow Trout *(Oncorhynchus mykiss)* Source : Spring Valley Trout Hatchery

Culture Temperature :	15 ± 2 °C	Weight (Mean) +- SD :	0.5 ± 0.1 g	Length (Mean) +- SD :	3.83 ± 0.35 cm
Culture Water Renewal :	≥ 1.0 L/min/kg fish	Weight (Range) :	0.3 – 0.7 g	Length (Range) :	3.20 – 4.40 cm
Culture Photoperiod :	16:8 (light: dark)			% Mortality within 7 days :	0.1%
Feeding rate and frequency :	daily: 1-5% biomass of trout.			Acclimation Time:	>14 days

Reference chemical: Phenol Test Date: Sep 26, 2018

Test Endpoint 96 hrs LC50 (95% confidence interval) : 10.6 (9.57, 11.6)mg/L Statistical Method : Probit

Historical Mean LC50 (warning limits) : 10.3 (8.54, 12.4) mg/L Concentration : 0,8,10,12,15,20 mg/L

Test Method EPS 1/RM/13

Method Deviations : None

Note: The results contained in this report refer only to the testing of the sample submitted. This report may not be reproduced, except in its entirety, without the written approval of the laboratory.

Analyst : Arthur Juan Mathias, Dustin Banks

Chelsea Tessier

Verified By : Chelsea Tessier, Team Leader Date: Oct 29, 2018 10:57 AM

Maxxam
A Bureau Veritas Group Company

RESULTS OF RAINBOW TROUT LC50 MULTI-CONCENTRATION

Success Through Science®

Client : 8815 DILLON CONSULTING LTD., WINNIPEG Job Number: B891584

Client Project Name & Number: -

Test Result:

96 hrs LC50 % vol/vol (95% CL): 70.7 (50.0-100) Statistical Method: Binomial

Sample Name : GRAB Sample Matrix : Water

Description: BROWN OPAQUE Sample Number: UO9725-07

Sample Collected: Oct 18, 2018 03:45 PM Sampling Method : N/A Site Collection: N/A

Sample Collected By: KAW Volume Received: 40 L Temp.Upon Arrival: 6 °C Storage: 2-6°C

Sample Received: Oct 19, 2018 08:05 AM pH: 6.3 Dissolved Oxygen: 1.3 mg/L

Analysis Start : Oct 23, 2018 11:00 AM Temperature : 14 °C Sample Conductance: 330 µS/cm

Concentration	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)
% vol/vol	Start	Start	Start	Start	24 hrs	24 hrs	24 hrs	24 hrs	48 hrs	48 hrs	48 hrs	48 hrs
0	14	7.9	302	9.0	0	0	0	0	0	0	0	0
6.25	14	7.5	305	8.8	0	0	0	0	0	0	0	0
12.5	14	7.5	307	8.6	0	0	0	0	0	0	0	0
25	14	7.4	310	8.0	0	0	0	0	0	0	0	0
50	15	7.1	320	6.6	0	0	0	0	0	0	0	0
100	14	6.7	333	3.7	10	100	0	0	10	100	0	0

Concentration	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)
% vol/vol	72 hrs	72 hrs	72 hrs	72 hrs	96 hrs	96 hr	96 hrs	96 hrs	96 hrs	96 hrs	96 hrs	96 hrs
0	0	0	0	0	14	7.7	310	8.9	0	0	0	0
6.25	0	0	0	0	14	7.5	312	8.6	0	0	0	0
12.5	0	0	0	0	15	7.7	314	8.7	0	0	0	0
25	0	0	0	0	15	7.6	319	8.5	0	0	0	0
50	0	0	0	0	15	7.5	331	8.1	0	0	0	0
100	10	100	0	0	15	7.3	344	7.7	10	100	0	0

Comments : None

Culture/Control/Dilution Water City of Edmonton dechlorinated tap water

Hardness: 170 mg/L $CaCO_3$ Other parameters available on request.

Test Conditions Test concentration : 0,6.25,12.5,25,50,100 (% vol/vol)

Organisms per Vessel :	10	Test Temperature :	15 ± 1 °C	Solution Depth :	>15 cm
Total # of Organisms Used :	60	Pre-aeration Time :	120 min.	Rate of Aeration	6.5±1 mL/min/L
Test Volume :	20 L	Vessel Volume :	38L	Test pH Adjusted:	No
Loading Density :	0.2 g/L	Photoperiod :	16:8 (light: dark)		

Test Organism : Rainbow Trout *(Oncorhynchus mykiss)* Source : Spring Valley Trout Hatchery

Culture Temperature :	15 ± 2 °C	Weight (Mean) +- SD :	0.4 ± 0.1 g	Length (Mean) +- SD :	3.83 ± 0.28 cm
Culture Water Renewal :	≥ 1.0 L/min/kg fish	Weight (Range) :	0.3 – 0.6 g	Length (Range) :	3.50 – 4.40 cm
Culture Photoperiod :	16:8 (light: dark)			% Mortality within 7 days :	0.1%
Feeding rate and frequency :	daily: 1-5% biomass of trout.			Acclimation Time:	>14 days

Maxxam
A Bureau Veritas Group Company

RESULTS OF RAINBOW TROUT LC50 MULTI-CONCENTRATION

Success Through Science®

Client : 8815 DILLON CONSULTING LTD., WINNIPEG Job Number: B891584

Client Project Name & Number: - Sample Number: UO9725-07

Reference chemical:	Phenol	Test Date:	Sep 26, 2018
Test Endpoint 96 hrs LC50 (95% confidence interval) :	10.6 (9.57, 11.6)mg/L	Statistical Method :	Probit
Historical Mean LC50 (warning limits) :	10.3 (8.54, 12.4) mg/L	Concentration :	0,8,10,12,15,20 mg/L

Test Method EPS 1/RM/13

Method Deviations : None

Note: The results contained in this report refer only to the testing of the sample submitted. This report may not be reproduced, except in its entirety, without the written approval of the laboratory.

Analyst : Arthur Juan Mathias, Dustin Banks

Chelsea Tessier

Verified By : Chelsea Tessier, Team Leader Date: Oct 29, 2018 11:07 AM

Maxxam
A Bureau Veritas Group Company

Success Through Science®

Your Project #: 18-8483
Site#: NUNAVUT
Your C.O.C. #: C#572949-01-01

Attention: Katie Whyte

DILLON CONSULTING LTD.
1558 Willson Place
Winnipeg, MB
CANADA R3T 0Y4

Report Date: 2019/03/06
Report #: R2693955
Version: 3 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B912716
Received: 2019/02/21, 15:15

Sample Matrix: Water
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity in Water by PC Titrator	3	N/A	2019/02/25	WIN SOP-00063	Based on SM-2320B
Carbonaceous BOD	3	2019/02/22	2019/02/22	WIN SOP-00018	Based on SM-5210B
Biochemical Oxygen Demand	3	2019/02/22	2019/02/22	WIN SOP-00018	Based on SM-5210B
BTEX/F1 in Water by HS GC/MS/FID (1)	3	N/A	2019/02/28	AB SOP-00039	CCME CWS/EPA 8260d m
F1-BTEX (1)	3	N/A	2019/02/28	AB SOP-00039	Auto Calc
Chloride (Cl) and Sulphate (SO4) by IC (1)	3	N/A	2019/02/22	AB SOP-00026	SM 23 4110 B m
Total Coliforms (MTF)	3	N/A	2019/02/21	WIN SOP-00003	SM 23 9221 B m
E. coli (MTF)	3	N/A	2019/02/21	WIN SOP-00003	SM 23 9221 F m
Conductivity in Water by PC Titrator	3	N/A	2019/02/25	WIN SOP-00063	Based on SM-2510B
Fluoride (1)	3	N/A	2019/02/25	AB SOP-00005	SM 23 4500-F C m
CCME Hydrocarbons (F2-F4 in water) (4)	3	2019/02/22	2019/02/24	WIN SOP-00056	CCME PHC-CWS m
Fecal Coliforms (MTF)	3	N/A	2019/02/21	WIN SOP-00003	SM 23 9221 F m
Hardness (1)	3	N/A	2019/02/26	AB WI-00065	Auto Calc
Hardness Total (calculated as CaCO3) (2, 5)	3	N/A	2019/02/27	BBY WI-00033	Auto Calc
Mercury - Low Level (Total) (3)	3	2019/02/27	2019/02/27	EENVSOP-00031	EPA 245.7 R2 m
Elements by ICP-Dissolved-Lab Filtered (1, 6)	3	N/A	2019/02/25	AB SOP-00042	EPA 6010d R4 m
Ion Balance (as Cations/Anions Ratio) (1)	3	N/A	2019/02/28	AB WI-00065	Auto Calc
Ion Balance (1)	2	N/A	2019/02/23	AB WI-00065	Auto Calc
Ion Balance (1)	1	N/A	2019/02/25	AB WI-00065	Auto Calc
Elements by CRC ICPMS (total) (2)	3	2019/02/25	2019/02/27	BBY7SOP-00003 BBY7SOP-00002	EPA 6020b R2 m
Nitrogen (total), Calc. TKN, NO3, NO2 (1)	3	N/A	2019/02/27	AB WI-00065	Auto Calc
Ammonia-N (Total) (1)	3	N/A	2019/02/25	AB SOP-00007	SM 23 4500 NH3 A G m
Nitrate and Nitrite (1)	3	N/A	2019/02/26	AB WI-00065	Auto Calc
Nitrate + Nitrite-N (calculated) (1)	3	N/A	2019/02/26	AB WI-00065	Auto Calc
Nitrogen (Nitrite - Nitrate) by IC (1)	2	N/A	2019/02/22	AB SOP-00023	SM 23 4110 B m
Nitrogen (Nitrite - Nitrate) by IC (1)	1	N/A	2019/02/25	AB SOP-00023	SM 23 4110 B m
Oil and Grease (Gravimetric, n-Hexane) (3)	3	2019/02/27	2019/02/27	EENVSOP-00093	SM 23 5520B m
pH in Water by PC Titrator (7)	3	N/A	2019/02/25	WIN SOP-00063	SM4500 H+B
Phenols (4-AAP) (3)	3	N/A	2019/02/27	EENVSOP-00061	MMCW 154 1996 m
Total Dissolved Solids (Calculated) (1)	3	N/A	2019/02/28	AB WI-00065	Auto Calc
Total Kjeldahl Nitrogen (1)	3	2019/02/27	2019/02/27	AB SOP-00008	EPA 351.1 R1978 m

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Your Project #: 18-8483
Site#: NUNAVUT
Your C.O.C. #: C#572949-01-01

Attention: Katie Whyte

DILLON CONSULTING LTD.
1558 Willson Place
Winnipeg, MB
CANADA R3T 0Y4

Report Date: 2019/03/06
Report #: R2693955
Version: 3 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B912716
Received: 2019/02/21, 15:15

Sample Matrix: Water
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Carbon (Total Organic) (1, 8)	2	N/A	2019/02/27	AB SOP-00087	MMCW 119 1996 m
Carbon (Total Organic) (1, 8)	1	N/A	2019/02/28	AB SOP-00087	MMCW 119 1996 m
Total Phosphorus (1)	3	2019/02/26	2019/02/26	AB SOP-00024	SM 22 4500-P A,B,F m
Total Hydrocarbons C6-C50 in Water Calc. (2)	3	N/A	2019/02/28	BBY WI-00033	Auto Calc
Rainbow Trout LC50 Multi-Concentration (3)	1	N/A	2019/02/25	EENVSOP-00160	EPS 1 RM13 2nd ed m
Total Suspended Solids	3	N/A	2019/02/22	WIN SOP-00042	Based on SM2540 D

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) This test was performed by Maxxam Calgary Environmental
(2) This test was performed by Maxxam Vancouver
(3) This test was performed by Maxxam Edmonton Environmental
(4) Silica gel clean up employed.
(5) "Total Hardness" was calculated from Total Ca and Mg concentrations and may be biased high (Hardness, or Dissolved Hardness, calculated from Dissolved Ca and Mg, should be used for compliance if available).
(6) Dissolved > Total Imbalance: When applicable, Dissolved and Total results were reviewed and data quality meets acceptable levels unless otherwise noted.

Your Project #: 18-8483
Site#: NUNAVUT
Your C.O.C. #: C#572949-01-01

Attention: Katie Whyte

DILLON CONSULTING LTD.
1558 Willson Place
Winnipeg, MB
CANADA R3T 0Y4

Report Date: 2019/03/06
Report #: R2693955
Version: 3 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B912716
Received: 2019/02/21, 15:15

(7) The APHA Standard Method requires pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the APHA Standard Method holding time.
(8) TOC present in the sample should be considered as non-purgeable TOC.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Amanda Hung, B.Sc., Project Manager
Email: AHung@maxxam.ca
Phone# (204)772-7276 Ext:7062215
==========
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B912716
Report Date: 2019/03/06

DILLON CONSULTING LTD.
Client Project #: 18-8483

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		VG3443			VG3443			VG3444		
Sampling Date		2019/02/20 11:30			2019/02/20 11:30			2019/02/21 09:00		
COC Number		C#572949-01-01			C#572949-01-01			C#572949-01-01		
	UNITS	**COMP**	**RDL**	**QC Batch**	**COMP Lab-Dup**	**RDL**	**QC Batch**	**G-1**	**RDL**	**QC Batch**
Calculated Parameters										
Hardness (CaCO3)	mg/L	92	0.50	9329050						
Total Hardness (CaCO3)	mg/L	88.1	0.50	9329057						
Ion Balance	N/A	0.87	0.010	9334489						
Ion Balance (% Difference)	%	7.1	N/A	9327851						
Dissolved Nitrate (NO3)	mg/L	0.26	0.044	9327854						
Nitrate plus Nitrite (N)	mg/L	0.089	0.014	9327856						
Dissolved Nitrite (NO2)	mg/L	0.10	0.033	9327854						
Calculated Total Dissolved Solids	mg/L	250	10	9327864						
Demand Parameters										
Biochemical Oxygen Demand	mg/L	89	30	9329109	200 (1)	30	9329109			
Carbonaceous BOD	mg/L	89	30	9329112	92	30	9329112			
Misc. Inorganics										
Alkalinity (Total as CaCO3)	mg/L	107	0.50	9331019	105	0.50	9331019			
Conductivity	uS/cm	507	2.0	9331010	504	2.0	9331010			
Total Organic Carbon (C)	mg/L	27 (2)	1.0	9333222						
pH	pH	7.13		9331007	7.12		9331007			
Bicarbonate (HCO3)	mg/L	130	0.50	9331019	129	0.50	9331019			
Carbonate (CO3)	mg/L	<0.50	0.50	9331019	<0.50	0.50	9331019			
Hydroxide (OH)	mg/L	<0.50	0.50	9331019	<0.50	0.50	9331019			
Anions										
Dissolved Fluoride (F)	mg/L	0.094	0.050	9331107						
Dissolved Chloride (Cl)	mg/L	70	0.50	9329890						
Dissolved Sulphate (SO4)	mg/L	32	0.50	9329890						
Nutrients										
Total Ammonia (N)	mg/L	7.9 (3)	0.075	9331269						
Total Nitrogen (N)	mg/L	19	0.055	9329051						
Total Phosphorus (P)	mg/L	2.0 (3)	0.015	9332068						
Total Total Kjeldahl Nitrogen	mg/L	19 (3)	0.50	9333197						
Dissolved Nitrite (N)	mg/L	0.030	0.010	9330010						

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Duplicate exceeds acceptance criteria due to sample matrix interference.
(2) Detection limits raised due to sample matrix.
(3) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Maxxam Job #: B912716
Report Date: 2019/03/06

DILLON CONSULTING LTD.
Client Project #: 18-8483

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		VG3443			VG3443			VG3444		
Sampling Date		2019/02/20 11:30			2019/02/20 11:30			2019/02/21 09:00		
COC Number		C#572949-01-01			C#572949-01-01			C#572949-01-01		
	UNITS	**COMP**	**RDL**	**QC Batch**	**COMP Lab-Dup**	**RDL**	**QC Batch**	**G-1**	**RDL**	**QC Batch**
Dissolved Nitrate (N)	mg/L	0.059	0.010	9330010						
Misc. Organics										
Extractable (n-Hex.) Oil and grease	mg/L							8.0	2.0	9334117
Phenols	mg/L							0.039	0.0020	9333753
Physical Properties										
Total Suspended Solids	mg/L	26.0	4.0	9329093						

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Maxxam Job #: B912716
Report Date: 2019/03/06

DILLON CONSULTING LTD.
Client Project #: 18-8483

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		VG3445		VG3446		
Sampling Date		2019/02/21 09:00		2019/02/20 11:30		
COC Number		C#572949-01-01		C#572949-01-01		
	UNITS	**G-2**	**RDL**	**FD**	**RDL**	**QC Batch**
Calculated Parameters						
Hardness (CaCO3)	mg/L	95	0.50	94	0.50	9329050
Total Hardness (CaCO3)	mg/L	95.7	0.50	89.4	0.50	9329057
Ion Balance	N/A	0.84	0.010	0.87	0.010	9334489
Ion Balance (% Difference)	%	8.6	N/A	6.8	N/A	9327851
Dissolved Nitrate (NO3)	mg/L	<0.22	0.22	0.28	0.044	9327854
Nitrate plus Nitrite (N)	mg/L	0.13	0.051	0.094	0.014	9327856
Dissolved Nitrite (NO2)	mg/L	0.41	0.033	0.099	0.033	9327854
Calculated Total Dissolved Solids	mg/L	310	10	250	10	9327864
Demand Parameters						
Biochemical Oxygen Demand	mg/L	180	30	260	30	9329109
Carbonaceous BOD	mg/L	150	30	110	30	9329112
Misc. Inorganics						
Alkalinity (Total as CaCO3)	mg/L	159	0.50	106	0.50	9331019
Conductivity	uS/cm	642	2.0	505	2.0	9331010
Total Organic Carbon (C)	mg/L	42 (1)	1.0	25	0.50	9333222
pH	pH	7.28		7.17		9331007
Bicarbonate (HCO3)	mg/L	193	0.50	130	0.50	9331019
Carbonate (CO3)	mg/L	<0.50	0.50	<0.50	0.50	9331019
Hydroxide (OH)	mg/L	<0.50	0.50	<0.50	0.50	9331019
Anions						
Dissolved Fluoride (F)	mg/L	0.11	0.050	0.095	0.050	9331107
Dissolved Chloride (Cl)	mg/L	75	0.50	71	0.50	9329890
Dissolved Sulphate (SO4)	mg/L	34	0.50	32	0.50	9329890
Nutrients						
Total Ammonia (N)	mg/L	17 (2)	0.15	7.9 (2)	0.075	9331269
Total Nitrogen (N)	mg/L	47	0.055	19	0.055	9329051
Total Phosphorus (P)	mg/L	4.6 (2)	0.030	2.0 (2)	0.015	9332068
Total Total Kjeldahl Nitrogen	mg/L	47 (2)	1.3	19 (2)	0.50	9333197
Dissolved Nitrite (N)	mg/L	0.13	0.010	0.030	0.010	9330010
Dissolved Nitrate (N)	mg/L	<0.050	0.050	0.064	0.010	9330010

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limits raised due to sample matrix.
(2) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Maxxam Job #: B912716
Report Date: 2019/03/06

DILLON CONSULTING LTD.
Client Project #: 18-8483

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		VG3445		VG3446		
Sampling Date		2019/02/21 09:00		2019/02/20 11:30		
COC Number		C#572949-01-01		C#572949-01-01		
	UNITS	**G-2**	**RDL**	**FD**	**RDL**	**QC Batch**
Misc. Organics						
Extractable (n-Hex.) Oil and grease	mg/L	9.1	2.0	5.1	2.0	9334117
Phenols	mg/L	0.077	0.0020	0.039	0.0020	9333753
Physical Properties						
Total Suspended Solids	mg/L	63.0	4.0	33.0	4.0	9329093
RDL = Reportable Detection Limit						

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Maxxam Job #: B912716
Report Date: 2019/03/06

DILLON CONSULTING LTD.
Client Project #: 18-8483

PETROLEUM HYDROCARBONS (CCME)

Maxxam ID		VG3444	VG3445	VG3446		
Sampling Date		2019/02/21 09:00	2019/02/21 09:00	2019/02/21 09:00		
COC Number		C#572949-01-01	C#572949-01-01	C#572949-01-01		
	UNITS	**G-1**	**G-2**	**FD**	**RDL**	**QC Batch**
Ext. Pet. Hydrocarbon						
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	0.14	<0.10	0.10	9330640
F3 (C16-C34 Hydrocarbons)	mg/L	1.2	2.0	1.2	0.10	9330640
F4 (C34-C50 Hydrocarbons)	mg/L	0.44	0.78	0.47	0.20	9330640
Surrogate Recovery (%)						
O-TERPHENYL (sur.)	%	111	111	111		9330640
RDL = Reportable Detection Limit						

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Maxxam Job #: B912716
Report Date: 2019/03/06

DILLON CONSULTING LTD.
Client Project #: 18-8483

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		VG3443	VG3445	VG3446		
Sampling Date		2019/02/20 11:30	2019/02/21 09:00	2019/02/20 11:30		
COC Number		C#572949-01-01	C#572949-01-01	C#572949-01-01		
	UNITS	**COMP**	**G-2**	**FD**	**RDL**	**QC Batch**
Lab Filtered Elements						
Dissolved Calcium (Ca)	mg/L	26	27	27	0.30	9331338
Dissolved Iron (Fe)	mg/L	<0.060	<0.060	<0.060	0.060	9331338
Dissolved Magnesium (Mg)	mg/L	6.4	6.8	6.5	0.20	9331338
Dissolved Manganese (Mn)	mg/L	0.035	0.040	0.035	0.0040	9331338
Dissolved Potassium (K)	mg/L	7.6	11	7.8	0.30	9331338
Dissolved Sodium (Na)	mg/L	35	39	36	0.50	9331338
Low Level Elements						
Total Mercury (Hg)	ug/L	0.0065	0.012	0.0075	0.0020	9333216
Total Metals by ICPMS						
Total Aluminum (Al)	ug/L	96.2	144	171	3.0	9331805
Total Antimony (Sb)	ug/L	<0.50	<0.50	<0.50	0.50	9331805
Total Arsenic (As)	ug/L	0.83	0.94	0.87	0.10	9331805
Total Barium (Ba)	ug/L	33.5	35.1	34.7	1.0	9331805
Total Beryllium (Be)	ug/L	<0.10	<0.10	<0.10	0.10	9331805
Total Cadmium (Cd)	ug/L	0.038	0.236	0.038	0.010	9331805
Total Cesium (Cs)	ug/L	<0.20	<0.20	<0.20	0.20	9331805
Total Chromium (Cr)	ug/L	<1.0	1.0	<1.0	1.0	9331805
Total Cobalt (Co)	ug/L	<0.20	0.20	<0.20	0.20	9331805
Total Copper (Cu)	ug/L	180	254	179	0.50	9331805
Total Iron (Fe)	ug/L	131	186	135	10	9331805
Total Lead (Pb)	ug/L	1.46	1.80	1.08	0.20	9331805
Total Lithium (Li)	ug/L	3.2	3.6	3.3	2.0	9331805
Total Manganese (Mn)	ug/L	37.3	45.6	37.4	1.0	9331805
Total Molybdenum (Mo)	ug/L	<1.0	1.1	<1.0	1.0	9331805
Total Nickel (Ni)	ug/L	2.0	2.4	1.9	1.0	9331805
Total Rubidium (Rb)	ug/L	7.78	11.6	8.29	0.20	9331805
Total Selenium (Se)	ug/L	0.18	0.30	0.19	0.10	9331805
Total Silver (Ag)	ug/L	0.023	0.072	0.026	0.020	9331805
Total Strontium (Sr)	ug/L	127	137	131	1.0	9331805
Total Thallium (Tl)	ug/L	<0.010	<0.010	<0.010	0.010	9331805
Total Titanium (Ti)	ug/L	8.0	13.2	5.1	5.0	9331805
Total Uranium (U)	ug/L	<0.10	0.11	<0.10	0.10	9331805
Total Vanadium (V)	ug/L	<5.0	<5.0	<5.0	5.0	9331805
RDL = Reportable Detection Limit						

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Maxxam Job #: B912716
Report Date: 2019/03/06

DILLON CONSULTING LTD.
Client Project #: 18-8483

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		VG3443	VG3445	VG3446		
Sampling Date		2019/02/20 11:30	2019/02/21 09:00	2019/02/20 11:30		
COC Number		C#572949-01-01	C#572949-01-01	C#572949-01-01		
	UNITS	**COMP**	**G-2**	**FD**	**RDL**	**QC Batch**
Total Zinc (Zn)	ug/L	70.1	107	69.7	5.0	9331805
RDL = Reportable Detection Limit						

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Maxxam Job #: B912716
Report Date: 2019/03/06

DILLON CONSULTING LTD.
Client Project #: 18-8483

VOLATILE ORGANICS BY GC-MS (WATER)

Maxxam ID		VG3444		VG3445	VG3446		
Sampling Date		2019/02/21 09:00		2019/02/21 09:00	2019/02/21 09:00		
COC Number		C#572949-01-01		C#572949-01-01	C#572949-01-01		
	UNITS	**G-1**	**QC Batch**	**G-2**	**FD**	**RDL**	**QC Batch**
Volatiles							
Benzene	ug/L	<0.40	9334821	<0.40	<0.40	0.40	9334821
Toluene	ug/L	<0.40	9334821	0.73	<0.40	0.40	9334821
Ethylbenzene	ug/L	<0.40	9334821	<0.40	<0.40	0.40	9334821
m & p-Xylene	ug/L	<0.80	9334821	<0.80	<0.80	0.80	9334821
o-Xylene	ug/L	<0.40	9334821	<0.40	<0.40	0.40	9334821
Xylenes (Total)	ug/L	<0.89	9329053	<0.89	<0.89	0.89	9329052
F1 (C6-C10) - BTEX	ug/L	<100	9329053	<100	<100	100	9329052
F1 (C6-C10)	ug/L	<100	9334821	<100	<100	100	9334821
Surrogate Recovery (%)							
1,4-Difluorobenzene (sur.)	%	95	9334821	97	96		9334821
4-Bromofluorobenzene (sur.)	%	96	9334821	99	98		9334821
D4-1,2-Dichloroethane (sur.)	%	87	9334821	90	89		9334821
RDL = Reportable Detection Limit							

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Maxxam Job #: B912716
Report Date: 2019/03/06

DILLON CONSULTING LTD.
Client Project #: 18-8483

TOTAL PETROLEUM HYDROCARBONS (WATER)

Maxxam ID		VG3444	VG3445	VG3446		
Sampling Date		2019/02/21 09:00	2019/02/21 09:00	2019/02/21 09:00		
COC Number		C#572949-01-01	C#572949-01-01	C#572949-01-01		
	UNITS	**G-1**	**G-2**	**FD**	**RDL**	**QC Batch**
Calculated Parameters						
Calculated C6-C50 Hydrocarbons	mg/L	1.6	2.9	1.6	0.26	9330153
RDL = Reportable Detection Limit						

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Maxxam Job #: B912716
Report Date: 2019/03/06

DILLON CONSULTING LTD.
Client Project #: 18-8483

MICROBIOLOGY (WATER)

Maxxam ID		VG3444	VG3445	VG3446		
Sampling Date		2019/02/21 09:00	2019/02/21 09:00	2019/02/21 09:00		
COC Number		C#572949-01-01	C#572949-01-01	C#572949-01-01		
	UNITS	**G-1**	**G-2**	**FD**	**RDL**	**QC Batch**
Microbiological Param.						
E. coli (MTF)	MPN/100mL	>1100000	>1100000	>1100000	3	9329367
Fecal Coliforms (MTF)	MPN/100mL	>1100000	>1100000	>1100000	3	9329362
Total Coliforms (MTF)	MPN/100mL	>1100000	>1100000	>1100000	3	9329360
RDL = Reportable Detection Limit						

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Maxxam Job #: B912716
Report Date: 2019/03/06

DILLON CONSULTING LTD.
Client Project #: 18-8483

TOXICOLOGY (WATER)

Maxxam ID		VG3445	
Sampling Date		2019/02/21 09:00	
COC Number		C#572949-01-01	
	UNITS	**G-2**	**QC Batch**
Rainbow Trout Bioassay			
LC50	% vol/vol	ATTACHED	9331461

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Maxxam Job #: B912716
Report Date: 2019/03/06

DILLON CONSULTING LTD.
Client Project #: 18-8483

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	5.4°C
Package 2	6.2°C
Package 3	6.0°C
Package 4	3.3°C

Results relate only to the items tested.

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Maxxam Job #: B912716
Report Date: 2019/03/06

DILLON CONSULTING LTD.
Client Project #: 18-8483

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
9329093	JWI	Spiked Blank	Total Suspended Solids	2019/02/22		98	%	80 - 120
9329093	JWI	Method Blank	Total Suspended Solids	2019/02/22	<4.0		mg/L	
9329093	JWI	RPD	Total Suspended Solids	2019/02/22	0		%	20
9329109	JWI	Method Blank	Biochemical Oxygen Demand	2019/02/22	<1		mg/L	
9329109	JWI	RPD [VG3443-01]	Biochemical Oxygen Demand	2019/02/22	78 (1)		%	20
9329112	JWI	Method Blank	Carbonaceous BOD	2019/02/22	<1		mg/L	
9329112	JWI	RPD [VG3443-01]	Carbonaceous BOD	2019/02/22	3.3		%	20
9329360	LCO	Method Blank	Total Coliforms (MTF)	2019/02/21	<3		MPN/100mL	
9329890	SSO	Matrix Spike	Dissolved Chloride (Cl)	2019/02/22		NC	%	80 - 120
			Dissolved Sulphate (SO4)	2019/02/22		NC	%	80 - 120
9329890	SSO	Spiked Blank	Dissolved Chloride (Cl)	2019/02/22		106	%	80 - 120
			Dissolved Sulphate (SO4)	2019/02/22		106	%	75 - 125
9329890	SSO	Method Blank	Dissolved Chloride (Cl)	2019/02/22	<0.50		mg/L	
			Dissolved Sulphate (SO4)	2019/02/22	<0.50		mg/L	
9329890	SSO	RPD	Dissolved Chloride (Cl)	2019/02/25	1.3 (2)		%	20
			Dissolved Sulphate (SO4)	2019/02/25	0.67		%	20
9330010	SSO	Matrix Spike	Dissolved Nitrite (N)	2019/02/22		99	%	80 - 120
			Dissolved Nitrate (N)	2019/02/22		101	%	80 - 120
9330010	SSO	Spiked Blank	Dissolved Nitrite (N)	2019/02/22		99	%	80 - 120
			Dissolved Nitrate (N)	2019/02/22		99	%	80 - 120
9330010	SSO	Method Blank	Dissolved Nitrite (N)	2019/02/22	<0.010		mg/L	
			Dissolved Nitrate (N)	2019/02/22	<0.010		mg/L	
9330010	SSO	RPD	Dissolved Nitrite (N)	2019/02/22	NC		%	20
			Dissolved Nitrate (N)	2019/02/22	13		%	20
9330640	SPR	Matrix Spike	O-TERPHENYL (sur.)	2019/02/24		105	%	60 - 140
			F2 (C10-C16 Hydrocarbons)	2019/02/24		109	%	60 - 140
			F3 (C16-C34 Hydrocarbons)	2019/02/24		105	%	60 - 140
			F4 (C34-C50 Hydrocarbons)	2019/02/24		108	%	60 - 140
9330640	SPR	Spiked Blank	O-TERPHENYL (sur.)	2019/02/24		108	%	60 - 140
			F2 (C10-C16 Hydrocarbons)	2019/02/24		115	%	60 - 140
			F3 (C16-C34 Hydrocarbons)	2019/02/24		111	%	60 - 140
			F4 (C34-C50 Hydrocarbons)	2019/02/24		113	%	60 - 140
9330640	SPR	Method Blank	O-TERPHENYL (sur.)	2019/02/24		109	%	60 - 140
			F2 (C10-C16 Hydrocarbons)	2019/02/24	<0.10		mg/L	
			F3 (C16-C34 Hydrocarbons)	2019/02/24	<0.10		mg/L	
			F4 (C34-C50 Hydrocarbons)	2019/02/24	<0.20		mg/L	
9330640	SPR	RPD	F2 (C10-C16 Hydrocarbons)	2019/02/24	19		%	30
			F3 (C16-C34 Hydrocarbons)	2019/02/24	2.7		%	30
			F4 (C34-C50 Hydrocarbons)	2019/02/24	18		%	30
9331010	ES4	Spiked Blank	Conductivity	2019/02/25		101	%	90 - 110
9331010	ES4	Method Blank	Conductivity	2019/02/25	<2.0		uS/cm	
9331010	ES4	RPD [VG3443-02]	Conductivity	2019/02/25	0.59		%	20
9331019	ES4	Spiked Blank	Alkalinity (Total as CaCO3)	2019/02/25		96	%	80 - 120
9331019	ES4	Method Blank	Alkalinity (Total as CaCO3)	2019/02/25	<0.50		mg/L	
			Bicarbonate (HCO3)	2019/02/25	<0.50		mg/L	
			Carbonate (CO3)	2019/02/25	<0.50		mg/L	
			Hydroxide (OH)	2019/02/25	<0.50		mg/L	
9331019	ES4	RPD [VG3443-02]	Alkalinity (Total as CaCO3)	2019/02/25	1.0		%	20
			Bicarbonate (HCO3)	2019/02/25	1.0		%	20
			Carbonate (CO3)	2019/02/25	NC		%	20
			Hydroxide (OH)	2019/02/25	NC		%	20
9331107	IK0	Matrix Spike	Dissolved Fluoride (F)	2019/02/25		104	%	80 - 120
9331107	IK0	Spiked Blank	Dissolved Fluoride (F)	2019/02/25		99	%	80 - 120
9331107	IK0	Method Blank	Dissolved Fluoride (F)	2019/02/25	<0.050		mg/L	
9331107	IK0	RPD	Dissolved Fluoride (F)	2019/02/25	0		%	20

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
9331269	JLD	Matrix Spike	Total Ammonia (N)	2019/02/25		107	%	80 - 120
9331269	JLD	Spiked Blank	Total Ammonia (N)	2019/02/25		99	%	80 - 120
9331269	JLD	Method Blank	Total Ammonia (N)	2019/02/25	<0.015		mg/L	
9331269	JLD	RPD	Total Ammonia (N)	2019/02/25	9.0		%	20
9331338	FM0	Matrix Spike	Dissolved Calcium (Ca)	2019/02/25		NC	%	80 - 120
			Dissolved Iron (Fe)	2019/02/25		92	%	80 - 120
			Dissolved Magnesium (Mg)	2019/02/25		92	%	80 - 120
			Dissolved Manganese (Mn)	2019/02/25		90	%	80 - 120
			Dissolved Potassium (K)	2019/02/25		91	%	80 - 120
			Dissolved Sodium (Na)	2019/02/25		83	%	80 - 120
9331338	FM0	Spiked Blank	Dissolved Calcium (Ca)	2019/02/25		98	%	80 - 120
			Dissolved Iron (Fe)	2019/02/25		100	%	80 - 120
			Dissolved Magnesium (Mg)	2019/02/25		97	%	80 - 120
			Dissolved Manganese (Mn)	2019/02/25		96	%	80 - 120
			Dissolved Potassium (K)	2019/02/25		91	%	80 - 120
			Dissolved Sodium (Na)	2019/02/25		91	%	80 - 120
9331338	FM0	Method Blank	Dissolved Calcium (Ca)	2019/02/25	<0.30		mg/L	
			Dissolved Iron (Fe)	2019/02/25	<0.060		mg/L	
			Dissolved Magnesium (Mg)	2019/02/25	<0.20		mg/L	
			Dissolved Manganese (Mn)	2019/02/25	<0.0040		mg/L	
			Dissolved Potassium (K)	2019/02/25	<0.30		mg/L	
			Dissolved Sodium (Na)	2019/02/25	<0.50		mg/L	
9331338	FM0	RPD	Dissolved Calcium (Ca)	2019/02/25	0.22		%	20
			Dissolved Iron (Fe)	2019/02/25	1.2		%	20
			Dissolved Magnesium (Mg)	2019/02/25	1.3		%	20
			Dissolved Manganese (Mn)	2019/02/25	0.51		%	20
			Dissolved Potassium (K)	2019/02/25	0.29		%	20
			Dissolved Sodium (Na)	2019/02/25	2.2		%	20
9331805	VBA	Matrix Spike	Total Aluminum (Al)	2019/02/26		99	%	80 - 120
			Total Antimony (Sb)	2019/02/26		99	%	80 - 120
			Total Arsenic (As)	2019/02/26		101	%	80 - 120
			Total Barium (Ba)	2019/02/26		101	%	80 - 120
			Total Beryllium (Be)	2019/02/26		99	%	80 - 120
			Total Cadmium (Cd)	2019/02/26		99	%	80 - 120
			Total Cesium (Cs)	2019/02/26		99	%	80 - 120
			Total Chromium (Cr)	2019/02/26		96	%	80 - 120
			Total Cobalt (Co)	2019/02/26		96	%	80 - 120
			Total Copper (Cu)	2019/02/26		94	%	80 - 120
			Total Iron (Fe)	2019/02/26		100	%	80 - 120
			Total Lead (Pb)	2019/02/26		100	%	80 - 120
			Total Lithium (Li)	2019/02/26		97	%	80 - 120
			Total Manganese (Mn)	2019/02/26		97	%	80 - 120
			Total Molybdenum (Mo)	2019/02/26		102	%	80 - 120
			Total Nickel (Ni)	2019/02/26		94	%	80 - 120
			Total Rubidium (Rb)	2019/02/26		100	%	80 - 120
			Total Selenium (Se)	2019/02/26		99	%	80 - 120
			Total Silver (Ag)	2019/02/26		99	%	80 - 120
			Total Strontium (Sr)	2019/02/26		105	%	80 - 120
			Total Thallium (Tl)	2019/02/26		100	%	80 - 120
			Total Titanium (Ti)	2019/02/26		98	%	80 - 120
			Total Uranium (U)	2019/02/26		102	%	80 - 120
			Total Vanadium (V)	2019/02/26		98	%	80 - 120
			Total Zinc (Zn)	2019/02/26		97	%	80 - 120
9331805	VBA	Spiked Blank	Total Aluminum (Al)	2019/02/26		98	%	80 - 120
			Total Antimony (Sb)	2019/02/26		98	%	80 - 120

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Total Arsenic (As)	2019/02/26		98	%	80 - 120
			Total Barium (Ba)	2019/02/26		101	%	80 - 120
			Total Beryllium (Be)	2019/02/26		100	%	80 - 120
			Total Cadmium (Cd)	2019/02/26		98	%	80 - 120
			Total Cesium (Cs)	2019/02/26		97	%	80 - 120
			Total Chromium (Cr)	2019/02/26		98	%	80 - 120
			Total Cobalt (Co)	2019/02/26		98	%	80 - 120
			Total Copper (Cu)	2019/02/26		98	%	80 - 120
			Total Iron (Fe)	2019/02/26		100	%	80 - 120
			Total Lead (Pb)	2019/02/26		101	%	80 - 120
			Total Lithium (Li)	2019/02/26		99	%	80 - 120
			Total Manganese (Mn)	2019/02/26		99	%	80 - 120
			Total Molybdenum (Mo)	2019/02/26		98	%	80 - 120
			Total Nickel (Ni)	2019/02/26		97	%	80 - 120
			Total Rubidium (Rb)	2019/02/26		101	%	80 - 120
			Total Selenium (Se)	2019/02/26		98	%	80 - 120
			Total Silver (Ag)	2019/02/26		97	%	80 - 120
			Total Strontium (Sr)	2019/02/26		101	%	80 - 120
			Total Thallium (Tl)	2019/02/26		99	%	80 - 120
			Total Titanium (Ti)	2019/02/26		101	%	80 - 120
			Total Uranium (U)	2019/02/26		101	%	80 - 120
			Total Vanadium (V)	2019/02/26		98	%	80 - 120
			Total Zinc (Zn)	2019/02/26		100	%	80 - 120
9331805	VBA	Method Blank	Total Aluminum (Al)	2019/02/26	<3.0		ug/L	
			Total Antimony (Sb)	2019/02/26	<0.50		ug/L	
			Total Arsenic (As)	2019/02/26	<0.10		ug/L	
			Total Barium (Ba)	2019/02/26	<1.0		ug/L	
			Total Beryllium (Be)	2019/02/26	<0.10		ug/L	
			Total Cadmium (Cd)	2019/02/26	<0.010		ug/L	
			Total Cesium (Cs)	2019/02/26	<0.20		ug/L	
			Total Chromium (Cr)	2019/02/26	<1.0		ug/L	
			Total Cobalt (Co)	2019/02/26	<0.20		ug/L	
			Total Copper (Cu)	2019/02/26	<0.50		ug/L	
			Total Iron (Fe)	2019/02/26	<10		ug/L	
			Total Lead (Pb)	2019/02/26	<0.20		ug/L	
			Total Lithium (Li)	2019/02/26	<2.0		ug/L	
			Total Manganese (Mn)	2019/02/26	<1.0		ug/L	
			Total Molybdenum (Mo)	2019/02/26	<1.0		ug/L	
			Total Nickel (Ni)	2019/02/26	<1.0		ug/L	
			Total Rubidium (Rb)	2019/02/26	<0.20		ug/L	
			Total Selenium (Se)	2019/02/26	<0.10		ug/L	
			Total Silver (Ag)	2019/02/26	<0.020		ug/L	
			Total Strontium (Sr)	2019/02/26	<1.0		ug/L	
			Total Thallium (Tl)	2019/02/26	<0.010		ug/L	
			Total Titanium (Ti)	2019/02/26	<5.0		ug/L	
			Total Uranium (U)	2019/02/26	<0.10		ug/L	
			Total Vanadium (V)	2019/02/26	<5.0		ug/L	
			Total Zinc (Zn)	2019/02/26	<5.0		ug/L	
9331805	VBA	RPD	Total Aluminum (Al)	2019/02/26	NC		%	20
			Total Antimony (Sb)	2019/02/26	NC		%	20
			Total Arsenic (As)	2019/02/26	NC		%	20
			Total Barium (Ba)	2019/02/26	2.7		%	20
			Total Beryllium (Be)	2019/02/26	NC		%	20
			Total Cadmium (Cd)	2019/02/26	NC		%	20
			Total Chromium (Cr)	2019/02/26	NC		%	20

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Total Cobalt (Co)	2019/02/26	NC		%	20
			Total Copper (Cu)	2019/02/26	1.0		%	20
			Total Iron (Fe)	2019/02/26	NC		%	20
			Total Lead (Pb)	2019/02/26	5.0		%	20
			Total Lithium (Li)	2019/02/26	NC		%	20
			Total Manganese (Mn)	2019/02/26	NC		%	20
			Total Molybdenum (Mo)	2019/02/26	NC		%	20
			Total Nickel (Ni)	2019/02/26	NC		%	20
			Total Selenium (Se)	2019/02/26	NC		%	20
			Total Silver (Ag)	2019/02/26	NC		%	20
			Total Strontium (Sr)	2019/02/26	1.5		%	20
			Total Thallium (Tl)	2019/02/26	NC		%	20
			Total Titanium (Ti)	2019/02/26	NC		%	20
			Total Uranium (U)	2019/02/26	NC		%	20
			Total Vanadium (V)	2019/02/26	NC		%	20
			Total Zinc (Zn)	2019/02/26	3.0		%	20
9332068	JLD	Matrix Spike	Total Phosphorus (P)	2019/02/26		NC	%	80 - 120
9332068	JLD	QC Standard	Total Phosphorus (P)	2019/02/26		92	%	80 - 120
9332068	JLD	Spiked Blank	Total Phosphorus (P)	2019/02/26		98	%	80 - 120
9332068	JLD	Method Blank	Total Phosphorus (P)	2019/02/26	<0.0030		mg/L	
9332068	JLD	RPD	Total Phosphorus (P)	2019/02/26	0.25		%	20
9333197	JLD	Matrix Spike	Total Total Kjeldahl Nitrogen	2019/02/27		101	%	80 - 120
9333197	JLD	QC Standard	Total Total Kjeldahl Nitrogen	2019/02/27		95	%	80 - 120
9333197	JLD	Spiked Blank	Total Total Kjeldahl Nitrogen	2019/02/27		104	%	80 - 120
9333197	JLD	Method Blank	Total Total Kjeldahl Nitrogen	2019/02/27	<0.050		mg/L	
9333197	JLD	RPD	Total Total Kjeldahl Nitrogen	2019/02/27	NC		%	20
9333216	APY	Matrix Spike	Total Mercury (Hg)	2019/02/27		108	%	80 - 120
9333216	APY	QC Standard	Total Mercury (Hg)	2019/02/27		97	%	80 - 120
9333216	APY	Spiked Blank	Total Mercury (Hg)	2019/02/27		107	%	80 - 120
9333216	APY	Method Blank	Total Mercury (Hg)	2019/02/27	<0.0020		ug/L	
9333216	APY	RPD	Total Mercury (Hg)	2019/02/27	NC		%	20
9333222	SPM	Matrix Spike	Total Organic Carbon (C)	2019/02/27		110	%	80 - 120
9333222	SPM	Spiked Blank	Total Organic Carbon (C)	2019/02/27		110	%	80 - 120
9333222	SPM	Method Blank	Total Organic Carbon (C)	2019/02/27	<0.50		mg/L	
9333222	SPM	RPD	Total Organic Carbon (C)	2019/02/27	NC		%	20
9333753	YY	Matrix Spike	Phenols	2019/02/27		96	%	80 - 120
9333753	YY	Spiked Blank	Phenols	2019/02/27		92	%	80 - 120
9333753	YY	Method Blank	Phenols	2019/02/27	<0.0020		mg/L	
9333753	YY	RPD	Phenols	2019/02/27	NC		%	20
9334117	REE	Spiked Blank	Extractable (n-Hex.) Oil and grease	2019/02/27		100	%	70 - 130
9334117	REE	Method Blank	Extractable (n-Hex.) Oil and grease	2019/02/27	<2.0		mg/L	
9334821	MZ	Matrix Spike	1,4-Difluorobenzene (sur.)	2019/02/28		95	%	50 - 140
			4-Bromofluorobenzene (sur.)	2019/02/28		98	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2019/02/28		94	%	50 - 140
			Benzene	2019/02/28		102	%	50 - 140
			Toluene	2019/02/28		99	%	50 - 140
			Ethylbenzene	2019/02/28		103	%	50 - 140
			m & p-Xylene	2019/02/28		103	%	50 - 140
			o-Xylene	2019/02/28		100	%	50 - 140
			F1 (C6-C10)	2019/02/28		79	%	60 - 140
9334821	MZ	Spiked Blank	1,4-Difluorobenzene (sur.)	2019/02/28		97	%	50 - 140
			4-Bromofluorobenzene (sur.)	2019/02/28		98	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2019/02/28		92	%	50 - 140
			Benzene	2019/02/28		98	%	60 - 130
			Toluene	2019/02/28		96	%	60 - 130

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Maxxam Job #: B912716
Report Date: 2019/03/06

DILLON CONSULTING LTD.
Client Project #: 18-8483

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Ethylbenzene	2019/02/28		101	%	60 - 130
			m & p-Xylene	2019/02/28		100	%	60 - 130
			o-Xylene	2019/02/28		96	%	60 - 130
			F1 (C6-C10)	2019/02/28		95	%	60 - 140
9334821	MZ	Method Blank	1,4-Difluorobenzene (sur.)	2019/02/28		97	%	50 - 140
			4-Bromofluorobenzene (sur.)	2019/02/28		99	%	50 - 140
			D4-1,2-Dichloroethane (sur.)	2019/02/28		90	%	50 - 140
			Benzene	2019/02/28	<0.40		ug/L	
			Toluene	2019/02/28	<0.40		ug/L	
			Ethylbenzene	2019/02/28	<0.40		ug/L	
			m & p-Xylene	2019/02/28	<0.80		ug/L	
			o-Xylene	2019/02/28	<0.40		ug/L	
			F1 (C6-C10)	2019/02/28	<100		ug/L	
9334821	MZ	RPD	Benzene	2019/02/28	NC		%	30
			Toluene	2019/02/28	NC		%	30
			Ethylbenzene	2019/02/28	NC		%	30
			m & p-Xylene	2019/02/28	NC		%	30
			o-Xylene	2019/02/28	NC		%	30
			F1 (C6-C10)	2019/02/28	NC		%	30

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Duplicate exceeds acceptance criteria due to sample matrix interference.

(2) Detection limits raised due to dilution to bring analyte within the calibrated range.

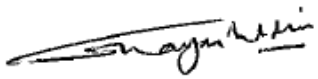
Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Maxxam Job #: B912716
Report Date: 2019/03/06

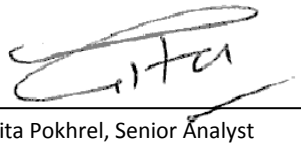
DILLON CONSULTING LTD.
Client Project #: 18-8483

VALIDATION SIGNATURE PAGE

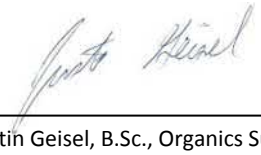
The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



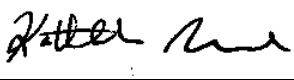
Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics



Gita Pokhrel, Senior Analyst

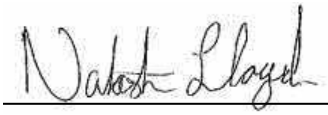


Justin Geisel, B.Sc., Organics Supervisor

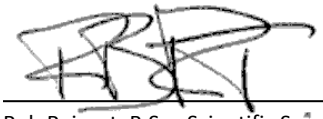


Kathleah Manuel, B.Sc, Analyst

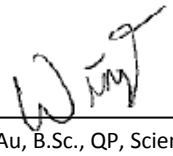
Kendra Williams, B.Sc, Microbiologist, Microbiology Team Lead



Natasha Lloyd, Analyst 2



Rob Reinert, B.Sc., Scientific Specialist



Winnie Au, B.Sc., QP, Scientific Specialist

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Maxxam Job #: B912716
Report Date: 2019/03/06

DILLON CONSULTING LTD.
Client Project #: 18-8483

VALIDATION SIGNATURE PAGE(CONT'D)

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics International Corporation o/a Maxxam Analytics Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Maxxam
A Bureau Veritas Group Company

Maxxam Analytics International Corporation o/a Maxxam Analytics
D-675 Berry Street, Winnipeg, Manitoba Canada R3H 1A7 Tel:(204) 772-7276 Toll-free:800-563-6266 Fax:(204) 772-2386 www.maxxam.ca

Chain Of Custody Record

INVOICE TO:		Report Information		Project Information		Laboratory Use Only	
Company Name	#8815 DILLON CONSULTING LTD.	Company Name		Quotation #	B70221	Maxxam Job #	Bottle Order #:
Contact Name	ACCOUNTS PAYABLE	Contact Name	Katie Whyte	P.O. #		B912716	572949
Address	1558 Willson Place Winnipeg MB R3T 0Y4	Address	Cell: (204)-851-1949	Project #	18-8483	Chain Of Custody Record	Project Manager
Phone	(204) 453-2301 Fax: (204) 452-4412	Phone	(204) 453-2353 Ext: 4017 Fax:	Project Name		C#572949-01-01	Amanda Hung
Email	apwinnipeg@dillon.ca	Email	kwhyte@dillon.ca	Site #	Nunavut		
				Sampled By			

Regulatory Criteria

Special Instructions: Dissolved metals not field filtered. Preservative rinsed out.

Note: For regulated drinking water samples - please use the Drinking Water Chain of Custody Form

Samples must be kept cool (< 10°C) from time of sampling until delivery to maxxam

Turnaround Time (TAT) Required

Please provide advance notice for rush projects

Regular (Standard) TAT X
(will be applied if Rush TAT is not specified)
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)
Date Required: _____ Time Required: _____
Rush Confirmation Number _____ *(call lab for #)*

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Regulated Drinking Water ? (Y / N)	Metals Field Filtered ? (Y / N)	Total Suspended Solids	Biochemical Oxygen Demand	Carbonaceous BOD	Volatile (Alk, pH, EC, Cl, SO4, NO3, NO2, Hard., Diss. Ca, Mg, K, Na, Ion Bal.)	Fluoride	Ammonia-N (Total)	Total Phosphorus	Total Kjeldahl Nitrogen, Total Nitrogen	Carbon (Total Organic)	Total Metals (sub to Burnaby)	# of Bottles	Comments
1		COMP	19/02/20	11:30	WW	N	N	X	X	X	X	X	X	X	X	X	X	7	
2		G-1	19/02/21	9:00		N	N											7	
3		G-2	19/02/21	9:00		N	N	X	X	X	X	X	X	X	X	X	X	17	(1 extra carboy for back-up)
4		FD	19/02/20,21	11:30, 9:00		N	N	X	X	X	X	X	X	X	X	X	X	14	Pg 1 COC + Mercury, Sampled 19/02/20 at 11:30. Remainig FD parameters sampled 19/02/21 at 9:00.
5																			
6																			
7																			
8																			
9																			
10																			

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted	Lab Use Only: Time Sensitive	Temperature (°C) on Receipt	Custody Seal Intact on Cooler?
Katie Whyte / Katie Whyte	19/02/21	15:15	Jocelyn M.	2019/02/21	15:15		☐	5.5/5.4/5.3	☐ Yes ☐ No

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO MAXXAM'S STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.MAXXAM.CA/TERMS.

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

Representative

White: Maxxam Yellow: Client

Maxxam
A Bureau Veritas Group Company

Maxxam Analytics International Corporation o/a Maxxam Analytics
D-675 Berry Street, Winnipeg, Manitoba Canada R3H 1A7 Tel:(204) 772-7276 Toll-free:800-563-6266 Fax:(204) 772-2386 www.maxxam.ca

Chain Of Custody Record

INVOICE TO:		Report Information		Project Information		Laboratory Use Only	
Company Name	#8815 DILLON CONSULTING LTD.	Company Name		Quotation #	B70221	Maxxam Job #	Bottle Order #:
Contact Name	ACCOUNTS PAYABLE	Contact Name	Katie Whyte	P.O. #			572949
Address	1558 Willson Place	Address		Project #	18-8483	Chain Of Custody Record	Project Manager
	Winnipeg MB R3T 0Y4			Project Name		C#572949-01-02	Amanda Hung
Phone	(204) 453-2301 Fax: (204) 452-4412	Phone	(204) 453-2353 Ext: 4017 Fax:	Site #	Nunavut		
Email	apwinnipeg@dillon.ca	Email	kwhyte@dillon.ca	Sampled By			

Regulatory Criteria

Special Instructions: Dissolved metals not field filtered. Preservative rinsed out.

Note: For regulated drinking water samples - please use the Drinking Water Chain of Custody Form

Samples must be kept cool (< 10ºC) from time of sampling until delivery to maxxam

Turnaround Time (TAT) Required

Please provide advance notice for rush projects

Regular (Standard) TAT X

(will be applied if Rush TAT is not specified)

Standard TAT = 5-7 Working days for most tests.

Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)

Date Required: _____ Time Required: _____

Rush Confirmation Number: _____ *(call lab for #)*

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Regulated Drinking Water ? (Y / N)	Metals Field Filtered ? (Y / N)	Phenols (4-AAP)	Oil and Grease (Gravimetric, n -Hexane)	BTEX/F1-F4 in Water, Total Hydrocarbons (calculated)	Total, Fecal Coliforms & E.coli (MTF)	Rainbow Trout LC50 Multi-Concentration	MERCURY					# of Bottles	Comments
1		COMP	19/02/20	11:30	WW	N	N						X					7	
2		G-1	19/02/21	9:00	|	N	N	X	X	X	X							7	
3		G-2	19/02/21	9:00	|	N	N	X	X	X	X	X	X					17	(1 extra carboy for back-up)
4		FD	19/02/20,21	11:30,9:00	|	N	N	X	X	X	X		X					14	See note on pg. 1.
5																			
6																			
7																			
8																			
9																			
10																			

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted	Lab Use Only: Time Sensitive	Temperature (ºC) on Receipt	Custody Seal Intact on Cooler?
Katie Whyte / Katie Whyte	19/02/21	15:15	Jocelyn M.	2019/02/21	15:15		☐	5.5 / 5.4 / 5.3	☐ Yes ☐ No

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO MAXXAM'S STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.MAXXAM.CA/TERMS.

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

Representant

White: Maxxam Yellow: Client

Maxxam
A Bureau Veritas Group Company

RESULTS OF RAINBOW TROUT LC50 MULTI-CONCENTRATION

Success Through Science®

Client : 8815 DILLON CONSULTING LTD., WINNIPEG Job Number: B912716

Client Project Name & Number: - 18-8483

Test Result:

96 hrs LC50 % vol/vol (95% CL): 35.4 (25.0-50.0) Statistical Method: Binomial

Sample Name : G-2 Sample Matrix : Water

Description: brown, cloudy Sample Number: VG3445-13

Sample Collected: Feb 21, 2019 09:00 AM Sampling Method : N/A Site Collection: N/A

Sample Collected By: N/A Volume Received: 39 L Temp.Upon Arrival: 5 °C Storage: 2-6°C

Sample Received: Feb 21, 2019 03:15 PM pH: 6.9 Dissolved Oxygen: 1.4 mg/L

Analysis Start : Feb 25, 2019 12:16 PM Temperature : 14 °C Sample Conductance: 517 µS/cm

Concentration	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)
% vol/vol	Start	Start	Start	Start	24 hrs	24 hrs	24 hrs	24 hrs	48 hrs	48 hrs	48 hrs	48 hrs
0	16	7.9	334	9.1	0	0	0	0	0	0	0	0
6.25	16	7.8	346	8.9	0	0	0	0	0	0	0	0
12.5	16	7.7	359	8.4	0	0	0	0	0	0	0	0
25	16	7.6	384	8.1	0	0	0	0	0	0	0	0
50	15	7.2	429	5.4	1	10.0	D(5)	50.0	10	100	0	0
100	15	7.0	524	2.3	10	100	0	0	10	100	0	0

Concentration	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)	Temperature (°C)	pH (pH)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)	Atypical Behaviour (%)
% vol/vol	72 hrs	72 hrs	72 hrs	72 hrs	96 hrs	96 hr	96 hrs	96 hrs	96 hrs	96 hrs	96 hrs	96 hrs
0	0	0	0	0	16	7.7	336	8.3	0	0	0	0
6.25	0	0	0	0	16	7.8	347	8.5	0	0	0	0
12.5	0	0	0	0	16	7.8	361	8.5	0	0	0	0
25	0	0	0	0	16	7.8	384	8.5	0	0	0	0
50	10	100	0	0	16	7.7	435	8.4	10	100	0	0
100	10	100	0	0	16	7.6	532	7.9	10	100	0	0

Atypical Behaviour Notes : D=Dark pigmentation

Comments : None

Culture/Control/Dilution Water City of Edmonton dechlorinated tap water

Hardness: 190 mg/L $CaCO_3$ Other parameters available on request.

Test Conditions Test concentration : 0,6.25,12.5,25,50,100 (% vol/vol)

Organisms per Vessel :	10	Test Temperature :	15 ± 1 °C	Solution Depth :	>15 cm
Total # of Organisms Used :	60	Pre-aeration Time :	120 min.	Rate of Aeration	6.5±1 mL/min/L
Test Volume :	20 L	Vessel Volume :	38L	Test pH Adjusted:	No
Loading Density :	0.3 g/L	Photoperiod :	16:8 (light: dark)		

Test Organism : Rainbow Trout *(Oncorhynchus mykiss)* Source : Spring Valley Trout Hatchery

Culture Temperature :	15 ± 2 °C	Weight (Mean) +- SD :	0.5 ± 0.0 g	Length (Mean) +- SD :	4.07 ± 0.20 cm
Culture Water Renewal :	≥ 1.0 L/min/kg fish	Weight (Range) :	0.4 – 0.6 g	Length (Range) :	3.70 – 4.30 cm
Culture Photoperiod :	16:8 (light: dark)			% Mortality within 7 days :	0.2%
Feeding rate and frequency :	daily: 1-5% biomass of trout.			Acclimation Time:	>14 days

Maxxam
A Bureau Veritas Group Company

RESULTS OF RAINBOW TROUT LC50 MULTI-CONCENTRATION

Success Through Science®

Client :	8815	DILLON CONSULTING LTD., WINNIPEG	Job Number:	B912716
Client Project Name & Number:		- 18-8483	Sample Number:	VG3445-13

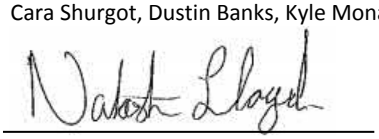
Reference chemical:	Phenol	Test Date:	Feb 07, 2019
Test Endpoint 96 hrs LC50 (95% confidence interval) :	9.90 (9.28, 10.6)mg/L	Statistical Method :	Untrimmed Spearman-Kärber
Historical Mean LC50 (warning limits) :	10.3 (8.63, 12.3) mg/L	Concentration :	0,8,10,12,15,20 mg/L

Test Method EPS 1/RM/13

Method Deviations : None

Note: The results contained in this report refer only to the testing of the sample submitted. This report may not be reproduced, except in its entirety, without the written approval of the laboratory.

Analyst : Cara Shurgot, Dustin Banks, Kyle Monaghan



Verified By : Natasha Lloyd, Analyst 2 Date: Mar 03, 2019 10:23 AM

Appendix B

Summary of GN and Dillon Wastewater Sampling

TABLE 1 - 2017 SUMMARY OF LABORATORY RESULTS, RANKIN INLET EFFLUENT

Summary of GRA-3 Wastewater Effluent Analysis														2017 Statistics				CEQG Water Quality Guidelines for the Protection of Aquatic Life - Marine		CCME Canada-wide Strategy for the Management of Municipal Wastewater Effluent - National Performance Standards	Fisheries Act - Wastewater Systems Effluent Regulations	Northwest Territories Water Board Guidelines (NWTWB)
Category	**Parameters (From ALS)**	**Unit**	**28-Feb-17**	**29-Mar-17**	**26-Apr-17**	**29-May-17**	**29-Jun-17**	**20-Jul-17**	**05-Sep-17**	**26-Sep-17**	**25-Oct-17**	**30-Nov-17**	**18-Dec-17**	**Min**	**Max**	**Average**	**Std. Dev.**	Short Term	Long Term			
Physical/Chemical	Total Suspended Solids	mg/L	**76**	**575**	**140**	**90**	**88**	**160**	**98**	**140**	**56.0**	**85.0**	**90.0**	56	575	145	146	25 (1)	N/A	25	25	180
	Biochemical Oxygen Demand	mg/L	**112**	**392**	**182**	58	94	**164**	98	**128**	59	**153**	**146**	58	392	144	92					120
	BOD Carbonaceous	mg/L	**111**	**390**	**159**	**47**	**82**	**169**	**82**	**115**	**53**	**138**	**110**	47	390	132	94			25	25	
	Hardness (as CaCO3)	mg/L	121	134	129	127	75	87.2	83.3	199	86.6	96.8	100	75	199	113	35					
	Bicarbonate (HCO3)	mg/L	139	232	179	135	118	127	121	147	99.4	143	127	99.4	232	142	36					
	Carbonate (CO3)	mg/L	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	0.0					
	Hydroxide (OH)	mg/L	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	0.0					
	Total Alkalinity (as CaCO3)	mg/L	114	190	146	111	96.9	104	99	120	81.5	117	104	81.5	190	117	29					
	Conductivity	uS/cm	574	753	682	549	392	417	410	507	379	537	491	379	753	517	120					
	pH	pH Units	7.06	6.47	7.13	7.12	7.07	6.95	7.02	7.17	7.10	6.99	6.91	6.47	7.17	7.00	0.19	N/A	7.0 to 8.7			6 to 9
Bacteriological	Fecal Coliforms	MPN/100 mL	**>110000**	**>110000**	**>24200**	**>24200**	/	**>24200**	/	**>24200**	**>24200**	**>24200**	**>24200**	>24200	>110000	/	/					100
	Total Coliforms	MPN/100 mL	/	/	/	/	/	/	/	**>24200**	/	/	**>2420**	>2420	>24200	/	/					1000
	Escherichia Coli	MPN/100 mL	/	/	/	/	/	/	/	>24200	/	/	>2420	>2420	>24200	/	/					
Nutrients	Total Ammonia (as N)	mg/L	4.91	13.5	6.35	3.61	11.9	4.86	6.05	6.6	6.57	9.23	6.2	3.61	13.5	7.3	3.1	N/A	N/A			
	Nitrate (as N)	mg/L	<0.020	0.058	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.047	<0.020	<0.020	<0.020	0.058	/	/	339	45			
	Nitrite (as N)	mg/L	<0.010	<0.020	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.013	<0.010	<0.01	<0.010	0.013	/	/					
	Total Organic Carbon	mg/L	91.8	109	106	44.8	61.8	68.4	47.5	50.4	42.0	97.0	85.9	42	109	73.1	25.6					
	Phosphorus (P)	mg/L	3.05	6.16	3.78	1.51	2.03	3.03	1.46	2.55	1.05	2.71	1.82	1.05	6.16	2.65	1.42					
Major Ions	Calcium (Ca)	mg/L	34.1	38.9	37	36.6	21.2	24.2	24.3	62.2	24.0	24.5	27.7	21.2	62.2	32.2	11.8					
	Chloride (Cl)	ug/L	75100	75900	86400	74700	49000	52700	56200	62400	51100	64800	63000	49000	86400	64664	12085	NRG	NRG			
	Fluoride (F)	mg/L	/	/	/	/	/	/	0.067	0.129	/	/	0.053	0.053	0.129	0.083	0.040	N/A	NRG			5*
	Magnesium (Mg)	mg/L	8.84	8.97	8.86	8.59	5.36	6.48	5.48	10.6	6.47	8.62	7.53	5.36	10.6	7.8	1.7					
	Potassium (K)	mg/L	12.1	14.7	11.9	8.19	8	10.7	6.53	13.4	8.53	12.5	9.53	6.53	14.7	10.6	2.6					
	Sodium (Na)	mg/L	49.5	49.5	47	59.8	30.9	35.1	27.3	45.4	33.9	46.1	40.7	27.3	59.8	42.3	9.7					
	Sulfate (SO4)	mg/L	34.7	37.0	40.5	35.7	16.3	19.5	28	30.3	26.5	30.8	29.4	16.3	40.5	29.9	7.3					500*
Metals (Total)	Aluminium (Al)	ug/L	203	224	156	134	240	290	113	233	194	258	161	113	290	201	55	N/A	N/A			2000
	Antimony (Sb)	ug/L	/	/	/	/	/	/	/	0.23	/	/	/	0.23	0.23	0.23	/					
	Arsenic (As)	ug/L	0.95	1.06	1.06	1.12	0.71	0.9	0.98	13.9	0.76	1.04	0.90	0.71	13.9	2.13	3.91	N/A	12.5			50
	Barium (Ba)	ug/L	/	/	/	/	/	/	/	66.9	/	/	/	66.9	66.9	66.9	/					1000*
	Beryllium (Be)	ug/L	/	/	/	/	/	/	/	<0.10	/	/	/	<0.010	<0.010	/	/					
	Cadmium (Cd)	ug/L	0.081	0.066	0.069	0.085	0.071	0.0881	0.0408	0.0946	0.0458	0.0816	0.0540	0.0408	0.0946	0.071	0.018	NRG	0.12			5*
	Cesium (Cs)	ug/L	/	/	/	/	/	/	/	0.099	/	/	/	0.099	0.099	0.099	/					
	Chromium (Cr)	ug/L	<1.0	<1.0	<1.0	1.2	1.1	1.45	0.54	0.65	0.65	1.02	0.84	0.54	1.45	/	/	N/A	1.5 (2)			100
	Cobalt (Co)	ug/L	<0.20	0.27	0.20	0.34	0.43	0.30	0.26	1.84	0.20	0.27	0.19	0.19	1.84	/	/					100*
	Copper (Cu)	ug/L	191	**316**	**223**	162	122	156	83.8	117	88.8	**209**	166	83.8	316	167	67	N/A	N/A			200*
	Iron (Fe)	ug/L	**1370**	**952**	**543**	**443**	**338**	**490**	265	**6020**	195	243	167	167	6020	1002	1703	N/A	N/A			300*
	Lead (Pb)	ug/L	1.49	2.13	1.56	3.94	2.63	2.27	2.13	1.51	1.16	8.38	1.02	1.02	8.38	2.57	2.09	N/A	N/A			50*
	Lithium (Li)	ug/L	/	/	/	/	/	/	/	6.4	/	/	/	6.4	6.4	6.4	/					
	Manganese (Mn)	ug/L	40.8	47.3	**52.2**	**77.1**	33.7	44.4	39.9	468	24.5	47.1	36.3	24.5	468	82.8	128.4					50*
	Molybdenum (Mo)	ug/L	/	/	/	/	/	/	/	0.387	/	/	/	0.387	0.387	0.387	/	N/A	N/A			200
	Nickel (Ni)	ug/L	3.5	3.6	3.1	4.7	3	3.45	3.47	4.05	2.01	3.45	2.46	2.01	4.7	3.3	0.7	N/A	N/A			300*
	Rubidium (Rb)	ug/L	/	/	/	/	/	/	/	12.5	/	/	/	12.5	12.5	12.5	/					
	Selenium (Se)	ug/L	/	/	/	/	/	/	/	0.246	/	/	/	0.246	0.246	0.246	/	N/A	N/A			50
	Silver (Ag)	ug/L	/	/	/	/	/	/	/	0.043	/	/	/	0.043	0.043	0.043	/	7.5	NRG			100
	Strontium (Sr)	ug/L	/	/	/	/	/	/	/	346	/	/	/	346	346	346	/					
	Thallium (Tl)	ug/L	/	/	/	/	/	/	/	0.011	/	/	/	0.011	0.011	0.011	/	N/A	N/A			
	Titanium (Ti)	ug/L	/	/	/	/	/	/	/	1.04	/	/	/	1.04	1.04	1.04	/					
	Uranium (U)	ug/L	/	/	/	/	/	/	/	0.376	/	/	/	0.376	0.376	0.376	/	NRG	NRG			
	Vanadium (V)	ug/L	/	/	/	/	/	/	/	1.6	/	/	/	1.6	1.6	1.6	/					
	Zinc (Zn)	ug/L	72.0	147	91.9	66	62.2	124	60.6	133	51.3	93.5	76.1	51.3	147	88.9	32.4	N/A	N/A			500
Other	Phenols	mg/L	0.0249	0.0471	0.0102	0.0071	0.01	0.01	0.0102	0.0096	0.0050	0.0118	0.0084	0.005	0.0471	0.014	0.012					
	Oil and Grease	mg/L	**40.1**	**44.3**	**33.3**	**22.6**	**29.9**	**93.6**	**22.1**	**34.3**	**9.9**	**25.0**	**28.0**	9.9	93.6	34.8	21.6					5
	Total Hydrocarbons (C6-C50)	mg/L	12.4	22.9	18.7	11.3	15.5	/	/	/	11.4	17.7	13.9	11.3	22.9	15.5	4.1					

NRG - No Guideline
N/A = Not Applicable

Value	Exceeds CCME Canada-wide Strategy for the Management of Municipal Wastewater Effluent National Performance Standard
Value	CCME Canadian Environmental Quality Guidelines (CEQG) for the Protection of Aquatic Life – Marine
Value	Exceeds NWTWB Guidelines

(1) Clear Flow: Maximum increase of 25 mg/L from background levels for any short-term exposure. Maximum average increase of 5 mg/L from background levels for longer term exposures. High Flow: Maximum increase of 25 mg/L from background levels at any 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.
(2) Hexavalent chromium limit
* Dissolved

TABLE 2 - 2018 SUMMARY OF LABORATORY RESULTS, RANKIN INLET EFFLUENT

Summary of GRA-3 Wastewater Effluent Analysis																			CEQG Water Quality Guidelines for the Protection of Aquatic Life - Marine		CCME Canada-wide Strategy for the Management of Municipal Wastewater Effluent - National Performance Standards	Fisheries Act - Wastewater Systems Effluent Regulations	Northwest Territories Water Board Guidelines (NWTWB)
															2018 Statistics								
Category	**Environment Canada FAD Parameters**	**Unit**	**25-Jan-18**	**20-Feb-18**	**1/3/2018+**	**10-Apr-18**	**9-May-18**	**25-Jun-18**	**23-Jul-18**	**15-Aug-18**	**12-Sep-18**	**26-Oct-18**	**7-Nov-18**	**12-Dec-18**	**Min**	**Max**	**Average**	**Std. Dev.**	Short Term	Long Term			
Physical/Chemical	TSS	mg/L	**117**	**65.9**	/	**62.7**	**84.1**	**416**	**57.2**	**86.7**	**380**	**54.7**	**765**	**103**	54.7	765	199.3	227.9	25 (1)	N/A	25	25	180
	BOD5	mg/L	**173**	89	/	73	66	**211**	<50	84	**242**	**179**	**1490**	88	66	1490	270	433					120
	CBOD	mg/L	**146**	**82**	/	**68**	**66**	**167**	**<50**	**88**	**210**	**45**	**1460**	**82**	45	1460	241	431			25	25	
	Hardness	mg/L	125	136	/	166	195	102	65	96.5	86.5	62.0	113	72.1	62	195	111	42					
	Alkalinity - Bicarbonate (HCO3)	mg/L	157	141	/	160	176	198	87.4	147	183	84.9	171	/	84.9	198	151	38					
	Alkalinity - Carbonate (CO3)	mg/L	<0.60	<0.60	/	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	/	<0.60	<0.60	<0.60	0					
	Alkalinity - Hydroxide (OH)	mg/L	<0.34	<0.34	/	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	/	<0.34	<0.34	<0.34	0					
	Alkalinity - Total (as CaCO3)	mg/L	128	115	/	131	144	162	162	121	150	69.6	141	/	69.6	162	132	27					
	Conductivity	uS/cm	569	598	/	708	737	574	574	501	578	312	570	/	312	737	572	115					
	pH	pH Units	**6.91**	7.02	/	**6.79**	7.3	7.01	7.01	7.11	7.07	7.06	**6.69**	/	6.69	7.3	7.00	0.17	N/A	7.0 to 8.7			6 to 9
Bacteriological	Fecal Coliform	MPN/100 mL	**>24200**	**>24200**	/	**>24200**	/	**>24200**	**>24200**	**>24200**	**>24200**	**>2420**	**>24200**	/	>2420	>24200	/	/					100
	Total Coliform	MPN/100 mL	/	/	/	**>24200**	**>2420**	**>24200**	**>24200**	**>24200**	**>24200**	**>2420**	**>24200**	/	>2420	>24200	/	/					1000
	E. Coli	MPN/100 mL	/	/	/	>24200	>2420	>24200	>24200	>24200	>24200	>2420	>24200	/	>2420	>24200	/	/					
Nutrients	Ammonia-N	mg/L	5.9	4.45	/	4	3.13	74	4.34	8.44	22.9	4.31	38.6	13.4	3.13	74	17	22	N/A	N/A			
	Nitrate-N [NO3-N]	mg/L	<0.020	<0.020	/	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.024	0.059	<0.020	<0.020	0.059	/	/	339	45			
	Nitrite-N [NO2-N]	mg/L	<0.010	0.016	/	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.016	/	/					
	Total Organic Carbon (TOC)	mg/L	106	61.2	/	68.6	53.1	210	25.8	51.1	123	48.5	1670	46.6	25.8	1670	224.0	482.3					
	Total Phosphorus	mg/L	2.87	1.35	/	1.67	1.53	11.1	1.22	2.91	0.821	1.36	2.23	2.03	0.821	11.1	2.64	2.88					
Major Ions	Calcium (Ca)	mg/L	35	39.7	/	46.1	60.1	29.1	18.1	28.5	25.4	18.3	31.6	20.1	18.1	60.1	32.0	12.8					
	Chloride (Cl)	mg/L	80.9	88.4	/	97.9	115	52.6	38.8	57	58.7	39.2	55.4	48.6	38.8	115	66.6	25.2	NRG	NRG			
	Fluoride (F)	mg/L	/	/	/	0.223	0.273	0.02	0.114	0.093	/	0.161	0.099	0.130	0.02	0.273	0.14	0.08	N/A	NRG			5*
	Magnesium (Mg)	mg/L	9.04	8.95	/	12.3	11	7.25	4.79	6.17	5.59	3.96	8.26	5.32	3.96	12.3	7.51	2.65					
	Potassium (K)	mg/L	9.76	8.82	/	10.8	9.98	28.2	7.18	9.97	12.5	5.32	23.3	7.41	5.32	28.2	12.11	7.10					
	Sodium	mg/L	46.8	51.4	/	62.1	59.2	45.7	27.5	36.5	33.7	21.5	50.0	29.3	21.5	62.1	42.2	13.3					
	Sulphate (SO4)	mg/L	34.8	40.9	/	50.2	51.6	21.8	19.8	24.6	22.9	19.2	23.5	22.1	19.2	51.6	30.1	12.2					500*
Metals (Total)	Aluminum (Al)	ug/L	136	234	/	242	219	721	269	406	474	167	676	112	112	721	332	211	N/A	N/A			2000
	Antimony (Sb)	ug/L	/	/	/	<0.5	0.14	0.77	3.2	/	0.64	0.16	1.02	0.16	0.14	3.2	0.87	1.1					
	Arsenic (As)	ug/L	1.07	2.18	/	1.24	1.25	1.9	0.84	1.13	1.28	0.79	24.8	1.07	0.79	24.8	3.41	7.11	N/A	12.5			50
	Barium (Ba)	ug/L	/	/	/	50.7	49.8	37	19.7	/	30.3	20.3	45.4	25.4	19.7	50.7	34.8	12.8					1000*
	Beryllium (Be)	ug/L	/	/	/	<0.5	<0.1	<0.1	<0.1	/	<0.5	<0.1	<0.1	<0.1	<0.1	<0.5	/	/					
	Cadmium (Cd)	ug/L	0.057	0.0428	/	0.045	0.039	0.425	0.0537	0.0777	0.323	0.0485	0.596	0.0741	0.039	0.596	0.162	0.194	NRG	0.12			5*
	Cesium (Cs)	ug/L	/	/	/	0.058	0.057	0.152	0.044	/	0.113	0.051	0.163	0.071	0.044	0.163	0.089	0.048					
	Chromium (Cr)	ug/L	0.89	0.94	/	0.68	0.63	5.03	2.61	2.35	3.05	1.06	4.16	0.73	0.63	5.03	2.01	1.55	N/A	1.5(2)			100
	Cobalt (Co)	ug/L	0.2	0.14	/	<0.5	0.14	1.2	0.26	0.41	0.69	0.23	0.75	0.17	0.14	1.2	0.42	0.35					100*
	Copper (Cu)	ug/L	184	182	/	163	158	**283**	131	134	**213**	118	**346**	188	118	346	191	68.7	N/A	N/A			200*
	Iron (Fe)	ug/L	263	141	/	146	153	**1200**	**314**	**594**	**1130**	**313**	**1010**	280	141	1200	504	413	N/A	N/A			300*
	Lead (Pb)	ug/L	1.98	1.13	/	1.08	1.45	3.23	1.37	1.58	5.56	2.28	4.52	1.87	1.08	5.56	2.37	1.47	N/A	N/A			50*
	Lithium (Li)	ug/L	/	/	/	5.5	16	4.5	2.3	/	7.6	2.6	3.3	2.5	2.3	16	5.5	4.6					
	Manganese (Mn)	ug/L	40.2	34	/	46.6	46	**79.2**	47.9	**101**	**89.7**	36.5	**90.3**	30.8	30.8	101	58.4	26.1					50*
	Molybdenum (Mo)	ug/L	/	/	/	1.03	1.06	3.17	0.938	/	9.58	0.933	2.33	0.966	0.933	9.58	2.50	2.98	N/A	N/A			200
	Nickel (Ni)	ug/L	2.66	2.47	/	3	2.74	14	3.04	3.68	6.1	3.85	6.58	2.36	2.36	14	4.59	3.43	N/A	N/A			300*
	Rubidium (Rb)	ug/L	/	/	/	10.1	9.41	27.4	6.7	/	13.3	5.96	25	8.26	5.96	27.4	13.3	8.3					
	Selenium (Se)	ug/L	/	/	/	<0.25	0.205	0.867	0.249	/	0.48	0.195	1.54	0.233	0.195	1.54	0.538	0.503	N/A	N/A			50
	Silver (Ag)	ug/L	/	/	/	<0.05	0.029	0.081	0.032	/	0.077	0.029	0.144	0.042	0.029	0.144	0.062	0.042	7.5	NRG			100
	Strontium (Sr)	ug/L	/	/	/	215	441	105	80.5	/	111	92.8	111	95.6	80.5	441	156	122					
	Thallium (Tl)	ug/L	/	/	/	<0.05	<0.01	0.014	<0.01	/	<0.05	<0.01	0.018	<0.01	0.014	0.014	0.014	0	N/A	N/A			
	Titanium (Ti)	ug/L	/	/	/	<1.5	8.23	52.2	3.4	/	8.7	3.37	5.83	6.68	3.37	52.2	12.6	17.6					
	Uranium (U)	ug/L	/	/	/	0.265	0.281	0.399	0.181	/	0.271	0.155	0.217	0.109	0.109	0.399	0.235	0.090	NRG	NRG			
	Vanadium (V)	ug/L	/	/	/	<2.5	<0.5	1.62	0.57	/	<2.5	<0.5	1.46	<0.5	<0.5	1.62	/	/					
	Zinc (Zn)	ug/L	77	57.6	/	78	58.1	250	67.9	446	166	65.2	316	71	57.6	446	150	132	N/A	N/A			500
Other	Total phenols	mg/L	0.0095	0.0069	/	0.0058	0.0059	0.138	0.0047	0.0141	0.03	0.0089	0.0844	0.0086	0.0047	0.138	0.029	0.043					
	Oil and Grease	mg/L	**30.5**	**22.5**	/	**18.1**	**23.1**	**79.3**	**12**	**21.6**	**56.3**	**17.8**	**78.0**	**22.2**	12	79.3	34.7	24.6					5
	Total Petroleum Hydrocarbons	mg/L	14.4	10.6	/	10.3	7.94	53.4	10.1	15.5	50	8.92	<0.38	12.4	7.94	53.4	20.1	18.1					

NRG - No Guideline
N/A = Not Applicable
+ March Sampling was not completed by O&M due to weather constraints

Value	Exceeds CCME Canada-wide Strategy for the Management of Municipal Wastewater Effluent National Performance Standard
Value	CCME Canadian Environmental Quality Guidelines (CEQG) for the Protection of Aquatic Life – Marine
Value	Exceeds NWTWB Guidelines

(1) Clear Flow: Maximum increase of 25 mg/L from background levels for any short-term exposure. Maximum average increase of 5 mg/L from background levels for longer term exposures. High Flow: Maximum increase of 25 mg/L from background levels at any 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.

(2) Hexavalent chromium limit
* Dissolved

TABLE 3 - 2019 SUMMARY OF LABORATORY RESULTS, RANKIN INLET EFFLUENT

Summary of GRA-3 Wastewater Effluent Analysis												2019 Statistics				CEQG Water Quality Guidelines for the Protection of Aquatic Life - Marine		CCME Canada-wide Strategy for the Management of Municipal Wastewater Effluent - National Performance Standards	Fisheries Act - Wastewater Systems Effluent Regulations	Northwest Territories Water Board Guidelines (NWTWB)
Category	**Environment Canada FAD Parameters**	**Unit**	18-Jan-19	13-Feb-19	08-Mar-19	04-Apr-19	13-May-19	04-Jun-19	16-Jul-19	22-Jul-19	12-Aug-19	**Min**	**Max**	**Average**	**Std. Dev.**	Short Term	Long Term			
Physical/Chemical	TSS	mg/L	53.6	134	53.7	76.3	85.3	36.5	111	78	43.5	36.5	134	75	32	25 (1)	N/A	25	25	180
	BOD5	mg/L	82	101	82	51	106	27	113	108	16.7	16.7	113	76	36					120
	CBOD	mg/L	65	95	52	50	90	18.6	75	114	13.8	13.8	114	64	34			25	25	
	Hardness	mg/L	83.9	108	110	113	127	79.7	77.9	91.4	63.8	63.8	127	95.0	20.5					
	Alkalinity - Bicarbonate (HCO3)	mg/L	158	113	107	108	149	63.8	135	151	53.4	53.4	158	115	37.5					
	Alkalinity - Carbonate (CO3)	mg/L	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	0					
	Alkalinity - Hydroxide (OH)	mg/L	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	0					
	Alkalinity - Total (as CaCO3)	mg/L	130	92.6	87.5	88.7	122	52.3	110	124	43.8	43.8	130	95	30.8					
	Conductivity	uS/cm	502	448	448	494	557	290	430	491	241	241	557	433	103.1					
	pH	pH Units	6.9	6.92	6.8	7.01	6.90	6.80	7.29	7.23	7.27	6.8	7.29	7.01	0.202	N/A	7.0 to 8.7			6 to 9
Bacteriological	Fecal Coliform	MPN/100 mL	>24200	/	>24200	>24200	>24200	/	3870000	13000000	677000	>24200	13000000	/	/					100
	Total Coliform	MPN/100 mL	>24200	>2420	>24200	>2420	>24200	>2420	83600000	248000000	15500000	>2420	248000000	/	/					1000
	E. Coli	MPN/100 mL	>24200	>2420	>24200	>2420	>24200	>2420	10900000	26900000	1020000	>2420	26900000	/	/					
Nutrients	Ammonia-N	mg/L	10.9	6.6	5.4	3.2	7.03	2.47	9.2	1.9	1.99	1.9	10.9	5.4	3.3	N/A	N/A			
	Nitrate-N [NO3-N]	mg/L	<0.020	0.022	0.168	0.129	<0.020	0.072	<0.020	<0.020	<0.020	0.022	0.168	/	/	339	45			
	Nitrite-N [NO2-N]	mg/L	<0.010	<0.010	0.013	0.012	<0.010	0.039	<0.010	<0.010	<0.010	0.012	0.039	/	/					
	Total Organic Carbon (TOC)	mg/L	66.8	57.3	77.6	47.2	73.9	13.4	59.2	68.8	18.2	13.4	77.6	53.6	23.3					
	Total Phosphorus	mg/L	2.94	2.25	2.14	1.31	2.4	0.51	2.97	3.94	0.482	0.482	3.94	2.1	1.2					
Major Ions	Calcium (Ca)	mg/L	23.8	29.8	30.8	31.9	35.8	22.5	23	27.4	18.4	18.4	35.8	27.0	5.53					
	Chloride (Cl)	mg/L	55.9	60.5	66.8	73.5	77.2	44.6	43.7	49.9	35.8	35.8	77.2	56.4	14.2	NRG	NRG			
	Fluoride (F)	mg/L	0.105	0.122	0.155	<0.10	0.132	/	/	/	/	0.105	0.155	0.129	0.0209	N/A	NRG			5*
	Magnesium (Mg)	mg/L	5.93	8.05	8.01	8.07	9.22	5.68	4.95	5.59	4.33	4.33	9.22	6.65	1.71					
	Potassium (K)	mg/L	8.22	7.98	8.12	7.88	8.59	5.14	6.48	11.7	3.46	3.46	11.7	7.51	2.32					
	Sodium	mg/L	32.5	35.4	42.7	40.1	44.5	24.7	25.6	28	21.3	21.3	44.5	33	8.4					
	Sulphate (SO4)	mg/L	22.9	26.5	30.8	40.5	33.6	20.4	23.3	28.7	19.3	19.3	40.5	27.3	6.9					500*
Metals (Total)	Aluminum (Al)-Total	ug/L	215	398	223	83.3	171	148	115	112	84.1	83.3	398	172	99.1	N/A	N/A			2000
	Antimony (Sb)-Total	ug/L	0.18	0.15	0.38	/	0.16	/	/	/	/	0.15	0.38	0.22	0.11					
	Arsenic (As)-Total	ug/L	0.86	1.48	1.06	1.12	1.09	1.03	0.98	1.05	0.76	0.76	1.48	1.0	0.20	N/A	12.5			50
	Barium (Ba)-Total	ug/L	31.9	39.2	38.8	/	44.8	/	/	/	/	31.9	44.8	38.7	5.28					1000*
	Beryllium (Be)-Total	ug/L	<0.1	<0.1	<0.1	/	<0.1	/	/	/	/	<0.1	<0.1	/	/					5000*
	Bismuth (Bi)-Total	ug/L	4.63	1.49	0.728	/	1.46	/	/	/	/	0.728	4.63	2.08	1.74					
	Boron (B)-Total	ug/L	79	70	85	/	101	/	/	/	/	70	101	83.8	13.0					
	Cadmium (Cd)-Total	ug/L	0.0454	0.135	0.0492	0.0576	0.0595	0.0312	0.0744	0.136	0.0242	0.0242	0.136	0.0681	0.0410	NRG	0.12			5*
	Calcium (Ca)-Total	ug/L	23800	29800	30800	31900	35800	22500	23000	27400	18400	18400	35800	27044	5526					
	Cesium (Cs)-Total	ug/L	0.078	0.098	0.061	0.000	0.074	0	0	0	0	0	0.098	0.035	0.042					
	Chromium (Cr)-Total	ug/L	0.55	2.33	0.86	0.67	0.64	0.77	0.7	0.57	0.37	0.37	2.33	0.8	0.6	N/A	1.5 (2)			100
	Cobalt (Co)-Total	ug/L	0.17	0.58	0.19	0.13	0.2	0.26	0.33	0.53	0.19	0.13	0.58	0.3	0.2					100*
	Copper (Cu)-Total	ug/L	253	160	212	168	257	133	137	157	54.9	54.9	257	170	63.4	N/A	N/A			200*
	Iron (Fe)-Total	ug/L	246	828	229	258	632	407	226	284	126	126	828	360	228	N/A	N/A			300*
	Lead (Pb)-Total	ug/L	3.12	3.52	4.1	1.62	3.02	3.54	1.07	1.24	1.09	1.07	4.1	2.5	1.2	N/A	N/A			50*
	Lithium (Li)-Total	ug/L	3	4	3.9	/	4	/	/	/	/	3	4	3.7	0.5					
	Magnesium (Mg)-Total	ug/L	5930	8050	8010	8070	9220	5680	4950	5590	4330	4330	9220	6648	1706					
	Manganese (Mn)-Total	ug/L	32.3	52.9	53.6	60.1	62	35.3	34.8	51.7	43.8	32.3	62	47.4	11.2					50*
	Mercury (Hg)-Total	ug/L	0.025	0.013	0.007	0.006	0.014	<0.005	0.61	0.017	<0.005	0.006	0.61	0.10	0.23		0.016			0.6
	Molybdenum (Mo)-Total	ug/L	1.14	1.04	1.72	/	0.743	/	/	/	/	0.743	1.72	1.16	0.409	N/A	N/A			200
	Nickel (Ni)-Total	ug/L	2.56	4.14	4.29	2.47	3.08	3.14	6.67	13.8	0.99	0.99	13.8	4.57	3.80	N/A	N/A			300*
	Phosphorus (P)-Total	ug/L	3330	2580	1730	/	2860	/	/	/	/	1730	3330	2625	672					
	Potassium (K)-Total	ug/L	8220	7980	8120	7880	8590	5140	6480	11700	3460	3460	11700	7508	2319					
	Rubidium (Rb)-Total	ug/L	9.54	8.36	7.94	/	8.76	/	/	/	/	7.94	9.54	8.65	0.68					
	Selenium (Se)-Total	ug/L	0.258	0.267	0.192	/	0.272	/	/	/	/	0.192	0.272	0.247	0.037	N/A	N/A			50
	Silicon (Si)-Total	ug/L	380	720	640	/	500	/	/	/	/	380	720	560	151					
	Silver (Ag)-Total	ug/L	0.095	0.041	0.028	/	0.029	/	/	/	/	0.028	0.095	0.048	0.032	7.5	NRG			100
	Sodium (Na)-Total	ug/L	32500	35400	42700	40100	44500	24700	25600	28000	21300	21300	44500	32756	8424					
	Strontium (Sr)-Total	ug/L	116	136	146	/	164	/	/	/	/	116	164	140.5	20.0					
	Sulfur (S)-Total	ug/L	10700	10900	12800	/	13800	/	/	/	/	10700	13800	12050	1502					
	Tellurium (Te)-Total	ug/L	<0.2	<0.2	<0.2	/	<0.2	/	/	/	/	<0.2	<0.2	/	/					
	Thallium (Tl)-Total	ug/L	<0.01	<0.01	<0.01	/	<0.01	/	/	/	/	<0.01	<0.01	/	/	N/A	N/A			
	Thorium (Th)-Total	ug/L	<0.1	0.11	<0.1	/	<0.1	/	/	/	/	0.11	0.11	/	/					
	Tin (Sn)-Total	ug/L	1.04	0.86	1.01	/	0.74	/	/	/	/	0.74	1.04	0.91	0.14					5000
	Titanium (Ti)-Total	ug/L	6.87	9.97	2.5	/	3.27	/	/	/	/	2.5	9.97	5.65	3.45					
	Tungsten (W)-Total	ug/L	<0.1	<0.1	<0.1	/	<0.1	/	/	/	/	<0.1	<0.1	/	/					
	Uranium (U)-Total	ug/L	0.117	0.137	0.111	/	0.101	/	/	/	/	0.101	0.137	0.117	0.015	NRG	NRG			
	Vanadium (V)-Total	ug/L	<0.5	1.14	<0.5	/	<0.5	/	/	/	/	<0.5	1.14	/	/					
	Zinc (Zn)-Total	ug/L	106	82.5	84.8	59.3	86.5	44	83	104	26.5	26.5	106	75.2	26.7	N/A	N/A			500
	Zirconium (Zr)-Total	ug/L	0.956	0.35	0.494	/	0.591	/	/	/	/	0.35	0.956	0.598	0.259					
Other	Total phenols	mg/L	0.0611	0.0106	0.0099	0.0051	0.0099	0.0026	0.0116	0.0117	0.0021	0.0021	0.0611	0.014	0.018					
	Oil and Grease	mg/L	18	48.8	14.8	11.1	19.3	8.3	18.3	17.5	7.4	7.4	48.8	18	12					5
	Total Petroleum Hydrocarbons	mg/L	12.5	16.7	17.9	0.86	11.7	3.54	12.1	1.28	2.76	0.86	17.9	8.82	6.73					

NRG - No Guideline
N/A = Not Applicable

Value Exceeds CCME Canada-wide Strategy for the Management of Municipal Wastewater Effluent National Performance Standard
Value CCME Canadian Environmental Quality Guidelines (CEQG) for the Protection of Aquatic Life – Marine
Value Exceeds NWTWB Guidelines

(1) Clear Flow: Maximum increase of 25 mg/L from background levels for any short-term exposure. Maximum average increase of 5 mg/L from background levels for longer term exposures. High Flow: Maximum increase of 25 mg/L from background levels at any 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.
(2) Hexavalent chromium limit
* Dissolved

TABLE 4 - OCTOBER 2018 AND FEBRUARY 2019 SITE VISIT SUMMARY OF LABORATORY RESULTS, RANKIN INLET EFFLUENT

Category	Environment Canada FAD Parameters	Unit	Site Visit 1				Site Visit 2			CEQG Water Quality Guidelines for the Protection of Aquatic Life – Marine		CCME Canada-wide Strategy for the Management of Municipal Wastewater Effluent National Performance Standards	Fisheries Act - Wastewater Systems Effluent Regulations	Northwest Territories Water Board Guidelines (NWTWB)
			COMP	GRAB	OUTFALL	BACKGROUND	COMP	G-1	G-2	Short Term	Long Term			
Physical/Chemical	TSS	mg/L	**87.0**	/	18.0	6.0	**26**	/	**63**	25 (4)	N/A	25	25	180
	BOD5	mg/L	**130**	/	5	<3	89	/	**180**					120
	CBOD	mg/L	**130**	/	5	<3	**89**	/	**150**			25	25	
	Hardness (CaCO3)	mg/L	65	/	5400	5400	92	/	95.7					
	Alkalinity - Bicarbonate (HCO3)	mg/L	119	/	129	127	130	/	193					
	Alkalinity - Carbonate (CO3)	mg/L	<0.50	/	<0.50	<0.50	<0.50	/	<0.50					
	Alkalinity - Hydroxide (OH)	mg/L	<0.50	/	<0.50	<0.50	<0.50	/	<0.50					
	Alkalinity - Total (as CaCO3)	mg/L	97.8	/	106	104	107	/	159					
	Conductivity	uS/cm	425	/	47700	48200	507	/	642					
	pH	pH Units	7.34	/	7.73	7.85	7.13	/	7.28	N/A	7.0 to 8.7			6 to 9
Bacteriological	Fecal Coliform	MPN/100 mL	/	**>1100000**	**240000**	/	/	**>1100000**	**>1100000**					100
	Total Coliform	MPN/100 mL	/	**>1100000**	**240000**	/	/	**>1100000**	**>1100000**					1000
	E. Coli	MPN/100 mL	/	>1100000	240000	/	/	>1100000	>1100000					
Nutrients	Total Ammonia-N	mg/L	12 (1)	/	0.90 (1)	0.89 (1)	7.9 (1)	/	17 (1)	N/A	N/A			
	Nitrate-N [NO3-N] Dissolved	mg/L	<0.020	/	<0.020	<0.020	0.059	/	<0.050	339	45			
	Nitrite-N [NO2-N] Dissolved	mg/L	<0.010	/	<0.010	<0.010	0.03	/	0.13	N/A	N/A			
	Total Kheldahl Nitrogen	mg/L	26	/	0.36	0.15	19 (1)	/	47 (1)					
	Total Organic Carbon (TOC)	mg/L	33 (1)	/	87 (1)	73 (1)	27 (3)	/	42 (3)					
	Total Phosphorus	mg/L	3.0 (1)	/	0.11	<0.030 (3)	2 (1)	/	4.6 (1)					
	Nitrate plus Nitrite (N) Dissolved	mg/L	<0.020	/	<0.020	<0.020		/						
	Nitrate plus Nitrite (N)	mg/L	<0.022	/	<0.022	<0.022	0.089	/	0.13					
Major Ions (Dissolved)	Calcium (Ca)	mg/L	18	/	310	320	26	/	27					
	Chloride (Cl)	ug/L	50	/	17000 (1)	18000 (1)	70	/	75	NRG	NRG			
	Fluoride (F)	mg/L	0.070	/	0.83	0.76	0.094	/	0.11	N/A	NRG			5*
	Magnesium (Mg)	mg/L	4.6	/	1100 (1)	1100 (1)	6.4	/	6.8					
	Potassium (K)	mg/L	7.4	/	350	360	7.6	/	11					
	Sodium	mg/L	27	/	9200 (1)	9200 (1)	35	/	39					
	Sulphate (SO4)	mg/L	23	/	**2400 (2)**	**2300 (2)**	32	/	34					500*
Metals (Total)	Aluminum (Al)	ug/L	147	/	<150	<150	96.2	/	144	N/A	N/A			2000
	Antimony (Sb)	ug/L	<0.50	/	<25	<25	<0.50	/	<0.50					
	Arsenic (As)	ug/L	0.79	/	<5.0	<5.0	0.83	/	0.94	N/A	12.5			50
	Barium (Ba)	ug/L	21.6	/	<50	<50	33.5	/	35.1					1000*
	Beryllium (Be)	ug/L	<0.10	/	<5.0	<5.0	<0.10	/	<0.10					5000*
	Cadmium (Cd)	ug/L	0.060	/	**<0.50**	**<0.50**	0.038	/	**0.236**	NRG	0.12			5*
	Cesium (Cs)	ug/L	<0.20	/	<10	<10	<0.20	/	<0.20					
	Chromium (Cr)	ug/L	<1.0	/	**<50**	**<50**	<1.0	/	1	N/A	1.5 (5)			100
	Cobalt (Co)	ug/L	0.24	/	<10	<10	<0.20	/	0.2					100*
	Copper (Cu)	ug/L	130	/	<25	<25	180	/	254	N/A	N/A			200*
	Iron (Fe)	ug/L	223	/	**<500**	**<500**	131	/	186	N/A	N/A			300*
	Lead (Pb)	ug/L		/	<10	<10	1.46	/	1.8	N/A	N/A			50*
	Lithium (Li)	ug/L	2.3	/	144	143	3.2	/	3.6					
	Manganese (Mn)	ug/L	35.9	/	<50	<50	37.3	/	45.6					50*
	Mercury (Hg)	ug/L	/	/	/	/	0.0065	/	0.012					0.6
	Molybdenum (Mo)	ug/L	<1.0	/	<50	<50	<1.0	/	1.1	N/A	N/A			200
	Nickel (Ni)	ug/L	2.3	/	<50	<50	2	/	2.4	N/A	N/A			300*
	Rubidium (Rb)	ug/L	8.15	/	106	102	7.78	/	11.6					
	Selenium (Se)	ug/L	0.23	/	<5.0	<5.0	0.18	/	0.3	N/A	N/A			50
	Silver (Ag)	ug/L	0.029	/	<1.0	<1.0	0.023	/	0.072	7.5	NRG			100
	Strontium (Sr)	ug/L	88.6	/	6970	6940	127	/	137					
	Thallium (Tl)	ug/L	<0.010	/	<0.50	<0.50	<0.010	/	<0.010	N/A	N/A			
	Titanium (Ti)	ug/L	9.4	/	<250	<250	8	/	13.2					
	Uranium (U)	ug/L	0.15	/	<5.0	<5.0	<0.10	/	0.11	NRG	NRG			
	Vanadium (V)	ug/L	<5.0	/	<250	<250	<5.0	/	<5.0					
	Zinc (Zn)	ug/L	76.3	/	<250	<250	70.1	/	107	N/A	N/A			500
Other	Total phenols	mg/L	/	0.029	0.031 (2)	<0.020 (2)	/	0.039	0.077					
	Oil and Grease	mg/L	/	**41**	<2.0	/	/	**8**	**9.1**					5
	Total Petroleum Hydrocarbons	mg/L	/	/	/	/	/	/	/					

NRG = No Recommended Guideline
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.
(2) Detection limits raised due to matrix interference.
(3) Detection limits raised due to sample matrix.
(4) Clear Flow: Maximum
(5) Hexavalent chromium limit.

Value	Exceeds CCME Canada-wide Strategy for the Management of Municipal Wastewater Effluent National Performance Standard
Value	Exceeds CCME Canadian Environmental Quality Guidelines (CEQG) for the Protection of Aquatic Life – Marine
Value	Exceeds NWTWB Guidelines

Appendix C

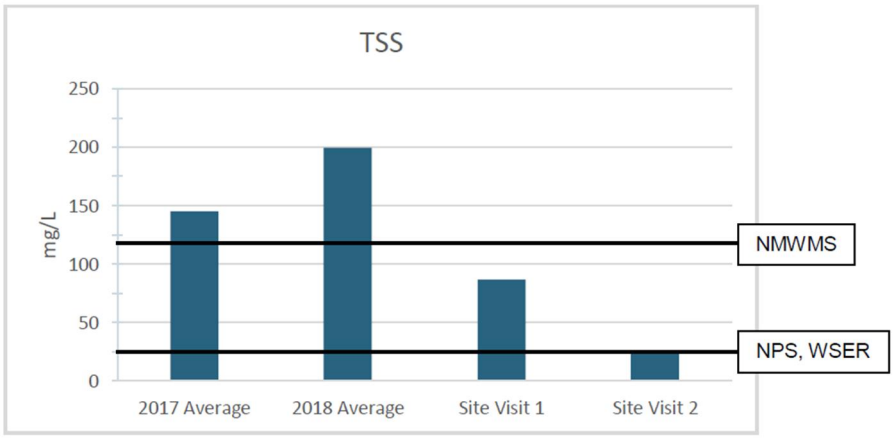
Comparison of Effluent Grab vs. Composites

Based on the inapplicability for automated composite sampling, the October and February composite sampling was undertaken using a manual method. As discussed with GN in the December 4, 2018 phone meeting, Dillon compared the data collected by grab versus by manual composite.

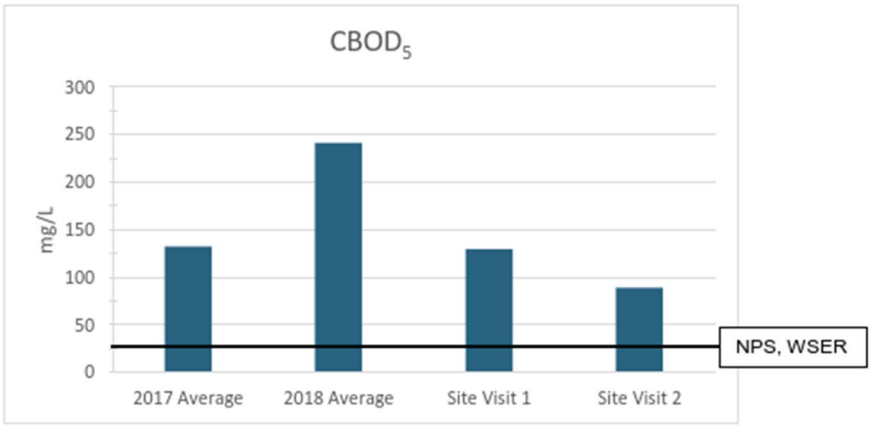
The grab sample data provided by the GN-CGS is comparable (analytically equivalent to) to the October 2018 composite data collected by Dillon; however, the grab sampling does have a higher degree of variability (standard deviation is higher). The February composite data is generally lower than the grab sample data provided by GN-CGS. Note that detection limits and some lab analytical methods vary between GN-CGS data and the Dillon sampling data.

For example, the results for TSS, CBOD5, and BOD5, are shown on Figure 1, Figure 2, and Figure 3 for comparison. The limits outlined in Recommendations for the Development of Nunavut Municipal Wastewater Management Standards (NMWMS), the CCME NPS, and the Fisheries Act WSER limits are also shown in Graphs 1 – 3 for comparison.

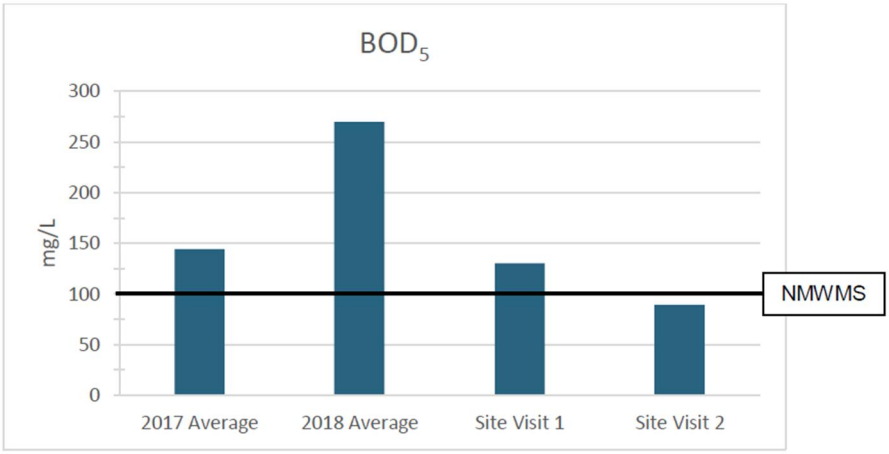
Graph 1 TSS comparison



Graph 2 $CBOD_5$ Comparison



Graph 3 BOD_5 Comparison



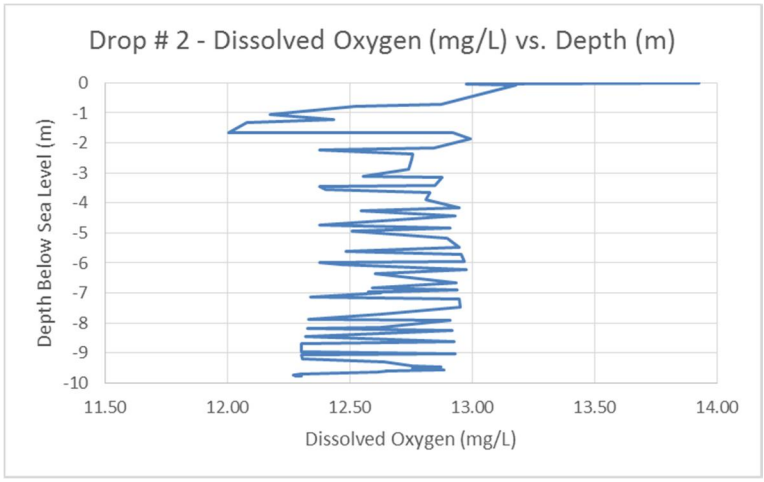
The Site Visit 1 composite sample for TSS, CBOD5, and BOD5 falls within the range of values from GN-CGS data for 2017 and 2018. The Site Visit 2 composite sample falls within the range of values from GN-CGS data for 2017 and 2018 for CBOD5 and BOD5, however, the Site Visit 2 TSS is below the range of values. The grab sample TSS average for 2017 and 2018 TSS is higher than the composites; this could be due to time of day when the grab sample is pulled. If the grab sample is taken during the day when loads are higher, the TSS value will be higher. The composite samples take into account the smaller loads during the nighttime. Also, the composite samples were taken in October and February when residents were constantly running water at a low flow rate to prevent pipes from freezing. Although the Site Visit 1 composite value is lower than the averages, it still falls within the range of data for TSS, CBOD5, and BOD5.

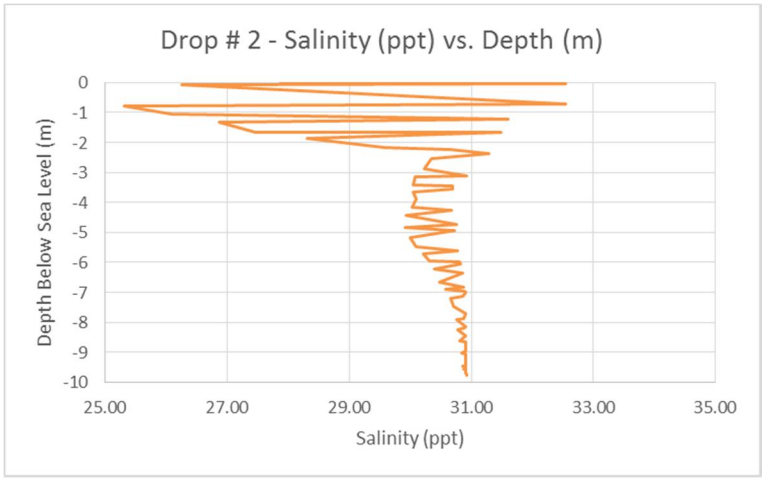
Although the grab sampling methodology is not temporally equivalent to the composite sampling, for the purposes of characterizing the effluent as requested by ECCC, the data provided by this assessment was deemed sufficient.

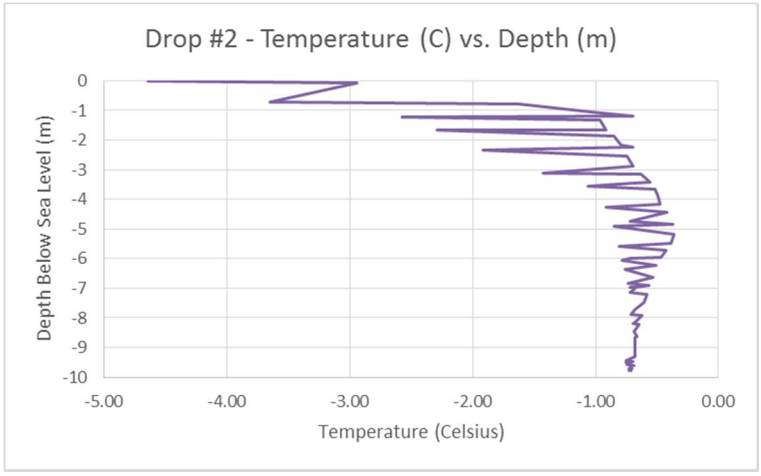
Appendix D

October 2018 Environmental Data

October 17, 2018 Salinity, Temperature, Depth Profile within 20 m of outfall (YSI 6130, note spikiness of recording is due to automated reading)





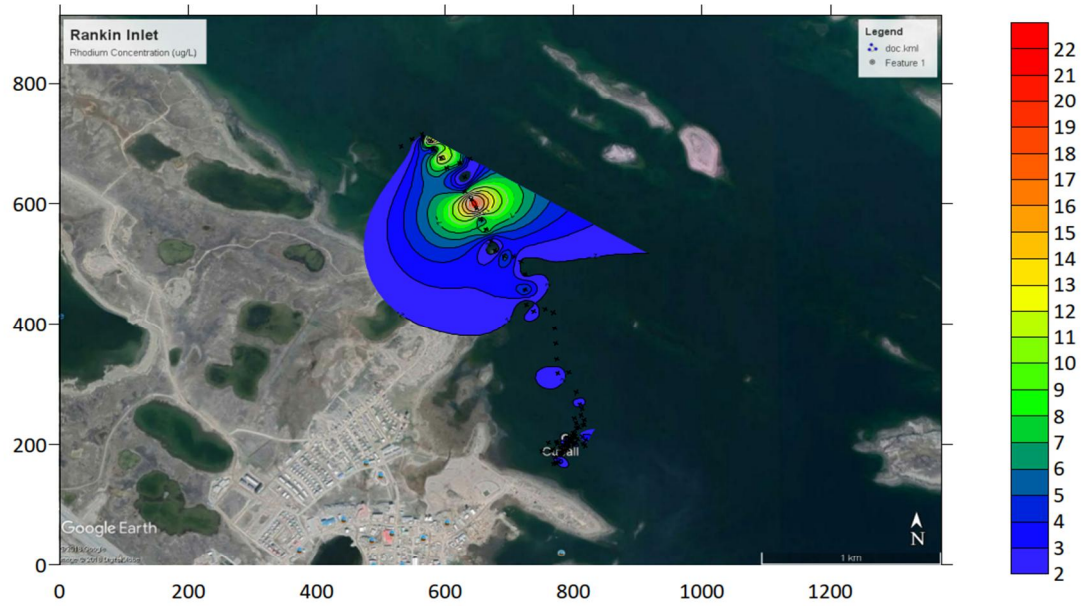


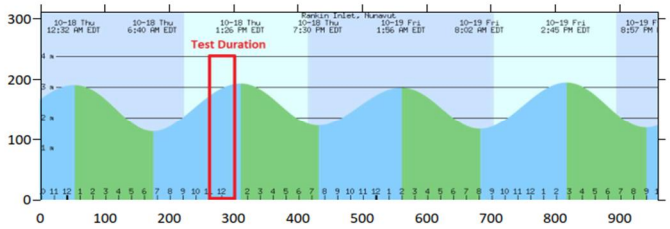
October 18, 2019 Environment Canada Data (Rankin Inlet Airport) for the Period of the Dye Test (1100-1300)

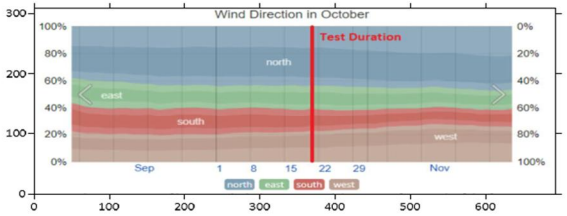
Date/Time (CDT)	Temperature (°C)	Wind (km/h)	Wind chill	Relative humidity (%)	Dew point (°C)	Pressure (kPa)	Visibility (km)
16:00	-2 (-2.0)	S 30	-9	68	-7	100.5	24
15:00	-2 (-2.2)	S 26	-9	64	-8	100.5	48
14:00	-2 (-2.4)	S 24	-9	66	-8	100.6	24
13:00	-3 (-2.6)	S 27	-10	68	-8	100.6	48
12:00	-4 (-3.8)	SE 22	-10	73	-8	100.7	48
11:00	-6 (-5.8)	SE 14	-11	75	-9	100.7	48
10:00	-7 (-7.0)	SSE 9	-11	76	-11	100.8	48
9:00	-8 (-8.1)	SSW 7	-12	81	-11	100.8	24
8:00	-10 (-9.8)	ESE 4	-12	86	-12	100.8	24
7:00	-11 (-10.9)	NE 5	-14	88	-13	100.9	24
6:00	-11 (-10.8)	WSW 7	-15	88	-12	100.9	24

10/18/2018 (Thursday)		
Time	Height	
CDT	(m)	(ft)
5:34	1.6	5.2
12:22	3.1	10.2
18:24	1.8	5.9

Rankin Inlet Tidal Station (#5100) http://tides.gc.ca/eng/station?sid=5100







Surfer model of interpolated October 18, 2019 Dye Test Readings and Tide and Average Wind

DILLON CONSULTING