

CITY OF IQALUIT WATER LICENCE 3AM-IQA1626 2021 ANNUAL WATER LICENCE REPORT

JUNE 24, 2022

EXECUTIVE SUMMARY

Under a Type A Water Licence 3AM-IQA1626 (the Licence), the City of Iqaluit (the City):

- Extracts water from Lake Geraldine for municipal use;
- Discharges Landfill run-off from the West 40 Landfill; and
- Discharges wastewater from the West 40 Wastewater Treatment Plant and backup Sewage Lagoon.

This Licence was issued by the Nunavut Water Board (NWB) in 2016 and expires on June 16, 2026. The City was granted two (2) amendments to the Licence in 2021, they were:

<u>Amendment No. 5 – New Solid Waste Management Facility and Additional Water Source</u>

- Construction and operation of the new solid waste management facility, including the Waste Transfer Station, the New North Landfill, and associated infrastructure.
- Withdrawal of water from Imiqtarviviniq (Dead Dog Lake) at Monitoring Station No. IQA-14, up to a total of 2,500 cubic metres of water annually for dust suppression and general municipal purposes.

Amendment No. 6 – Withdrawal of Water from the Sylvia Grinnell River

 Withdrawal of 350 cubic meters of water per day for the purposes of distributing to the community for drinking water purposes, as a result of the State of Emergency declared by the GN Minister of Community and Government Services.

This Annual Water Licence Report summarizes the activities conducted by the City in 2021, pursuant to the requirements stipulated in Schedule B of the Licence.

Monitoring Program

The City continued to perform monitoring requirements as per the City's approved Environmental Monitoring Program and Quality Assurance/ Quality Control Plan (the Monitoring Plan).

Long-Term Water Supply and Storage

Following the completion of a water balance assessment and a Fish and Fish Habitat Assessment of Unnamed Lake (March 2021), the City engaged Nunami-Stantec to conduct a highlevel options analysis evaluation of the two alternatives being considered for Long-Term Water Supply – i.e.: Sylvia Grinnell River and Unnamed Lake. As part of the options analysis evaluation, the City and Stantec were to engage the local Hunters and Trappers Association (HTA), as well as the Qikiqtani Inuit Association (QIA), as part of engagement efforts. A further presentation to the City's Public Works and Engineering Committee of the Whole meeting was to be conducted. The engagements were postponed due to covid-related challenges, and have since been rescheduled for Q2-2022.

Following the completion of planned engagement sessions, the options analysis evaluation will be finalized with a recommended option tabled to City Council for approval for the City's Long-Term Water supply strategy. This will be combined with the recommended Long-Term Storage alternative, approved by City Council in 2020. The City will then commence Preliminary Engineering Design for the recommended options in Q3-

2022. Preliminary Engineering Design will consider the technical, constructability, environmental, and economic viability of the supply source to the Lake Geraldine and adjacent independent reservoirs.

Niaqunguk River (Apex River) Supplementary Pumping Program

The City executed the replenishment of the Lake Geraldine Reservoir, via supplemental pumping of water from the Apex River. Pumping activities were completed between June 24, 2021 and June 24, 2021. A total of 76,320 m³ of water was pumped with maximum daily pumped volumes of 17,280 m³. The Lake Geraldine water level as of October 1, 2021 was recorded at 111,239 mASL.

Water Treatment Plant

As early as October 2nd, 2021, residents of the City of Iqaluit (the City) made complaints via social media and to the City regarding an odour emanating from the tap water described as "fuel-like". In response to the numerous complaints, the City issued water quality tests on the treated water at various locations in the water treatment plant and distribution system. On October 12th, 2021, the City identified strong fuel-like odours emanating from the North Clearwell within the WTP and the following day the Government of Nunavut Department of Health (GNDOH) issued a "Do Not Consume" (DNC) water quality (WQ) advisory pending confirmation of the treated water quality and the concerns of the presence of hydrocarbons.

On-site investigations confirmed that the source of contamination stemmed from a leak from a historic fuel tank which was buried in place. Identification of the source of hydrocarbon contamination and a review of its movement mechanisms revealed migration into the City's WTP through its buried tankage systems.

In an effort to isolate the WTP process, and mitigate further risk of contamination while a the City implemented an engineered internal by-pass, effectively by-passing the WTP process, in order to mitigate further risk of contamination. The by-pass would be in operation until a rememdiation plan has been developed and executed in the field. This has tentatively been set for Summer 2022.

Wastewater Treatment

In 2021, the City estimates that it discharged approximately 1,256,623 m³ of effluent from the Wastewater Treatment Plant. It also estimates that it removed approximately 288 m³ of sludge from the Wastewater Treatment Plant, which was deposited at the City's West 40 Landfill.

The primary treatment system remained in operation, following commissioning and handover in 2019. In 2021, the City completed the installation and commissioning of an emergency generator, along with the secondary treatment system. Operations of the facility was handed over to Operations Staff on March 15, 2021. There remains outstanding deficiencies from the secondary treatment system, which will be addressed in 2022.

Solid Waste Management

Construction of the Road to the Northwest Deposit was completed prior to the summer of 2021.





The NWB granted Amendment No. 5 to the Licence, which considers the construction and operation of a new Waste Transfer Station and Landfill. Construction of both facilities was originally planned for the summer of 2021; however, has been delayed until summer 2022 due to covid related challenges.

The City continues to accept and manage waste at the West 40 Landfill – this will be continued until the construction of the new landfill and waste transfer station is completed in 2023.

Lake Geraldine Dam

In 2021, the City conducted improvements to the Lake Geraldine Dam structure, based on recommendations provided in the 2020 Dam Safety Inspection. The improvements consisted of grading and repair of north, center and south berm crests, placement of additional rip-rap at washout locations, installation of new sealant at all existing sealant/expansion joint locations, and epoxy injection crack repairs of the concrete dam structure.

In 2021, the City retained Concentric Associates International to conduct a Dam Safety Inspection and Dam Safety Review, in order to ensure adherence to the Canadian Dam Safety Guidelines. Recommendations from the 2021 DSI and DSR have been included and prioritized in the City's 10-year capital plan, based on the timelines stipulated.

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INTRODUCTION

In June 2016, the City of Iqaluit (the City) was issued Water Licence number 3AM-IQA1626 (the Licence) by the Nunavut Water Board (NWB). This licence was issued for a ten-year period concluding in June 2026. The City has been granted six (6) amendments to its licence, two were issued in 2021, they were:

Amendment No. 5 – New Solid Waste Management Facility and Additional Water Source

- Construction and operation of the new solid waste management facility, including the Waste Transfer Station, the New North Landfill, and associated infrastructure.
- Withdrawal of water from Imiqtarviviniq (Dead Dog Lake) at Monitoring Station No. IQA-14, up to a total of 2,500 cubic metres of water annually for dust suppression and general municipal purposes.

Amendment No. 6 – Withdrawal of Water from the Sylvia Grinnell River

 Withdrawal of 350 cubic meters of water per day for the purposes of distributing to the community for drinking water purposes, as a result of the State of Emergency declared by the GN Minister of Community and Government Services.

A requirement of the Licence is an annual report due March 31 of each year, summarizing activities governed by the Licence for the previous calendar year. The City was granted an extension on the submission of the 2021 Annual Report until June 24, 2022. In accordance with Schedule B of the Water Licence, this Annual Water Licence Report summarizes the activities conducted by the City of Iqaluit in 2021.

ANALYSIS

A. The monthly and annual quantities in cubic metres of fresh water withdrawn from the Lake Geraldine Reservoir (Monitoring Station No. IQA-01).

Table 1 summarizes the estimated monthly and annual quantities of water drawn from Lake Geraldine, the City of Iqaluit's raw water source. The total water usage for 2021 was 1,163,133 cubic metres, which is below the maximum allowable withdrawal allowance of 2,000,000 cubic metres (amended withdrawal allowance, as per Amendment No. 4).

Table 1 2021 Raw Water Drawn from Lake Geraldine Reservoir

Month	Volume (m³)
January	93,960
February	89,690
March	104,358
April	97,740
May	108,778
June	105,770
July	88,830
August	81,642

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Total 2021	1,163,133
December	116,740
November	100,450
October	89,820
September	85,355

B. The monthly and annual quantities in cubic metres of any discharges from the Wastewater Treatment Facilities (Monitoring Stations No. IQA-02, IQA-04, IQA-08).

Table 2, 3 and 4 summarizes the monthly and annual quantities of discharge from the City of Iqaluit's Sewage Lagoon (IQA-02), Wastewater Treatment Plant (WWTP) (IQA-04), and West 40 Landfill (IQA-08) in 2021.

Table 2 IQA-02 – Discharge from the Sewage Lagoon in 2021

Date	Volume (m³)
June 11, 2021	4,900
June 12, 2021	4,900
June 13, 2021	4,900
June 14, 2021	4,900
June 15, 2021	4,900
June 16, 2021	4,900
June 17, 2021	4,900
June 18, 2021	4,900
Total	39,200

Table 3 IQA-04 – Discharge from the WWTP in 2021

Month	Volume (m³)
January	96,435
February	89,931
March	107,745
April	105,454
May	106,078
June	125,356
July	102,646
August	99,906
September	91,930

Total	1,256,623
December	122,598
November	104,272
October	104,272

Table 4 IQA-08 - Discharge from the West 40 Landfill in 2021

Date	Volume (m³)
July 29, 2021	140
Total	140

A total volume of 39,200 cubic metres of effluent was discharged from the Sewage Lagoon to Frobisher Bay (Station ID IQA-02) between June 11th to June 18, 2021. This equates to 4,900 cubic metres discharged per day during an eight (8) day period.

A total volume of 1,256,623 cubic metres of effluent was discharged from the City's WWTP to Frobisher Bay (Station ID IQA-04) in 2021. This equates to a monthly average of 104,719 cubic metres of effluent discharge.

A total volume of 140 cubic metres of effluent was discharged from West 40 Landfill Pond #2 to the environment (Station ID IQA-08) on July 29, 2021.

C. Reports generated from Dam Safety Inspections and Dam Safety Reviews and proposed actions to address issues identified and/or updates on continuing actions to address issues.

The City undertook a Dam Safety Inspection (DSI) and a Dam Safety Review (DSR) in 2021, as per requirements of the Canadian Dam Association (CDA) *Dam Safety Guidelines*. Four (4) separate inspections and one review were conducted. Details of each activity are highlighted below.

Lake Geraldine Dam Safety Inspection

Concentric Associates International Inc. was retained to conduct a Dam Safety Inspection in 2021. Four (4) inspections were completed May 11, 2021, July 14, 2021, August 18, 2021, and September 16, 2021. The purpose of the DSI is to assist the City by identifying any visual changes in the condition of the dam, identifying any new concerns, and making recommendations on maintenance, repairs, or further investigations. It is conducted in order to ensure adherence to the Canadian Dam Safety Guidelines.

The DSI producted the following recommendations:

- Updating permanent record file (ongoing).
- Implementation of a monitoring program to record data from the installed network piezometers and thermistors used to monitor hydrogeologic and thermal environments within the backfill and foundations in 2022 (2022).
- Installation of video surveillance (2022).



- Use and restocking of the aggregate stock piles on site as required (ongoing).
- Exercising and testing of the valves within the valve chamber (ongoing).
- Underwater survey of the concrete dam and spillway in 2022-2023 (2023).
- Concrete delamination survey to identify areas of concrete delamination within the downstream portion of the dam structure in 2022 (2022).
- Flattening of the downstream slope and installation of rip rap on the downstream slope of the north and central berms to reduce the risk of erosion of the roadway atop the berms (2022).

A copy of the DSI's completed in 2021 can be found in Appendix A.

Lake Geraldine Dam Safety Review

Concentric Associates International Inc. was retained to conduct a Dam Safety Review in 2021. A final report was issued on October 14, 2021. A DSR is a formal review process, conducted at regular intervals, that involves completion of items in accordance with the Dam Safety Guidelines. The DSR forms part of the record documentation of the history, condition, repairs, alterations, monitoring, operating, safety, and emergency procedures.

The DSR producted the following recommendations:

- Conduct a Dam Safety Review (DSR) in 2026 (2026).
- The Permanent Record File, Logbook, and Operations and Surveillance manual should be updated as new documentation is generated for the dam (ongoing).
- Review EPP and ERP documents, issue EPP to local authorities and key response agencies, update list of EPP document holders, and provide training to all dam personnel and external responders on the EPP and ERP (ongoing).
- A concrete delamination survey of the exposed surfaces of the concrete dam to ascertain the extent of future concrete repairs is recommended (2022).
- Additional crack sealing and sealant repairs (not completed in 2021) should be completed in 2022 (2022).
- An underwater inspection of the submerged portion of the concrete dam and spillway structures should be conducted in 2023 (2023).
- Height of the concrete core wall within the earthen berms be increased by an estimated 0.3m (Design 2022/ Construction 2023).
- The crest of the south, center and north berms be raised by 1.0m (Design 2022/ Construction 2023).
- Small weirs be installed at known weep locations in an effort to record flow rates of piping through the earth berms/ concrete dam (Design 2022/ Construction 2023).



- Warm water return line should be routed into the reservoir at the spillway and the discharged water should be infused with air to mitigate potential ice loading of the dam (Study 2022/ Design 2023/ Construction 2024).
- Installation of porous water sensors (piezometers) and data loggers be completed in 2022 as well as the implementation of a monitoring system to record temperature and water pressure data (2022).
- Installation of survey monuments to monitor vertical and horizontal movement within the concrete dam, center and north berms. A bi-annual survey program should be implemented (2022).
- Installation of three remote surveillance cameras (2022).
- A Dam Safety Inspection (DSI) is required yearly (ongoing).

A copy of the DSR completed in 2021 can be found in Appendix B.

D. The monthly and annual quantities in cubic metres of sludge removed from the Wastewater Treatment Facility.

Table 5 summarizes the monthly and annual quantities of sludge removed from the City of Iqaluit's Wastewater Treatment Plant (WWTP) in 2021 and disposed of at the City's West 40 Landfill.

Month	Volume (m³)
January	24
February	24
March	24
April	24
May	24
June	24
July	24
August	24
September	24
October	24
November	24
December	24
Total 2021	288

On average, approximately 24 cubic metres of sludge was removed from the WWTP on a monthly basis and deposited at a designated area in the West 40 Landfill. This equated to an annual total of approximately 288 cubic metres of sludge deposited at the West 40 Landfill.

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E. The monthly and annual quantities of waste disposed of at the West 40 Landfill.

A survey and assessment of airspace consumption of the West 40 Landfill was completed on July 27 17, 2021 by City consultant AECOM. The airspace consumption compares the waste surface from August 17, 2020, to July 27, 2021, and includes deposited waste and cover soil placement.

The remaining landfill airspace is determined by comparing the surveyed waste surface to the proposed final landfill cap design.

Table 6 summarizes the airspace consumption survey data for the period of August 17, 2020, to July 27, 2021.

Total Airspace Consumed					
11,651 m³					
	Time Span				
Weekly 48 weeks					
Monthly 11.3 months					
Daily 240 days (5-day work weeks)					
Aver	Average Airspace Consumed				
Weekly	242.7 m³ per week				
Monthly	1,031 m ³ per month				
Daily 48.5 m ³ per day					

Table 6 Waste disposed at the West 40 Landfill (2021)

The airspace at the West 40 landfill was monitored over a 48-week period in 2020 and 2021 – this equated to 11.3 months, or 240 days of observations. During this period, it was confirmed via survey that 11,651 cubic metres of airspace was consumed. Similarly, this translates to approximately 1,031 cubic metres per month of airspace consumed. Applying this over a 12-month period, the City estimates that approximately 12,372 cubic metres of airspace was consumed in 2021 at the West 40 Landfill. Further details can be found in Appendix C.

F. A summary report which includes all data and information generated under the Monitoring Program, including the QA/QC program, in electronic and printed formats acceptable to the Board.

In 2021, the City continued testing procedures as described in the City's Type A water licence 3AM-IQA1626, and Environmental Monitoring Program and Quality Assurance/ Quality Control Plan. Table 7 lists all samples that were taken in 2021. The complete monitoring results are provided in Appendix D.

Table 7 Summary of 2021 Sampling Conducted

Date	Test	Station ID	Sample Name	Lab Sample ID
19-Jan-2021	Α	IQA-01	Potable WTP	B21-02046-1



Date	Test	Station ID	Sample Name	Lab Sample ID
19-Jan-2021	А	IQA-01	Potable (Total)	B21-02046-2
19-Jan-2021	А	IQA-01	Raw WTP	B21-02046-3
19-Jan-2021	А	IQA-01	Raw WTP (Total)	B21-02046-4
19-Jan-2021	F	IQA-05	WWTP Influent	B21-02050-1
19-Jan-2021	F	IQA-04	WWTP Effluent	B21-02050-2
09-Mar-2021	Α	IQA-01	Potable WTP	B21-06618-1
09-Mar-2021	Α	IQA-01	Potable (Total)	B21-06618-2
09-Mar-2021	А	IQA-01	Raw WTP	B21-06618-3
09-Mar-2021	А	IQA-01	Raw WTP (Total)	B21-06618-4
07-Jun-2021	F	IQA-02	Lagoon (Start)	B21-17450-1
11-Jun-2021	F	IQA-02	Lagoon (Middle of Decant)	B21-18044-1
16-Jun-2021	E	IQA-08	Landfill Effluent Discharge	B21-18817-1
16-Jun-2021	Е	IQA-08A	Landfill Station Up-Gradient	B21-18817-2
18-Jun-2021	F	IQA-02	Lagoon (End of Decant)	B21-19118-1
29-Jun-2021	А	IQA-01	Raw WTP	B21-19977-1
29-Jun-2021	А	IQA-01	Raw (Total)	B21-19977-2
29-Jun-2021	А	IQA-01	Potable WTP	B21-19977-3
29-Jun-2021	А	IQA-01	Potable WTP (Total)	B21-19977-4
03-Aug-2021	А	IQA-01	Potable WTP	B21-24521-1
03-Aug-2021	Α	IQA-01	Potable WTP (Total)	B21-24521-2
03-Aug-2021	А	IQA-01	Raw WTP	B21-24521-3
03-Aug-2021	А	IQA-01	Raw WTP (Total)	B21-24521-4
03-Aug-2021	Е	IQA-08	Detention Pond	B21-24525-1
07-Sep-2021	А	IQA-01	Raw WTP	B21-28733-1
07-Sep-2021	А	IQA-01	Raw WTP (Total)	B21-28733-2
07-Sep-2021	А	IQA-01	Potable WTP	B21-28733-3
07-Sep-2021	А	IQA-01	Potable WTP (Total)	B21-28733-4
09-Sep-2021	F	IQA-04	WWTP Effluent	B21-29068-1
17-Sep-2021	E	IQA-08A	Landfill Station Up-Gradient	B21-30035-1
04-Oct-2021	F	IQA-05	WWTP Influent	B21-32514-1
01-Oct-2021	А	IQA-01	Raw WTP	B21-32539-1
01-Oct-2021	А	IQA-01	Raw WTP (Total)	B21-32539-2



Date	Test	Station ID	Sample Name	Lab Sample ID
01-Oct-2021	А	IQA-01	Potable WTP	B21-32539-3
01-Oct-2021	А	IQA-01	Potable WTP (Total)	B21-32539-4
05-Oct-2021	F	IQA-04	WWTP Effluent	B21-32543-1
28-Oct-2021	F	IQA-02	Lagoon Effluent	B21-35620-1
01-Nov-2021	F	IQA-02	Lagoon (Middle of Decant)	B21-35985-1
01-Nov-2021	F	IQA-05	WWTP Influent	B21-35985-2
01-Nov-2021	F	IQA-04	WWTP Effluent	B21-35985-3
02-Nov-2021	Α	IQA-01	Raw WTP	B21-36316-1
02-Nov-2021	А	IQA-01	Raw WTP (Total)	B21-36316-2
02-Nov-2021	Α	IQA-01	Potable WTP	B21-36316-3
02-Nov-2021	Α	IQA-01	Potable WTP (Total)	B21-36316-4
06-Nov-2021	F	IQA-02	Lagoon (End of Decant)	B21-36871-1
09-Dec-2021	А	IQA-01	Raw WTP	B21-40345-1
09-Dec-2021	Α	IQA-01	Raw WTP (Total)	B21-40345-2
09-Dec-2021	А	IQA-01	Potable WTP	B21-40345-3
09-Dec-2021	А	IQA-01	Potable WTP (Total)	B21-40345-4
09-Dec-2021	F	IQA-05	WWTP Influent	B21-40346-1
09-Dec-2021	F	IQA-04	WWTP Effluent	B21-40346-1

G. A summary of all construction activities carried out for the facilities.

Wastewater Treatment Plant

Substantial completion of the Plant's secondary treatment system was achieved on March 15, 2021. At which point, operations of the facility was handed over to the City. The City continued to work through outstanding deficiencies and operational issues with the Plant's primary and secondary treatment systems following substantial completion. This work is anticipated to continue into 2022. In addition, the City completed the installation of a stand-by generator for the Plant, with substantial completion achieved on November 15, 2021.

Water Treatment Plant

Following the water contamination event at the WTP in October 2021, the City applied for a modification to the Licence in order to construct an internal by-pass within the WTP, which would by-pass all tankage systems, while the City develops a plan for required remediation and repairs. The construction of the by-pass was completed in February 2022, and is currently in operation. The by-pass will remain in operation until recommendations from an investigation report are completed in 2022. The recommendations include:



- Replacement of the existing duel-media (sand/ anthracite) filter media with a granular activated carbon (GAC) filter media.
- Installation of a fuel containment area around the existing bulk fuel storage tank, and internal day tanks, along with leak detection systems.
- Remediation of the internal tankage structures within the WTP.
- Replacement of the existing Ultra-Violet (UV) disinfection system, with a new modern system (existing units are obsolete).

The City anticipates to complete this work by December 2022.

In addition to the construction of the internal by-pass, the City completed the installation of a hydrocarbon water monitoring system (S::CAN) on the treated water distribution line, prior to the treated water reservoirs. The monitoring station will sample and monitor in real-time levels of hydrocarbons in the treated water system. Should levels reach guidelines established per the Canadian Drinking Water Guidelines, the system will shutdown operation of the WTP. A second system will be installed in May 2022 to sample and monitor raw-water at the inlet of the WTP.

H. A summary of any modifications and/or major maintenance work carried out at the facilities and any associated structures.

Water Treatment Plant - Water Contamination Emergency

In early October 2021, residents of the City of Iqaluit (the City) made complaints regarding a fuel-like smell coming from their taps. The complaints prompted an investigation of the Iqaluit Water Treatment Plant (WTP) and public water supply, which revealed visible contamination in the North Clearwell of the WTP. This prompted a *Do Not Consume* water quality advisory by the Territory of Nunavut Chief Public Health Officer (CPHO).

On October 28, 2021, the Nunavut Water Board (NWB) received a request by the City for a Modification to the amended Licence No: 3AM-IQA1626 (the Licence) issued to the City. The Request was made due to the State of Emergency in the City of Iqaluit dated October 13, 2021 and declared by the territorial Minister of Community and Government Services. The declaration of a State of Emergency was made under the *Emergency Management Act* resulting in the Request being exempt from the conformity and impact assessment requirements as provided for under s. 152(1)(b) of *Nunavut Project and Planning Assessment Act* (NuPPAA).

On October 20, 2021, the Government of Nunavut (GN) requested assistance from the federal government. As a result, a Reverse Osmosis Water Purification Unit (ROWPU) to be operated by the Canadian Armed Forces Joint Task Force North CAF-JTFN) division is proposed to treat water withdrawn from the Lake Geraldine Reservoir. The Licensee advised that waste products of the treatment will be trucked to the City's Upgraded Wastewater Treatment Plant. The CAF-JTFN operated the ROWPU from October 23, 2022 to January 7, 2022. A final report detailing the operations of the CAF-JTNF ROWPU has been provided in Appendix E.

Following a series of investigations, the removal of the historic underground fuel oil storage tank, a number of upgrades to the water treatment plant, and

Igaluit



In the middle of December, a deteriorating wall was discovered between the Mixing Chamber (a treated water tank) and the Backwash Waste Tank (a process wastewater collection tank), which was believed to hydraulically connect both tanks. To prevent entry of backwash wastewater entering the treated water system, a single-tank bypass was installed to move water from the filter effluent header directly to the Pumping Chamber. A formal notification was issued to the NWB on November 16th, 2021, to provide details pertaining to the proposed modification to the WTP, which included the construction of a single-tank bypass.

On January 10, 2022, a short-term series of detectable petroleum hydrocarbon (PHC) results on the S::CAN online field spectrophotometer file were reported marginally above the instrumentation detection limit. Subsequently, over 100 odour complaints were made to the City Water Quality Hotline from January 14th and again on January 12th, 2022, regarding a fuel-like smell in the drinking water. The City and it's Engineer conducted a re-assessment of the Lake Geraldin intake, the distribution system, and the treated water infrastructure components in between.

On January 19, as a result of another pair of early morning PHC detections by the treated water S::CAN, device, City Operations staff shut down the WTP. Following consultations with the City, senior coordination team, consultants, GN-CGS, and CPHO, a decision was made to put a piped WTP bypass system into operation. This system conveys water through primary and secondary disinfection processes in a completely piped process, and the water does not come into contact with any of the concrete structures of the WTP until discharged into the Reservoirs. When the WTP bypass system was brought online, a shortterm precautionary boil water advisory was issued which is standard practice for modifications to water treatment processes. The precautionary boil water advisory was lifted on January 28th. At the time of this report, the City continues to operate the WTP using the WTP bypass system. The by-pass will remain in operation until recommendations from an investigation report are completed in 2022. The recommendations include:

- Replacement of the existing duel-media (sand/ anthracite) filter media with a granular activated carbon (GAC) filter media.
- Installation of a fuel containment area around the existing bulk fuel storage tank, and internal day tanks, along with leak detection systems.
- Remediation of the internal tankage structures within the WTP.
- Replacement of the existing Ultra-Violet (UV) disinfection system, with a new modern system (existing units are obsolete).

The City anticipates to complete this work by December 2022.

Details of the WTP bypass system have been included in Appendix F.

I. A progress report and revisions (if applicable) to any studies requested by the Board that relate to waste management, water use, or reclamation and a brief description of any future studies planned by the Licensee including, a non-technical executive summary for the general public, translated into Inuktitut.



Long-Term Water Project - Long-Term Supply and Storage

In November 2019, the City retained Exp to investigate viable alternatives for secondary water storage, in addition to the Lake Geraldine Reservoir. The intent is to investigate three (3) alternatives, which will meet future City demand requirements, given the projected growth of the municipality and water demand requirements. A recommended option was provided in October 2020 and presented to City of Iqaluit Council for endorsement in November 2020 – Council endorsed the recommended option. The final report was submitted to the City in December 2020. A copy of the report has been provided in Appendix E.

The City undertook an option analysis evaluation in 2021, which considered the evaluation of two options (Sylvia Grinnell River and Unnamed Lake) for the long-term supply and storage of water, that would complement the City's current water supply system (Lake Geraldine). The City will be planning to undertake consultations with local stakeholder groups in 2022. A final recommendation will be tabled to City Council in 2022, which will provide direction on the long-term supply and storage option to the City's current supply source Lake Geraldine. Detailed engineering design will be initiated thereafter, and will be anticipated to start in 2023.

J. Any revisions required, in the form of addenda, to Plans, Manuals and Reports approved under the Licence.

No revisions were made to Plans, Manuals and Reports approved under the Licence in 2021.

K. A list and description, including volumes and Spill Report Line Identification Numbers, of all un-authorized discharges, spills and summaries of follow-up action taken.

Table 6 below provides a summary of all reported spills/ un-authorized discharges that occurred in 2021.

Spill ID	Date	Location	Туре	Volume	Cause	Follow-Up Action
2021001	January 1, 2021	AV411	Sewage	Unknown	Blockage	Cleaned spill, removed blockage
2021320	February 10, 2021	МН9А	Sewage	Unknown	Blockage	Cleaned spill, removed blockage
2021092	March 12, 2021	WWTP	Sewage	Unknown	Power Outage	Cleaned spill
2021115	April 3, 2021	Between House 1615 & 1613	Sewage	Unknown	Collapsed Pipe	Road crew cleaned up, and repair of collapsed section
2021455	October 25, 2021	WTP	Fuel	Unknown	Fuel Leak	Removal of tank, remediation in facility
2021480	November 30, 2021	Reheat Station 1	Glycol	Unknown	Pipe Break	Road crew cleaned up

Table 6 Summary of spills/ un-authorized discharges in 2020

L. A summary of any closure and reclamation work undertaken and an outline of any work anticipated for the next year, including any changes to implementation and scheduling.

No closure and reclamation work was undertaken in 2021.

M. A summary of actions taken to address concerns or deficiencies listed in the inspection reports and/or compliance reports filed by an Inspector.

No inspections or compliance reports were filed requiring actions to address concerns or deficiencies in 2021.

N. A brief update on the implementation plan of all facilities within the scope of this Licence including projected implementation and status of the Upgraded Wastewater Treatment Plant.

Wastewater Treatment Plant

The primary treatment system remains in operation following commissioning of that system in 2019. Construction of the secondary treatment system was completed, less deficiencies, March 7, 2020 and initial commissioning commenced at that time. With the COVID-19 pandemic escalating across Canada shortly after, the Contractor responsible for the work made the decision to demobilize staff from Iqaluit on March 18, 2020 before commissioning activities were fully completed.

Status through most of 2020 and current status is Primary Treatment continues to function, with partial secondary treatment through Moving Bed Biofilm Reactor (MBBR) tanks and flow-through the new Dissolved Air Flotation (DAF) tanks.

Following negotiations with the Contractor and Consultant, the Contractor's staff have now remobilized back to site to complete the secondary treatment system commissioning work as of February 1, 2021. Commissioning completion of the secondary treatment system is anticipated by the end of March 2021.

The scope of work for the WWTP Upgrade includes replacement of the emergency diesel generator that has reached its end of life. A design to replace this existing generator for the plant was completed by the incumbent Consultant on February 8, 2021. The City intends to procure and install the new permanent emergency generator during Fall 2021.

Landfill and Waste Transfer Station

The detailed design of the landfill and waste transfer station began in 2019. The 100% design package for both components of the project was completed in 2020 and submitted to the Nunavut Water Board for review, as part of an application to amend the City's Type A water licence. The review process is currently ongoing. Once the review is complete and comments are received, the design will be updated accordingly.

Construction of the new landfill and waste transfer station is planned to begin during the summer of 2021. Construction of the new landfill is planned to be completed by Q4-2022. Similarly, construction of the waste transfer station is planned to be completed by Q3-2023.

O. A summary of any studies, reports and plans requested by the Board that related to waste disposal, water use, or reclamation and a brief description of any future studies planned.

Lake Geraldine Raw Water Supplementation from Apex River



The City executed the replenishment of the Lake Geraldine Reservoir, via supplemental pumping of water from the Apex River. Pumping activities were completed between June 24, 2021 and July 28, 2021. A total of 76,320 m³ of water was pumped, with maximum daily pumped volumes of 17,280 m³. Pumping records were maintained by the contractor at the pumping site but had not been provided to City's representative (Nunami Stantec Limited) for review and tabulation at the time of issuance of this report. No supplementary pumping occurred between June 29, 2021 and September 17, 2021, when Lake Geraldine water level was recorded at 111.295 masl, or approximately 1,667,097 m³. Equipment was demobilized thereafter. A final closeout report, which summarizes activities undertook under the pumping program, as been provided in Appendix G.

<u>Long-Term Water Project – Options Analysis Evaluation</u>

The goal of the Long-Term Water Project is to ensure that a new supplemental water supply source and storage alternative to Lake Geraldine is identified and implemented for use by 2026, when the City's current water licence expires. The Long-Term Water Project will ensure that the City will be able to meet water demand requirements for the short- and long-term periods, given the projected increase in water demand due to population growth and increase in economic development in the community.

For the supply component to the Long-Term Water Project, the City had previously conducted studies on the long-term viability of other nearby water sources (Apex River and Sylvia Grinnell River). Studies were commenced on Unnamed Lake with a Water Balance modelling study and a fish / fish habitat study. These studies were completed in March 2021. Preliminary analysis indicated that Unnamed Lake presents a viable solution for supporting the supplementation of fresh water to Lake Geraldine. As such, the City began to undertake the completion of an options analysis evaluation, which evaluates the following alternatives for the long-term supplementation of Lake Geraldine - a) Sylvia Grinnell River, and b) Unnamed Lake. The evaluation will be continuing into 2022, with the intent of presenting findings to local stakeholder groups such as the Qikiqtani Inuit Association (QIA) and Hunter's and Trappers Association (HTA). The City will be looking to obtain feedback from relevant stakeholder groups, prior to presenting a final preferred option to City Council. The City anticipates the completion of the options analysis evaluation in Q3-2022. Should Council approve the preferred option, the project would proceed to detailed design, which is anticipated to begin in 2023.

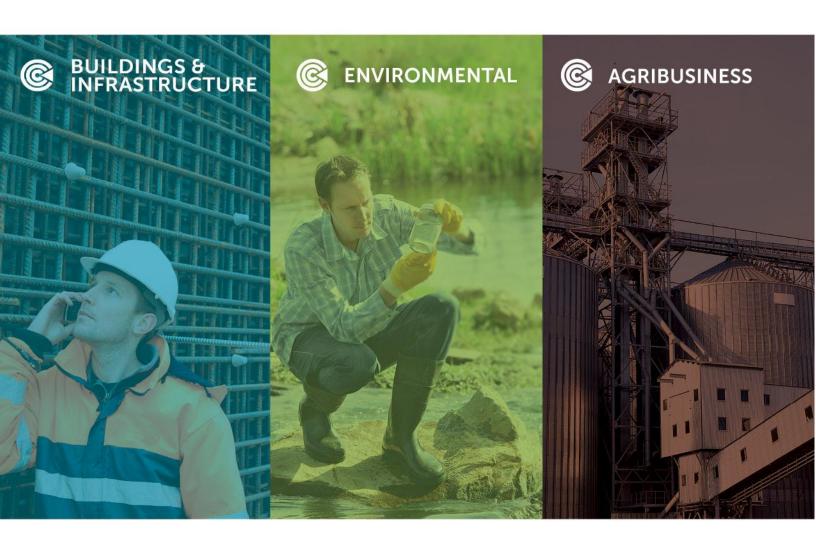
P. Any other details on the use of water or waste disposal requested by the Board by November 1st of the year being reported.

There are no additional details to be shared.

APPENDIX A DAM SAFETY INSPECTION REPORTS



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LAKE GERALDINE DAM
DAM SAFETY INSPECTION 2021 #1
IQALUIT, NUNAVUT

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C/O COLLIERS PROJECT LEADERS

PRODUCED BY: CONCENTRIC ASSOCIATES INTERNATIONAL INCORPORATED

CONCENTRIC REFERENCE NUMBER: 21-9162

DATE: MAY 11, 2021



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Appendix B: Lake Geraldine Dam Inspection Checklist



1. INTRODUCTION AND SCOPE OF WORK

This Dam Safety Inspection (DSI) of the Lake Geraldine Dam (LG Dam) has been prepared for the City of Iqaluit (City). As the owner of the LG Dam, the City of Iqaluit is responsible for its safe management. The purpose of this DSI is to assist the City by identifying any visual changes in the condition of the LG Dam, identifying any new concerns, and making recommendations on maintenance, repairs, or further investigations.

1.1 Dam Safety Guidelines

The most recent Dam Safety Guidelines (DSG), published by the Canadian Dam Association, were first released in 2007 and further revised in 2013. The DSG applies, in general, to those structures that are at least 2.5 meters in height, and which have at least 30,000 cubic meters of storage capacity. The LG Dam exceeds these minimum requirements and therefore requires annual DSI's. The DSI is considered to be an Engineering Inspection which is recommended by the DSG to be performed annually or semi-annually by a professional engineer. A Dam Safety Reviews (DSR) is required at a minimum, every 5 years. The most recent DSR was performed in 2019.

This DSI forms part of the dam's permanent record documentation along with other documentation that make up the historical record of the dam (and berms). Section 3.6 "Surveillance" of the DSG recommends more frequent visual inspections be performed. Routine inspections performed by City staff trained in dam surveillance are recommended on a weekly basis to identify any conditions that might indicate a change in the dam's performance.

1.2 Description of Structure

The LG Dam is comprised of a concrete section with an integral concrete spillway, and three earth berms; the north, center, and south berms. See below for a reference site plan and Appendix A for site photographs.

The 15.3m wide spillway has an upper elevation of 111.1 m (representing the current maximum operating level of the reservoir), while the concrete dam sections on either side of the spillway have an elevation of 112.3 m. At the maximum operating level of the reservoir, the concrete dam has approximately 0.95 m of freeboard.

The southern section of the concrete dam extends approximately 39.1 m to the south rock abutment. The northern section of the concrete dam extends 13.3 m to the north of the spillway section, where it joins the center earth berm.

The center earth berm extends north approximately 75m where it meets the access ramp and north access road. The north earth berm is located to the north of the access road ramp and extends 60m to the north rock abutment.

The south earth berm is a separate structure that is located in a valley to the south of the main concrete dam. The south berm is approximately 68.5m long. The berm sections of the dam incorporate a concrete cutoff wall which is reportedly founded in rock.



Site Plan



Table 1.1: LG Dam Summary*

Dam/Berm Segment	Length (m)	Crest Elevation	Base Elevation	Bedrock Elevation	Height of Dam/Berm (m)
North Berm	55.5	112.5	108.3	105.0	4.3
Center Berm	78.0	112.5	108.3	97.5	4.5
North Dam	13.3	112.3	102.6	97.5	11.0
Spillway	15.3	111.1	101.6	96	10.0
South Dam	39.1	112.3	102.6	67.5	11.0
South Berm	68.5	112.5	111.5	110.0	1.0

^{*}Tabular data based upon Meco "Dam Safety Management Plan", July 2020

1.3 Scope of Work

As per the requirements of the Dam Safety Guide, the primary task of this DSI is to help identify any significant changes in condition from previous inspections and reviews. A visual inspection can identify issues related to dam safety and provides the City of Iqaluit with the opportunity to mitigate any observed concerns or issues. This DSI report is the primary deliverable, and has been prepared in accordance with the Dam Safety Guide document.



The following is a summary of the scope of work for this assignment:

- Conduct a visual on-site assessment of the dam and berms above the water line;
- Prepare a photographic record documenting general and representative conditions;
- Identify, characterize, and risk-assess any significant visual changes in condition;
- Prepare a written report summarizing our observations, items of concern, and recommendations;
- Indicate any recommended repairs and outstanding recommendations from previous inspections and reviews;
- Submit final documents in electronic format.

2. HISTORY & BACKGROUND

2.1 Reservoir

The City of Iqaluit derives its water supply from Lake Geraldine, which is retained by a structure consisting of a cast in place concrete section incorporating an integral spillway, and three earth berms. All concrete structures are reported to be founded on bed rock, and engage the rock abutment at the south end of the concrete structure.

Lake Geraldine is a natural body of water in an irregularly shaped basin. It is fed by rainfall and snow/ice melt from a watershed with an area of approximately 385 hectares.

2.2 History

In the late 1950's, the demand for a reliable year round source of water resulted in the construction of a cast in place concrete gravity dam, and a section of earth berm with a central cast in place concrete cut off wall. The project was designed and built by the Department of National Defense. According to the literature, the original construction took place circa 1958.

Since that time, as the City has grown and water demands have risen, the dam has been raised four times to increase the storage capacity. In recent years, the City of Iqaluit has been pumping additional water into the reservoir in the fall of the year from a river located east of the reservoir.

The first height increase of the concrete dam and berms (0.3m) reportedly took place in 1979. This involved a concrete extension, which was dowelled into the existing structure.

The second height increase of the concrete dam and berms took place in 1985, and increased the height of the spillway structure by approximately 1.15m. The berm portion was widened and heightened as well to accommodate the increased storage capacity of the reservoir. The extension of the concrete dam was constructed of concrete dowelled into the existing structure, and incorporated a steel formwork frame over the spillway section.

The third extension was done in 1995, and increased the height of the concrete structures by a further 1.5m of concrete, with a corresponding increase in berm geometry. Based on analysis done prior to the extension, it was determined that the

Lake Geraldine Dam Safety Inspection, May 11, 2021



concrete structures would not have an adequate factor of safety against overturning if the extension was simply "dowelled-in" as before. The 1995 alteration therefore included an extensive rock-anchoring program for the concrete portions to provide the required stability to the structure.

The latest extension was completed in two phases over 2005/06. Additional rock anchors were installed thought the concrete structures in 2005 in preparation for a further height extension of 2m in 2006. The existing berms were enlarged and the existing cut-of-walls were extended in height. A new berm (south berm) and cut off wall were installed to the south of the main dam structure.

The last major repair program undertaken was completed in August 2017, various repairs were undertaken to maintain the concrete structures, berms and access roads. These repairs included:

- Placement of additional aggregate material and regrading of the north and south access roads.
- Repair of a sink hole in the south access road.
- Installation of additional riprap/armor stone on the upstream face of the center and north berms.
- Installation of additional aggregate and regrading of the top of the center and north berms.
- Replacement of the expansion joint sealant material on the downstream face of the concrete structures.
- Crack repair and sealing on the downstream face of the concrete structures.

In August 2019 various repairs were undertaken to repair the upstream face (below the water line) of the dam. These repairs included:

- Repair of the expansion joint.
- Polyurethane crack injection.
- Localized concrete repairs.

3. DAM SAFETY INSPECTION

3.1 Site Inspections and Staff Interviews

A visual site inspection of the LG Dam was performed on May 11, 2021 by Randy Scott of Concentric. The inspection was non-invasive in nature, and did not include an underwater survey or assessment.

A summary of observed conditions is as follows:

- Ice had formed on Lake Geraldine and snow accumulation was present on and at the base the berms, concrete structures, and Lake Geraldine (see photograph 1).
- The reservoir level (top of ice) was approximately 150 mm below the top of the spillway at the time of our review. The water level reported by Environment and Natural Resources Canada was 109.283 m, approximately 1.817 m below the level of the spillway.



- No significant changes were noted in the general condition of the concrete structures. No active seepage/leakage was observed within the visible portions of the concrete structures. Direct access to the base of the concrete structures and berms was obstructed by significant snow accumulation. Based upon our previous inspections and experience; water leakage/seepage may be present to a minor degree at the base of the expansion joint in the concrete structure.
- Although the majority of the north, center and south berms were covered in snow and ice, no significant changes such as sloughing, slides, bulging or displacement were noted in the earthen berms. No active seepage/leakage was observed within the visible portions of the berms however, based upon our previous inspections and experience; water leakage/seepage may be present to a minor degree within the center berm.
- A small section of the center berm on the downstream face of the berm adjacent to the north end of the concrete dam has been eroded away (see photograph 4).
- The aggregate stock piles located near the north berm have been exhausted and only a minimal amount of aggregate material remains.
- Moderate erosion of the stone and gravel was noted at the interface between the north end of the concrete structures and the south end of the center berm (see photograph 5).
- Examination of the south access road was not possible due to the accumulation of ice and snow. Localized erosion within the north access road was observed at the time of our review (see photograph 5).
- Displacement of the armor stone/riprap on the upstream face of the north and center berms is continuing. This erosion is consistent with the natural wave action within the reservoir (see photograph 7).
- Minor displacement of the stone at the crest of the north and center berms on the upstream face of the berm (see photograph 7).
- Members of the public continue to access the LG Dam, and Lake Geraldine (when iced over).
- The warning signs at the base of the access ramp to the north/center berm is missing and the remaining signage is faded (see photograph 8).
- Temperature sensor strings (thermistors) have been installed and abandoned at various locations on all berms (see photograph 9).
- The valve chamber adjacent to the south side of the concrete spillway was inaccessible due to heavy snow accumulation at this location. We did not inspect or exercise the valve controls. The 2015 DSI identified that the valve controls within the chamber appeared to be in an advanced state of corrosion and it remains unclear if this issue has been addressed and or the valves tested in recent years.

3.2 Dam Safety Analysis

A dam safety analysis was not completed as part of this inspection however, there was no obvious indicators that the concrete structures have had significant changes since the last DSI in 2020. The deep snow and ice on and around the LG Dam at the time of our inspection may have obstructed visual indicators such as sloughing, slides, bulging or displacement.



3.3 Operation, Maintenance, and Surveillance

This DSI falls under the requirements of a visual inspection by an engineer as stated in Section 3.6 "Surveillance" of the Dam Safety Guide. The lack of a centralized repository of operational and maintenance records has been an ongoing issue. This, along with other issues regarding the operation and maintenance of the dam and reservoir, is noted within the "Dam Safety Management Plan" dated July 16, 2020 and prepared by MECO.

Concentric is not aware of a staffed monitoring system or automated monitoring equipment. This has been previously identified and is still an outstanding issue however, installation of automated monitoring systems to record temperature and water pressure data is scheduled for 2022.

3.4 Recommendations and Required Action

Repairs to the access roads, berms and dam are scheduled for the summer of 2021. This work will include the following:

- Repair and regrading of the north access road.
- Installation of additional armor stone/riprap on the upstream side of the berms to replace the material that has been displaced due to wave action.
- Concrete repairs in the downstream face of the concrete dam.
- Crack sealing in the downstream face of the concrete dam.
- Removal and replacement of the sealant installed within the expansion joints on the top and downstream face of the concrete dam.
- Repair and regrading of the top of the center and north berms.
- New signage installed at the two access roads, access ramp to the berms and around the periphery of the LG Dam. Signage should be in all required languages.
- Removal of the temporary guardrail currently installed at the concrete structures.

Based on our inspection and review, we recommend the following:

- 1. Updating of the permanent record file and its storage in a central location with an index that documents the date and contents of all records. The permanent record file needs to include:
 - a) As-built drawings and specification for work undertaken at the dam.
 - b) Weekly/monthly inspections completed by City staff.
 - c) Dam Safety Inspections and Dam Safety Reports generated by third parties on behalf of the City of Iqaluit.
 - d) All maintenance records.
 - e) Correspondence with regulatory agencies.
 - f) Dam operation, maintenance and surveillance documents.
 - g) Reports and documentation generated by third parties on behalf of the City of Iqaluit.

Lake Geraldine Dam Safety Inspection, May 11, 2021



- 2. Implementation of a monitoring program to record data from the installed network of piezometers and thermistors used to monitor hydrogeologic and thermal environments within the backfill and foundations. This work is tentatively scheduled for implementation in summer of 2022.
- 3. The installation of video surveillance.
- 4. Use and restocking of the aggregate stock piles on site as required.
- 5. Exercising and testing of the valves within the valve chamber is required as part of preventative measures. The condition of the valves within the valve chamber at the base of the dam were previously identified as being in an advanced state of corrosion. To our knowledge no maintenance or testing has been completed on the controls valve in the last 5+ years. There is a significant potential for the valves to fail and not operate correctly when needed in an emergency.
- 6. Underwater survey of the concrete dam and spillway in 2022 2023.

4. LIMITATIONS

This report was prepared for the sole use of the City of Iqaluit.

This report was prepared exclusively for the purposed project and site locations outlined in this report. The report is based on information provided to, or obtained by Concentric as indicated in the report, and applies solely to site conditions existing at the time of the site investigations.

The conditions of the site may change over time or may have already changed due to natural forces or human intervention, and Concentric takes no responsibility for the impact that such changes may have on the accuracy or validity of the observations, conclusions and recommendations set out in this report.

The report does not extend to any latent defect or other deficiency which could not have been reasonably discoverable or discovered within the scope of the report. Information supplied by the City of Iqaluit or third parties for use in this report has not been verified by Concentric unless stated otherwise.

Concentric's report represents a review of available information with an established work scope, schedule, and budget. The material in the report reflects Concentric's judgement in light of the information available to it at the time of preparation. Any uses that a third party makes of this report, or any reliance on decisions made based on it, are the responsibilities of such third parties.

Concentric accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made based on this report.

Should there be any questions, please contact the undersigned.

Yours sincerely,

CONCENTRIC



Randy Scott Sr. Technologist Kathleen Perry-Theriault, P.Eng. Project Manager



APPENDIX A

Site Photographs





Photograph 1 – Overview of concrete structure, center berm and north berm.



Photograph 2 – Typical berm condition, center berm.





Photograph 3 – Typical berm condition, center berm and access ramp.



Photograph 4 – Moderate erosion of the earthen berm at the north end of the concrete dam – south end of the center berm.





Photograph 5 – Typical erosion of the north access road.



Photograph 6 – Small sink hole located in the center berm.





Photograph 7 – Area where the rip-rap on the upstream face of the dam has been eroded by wave action. South end of the center berm.



Photograph 8 – Typical signage condition.





Photograph 9 – Typical temperature sensor string installation (center berm).



APPENDIX B Lake Geraldine Dam Inspection Checklist





Lake Geraldine Dam Inspection Checklist

Inspector Name: Randy Scott

Inspection Date: May 11 2021

Weather: Broken Clouds 4° C

Height of Lake

Geraldine Reservoir: 109.164 m https://wateroffice.ec..164gc.ca/report/real_time_e.html?stn=10UH013

General Observations					
Description	Yes	No	Observations		
Snow and Ice Present on dam & berms	х		Dam and berm only partially visible due to the accumulation of ice and snow atop berm.		
Snow and Ice Present on the Lake	х		Top of ice approximately 150 mm below top of spillway.		
Vandalism and Debris (on site and lake)		х	No debris visible on site, dam, berms and adjacent areas. Snow and ice has covered all areas, obstructing visibility of debris that mat be present on the ground.		
Gates on Dam Locked (north and south ends on top of concrete dam)	х		Gates on north and south end of dam locked.		
Gates and Fencing Intact and Secure (north and south ends on top of concrete dam)	х		Gates and fencing secured to dam structure.		
North Access Road Gate Secured		×	Access gate open and road cleared of snow (presumable for our site review). Road accessible (snow covered and minor drifting), no damage to road bed observed.		
South Access Road Gate Secured		х	Access gate closed however, no lock present on gate. Road not accessible due to snow accumulation		
Dam Signage in good condition		х	Signage only in place at north end of north berm, recommend new signage be placed at south end of dam and at base of access ramp to center/north berm.		





Valve Chamber Condition and Damage (Indicate if there is any cracking, displacement, physical damage, cover is in place, etc)		х	Not visible, covered with deep snow.	
		Concre	ete Dam and Spillway	
Description	Yes	No	Observations No missing or spalled sections of concrete observed within the spillway. No missing or spalled sections of concrete observed on visible surfaces of dam face. No missing or spalled sections of concrete observed on visible surfaces of dam face. No wisible leakage observed due to heavy snow and ice accumulation around dam.	
Cracking / Spalling present on top (surface) of Dam (Indicate if new, existing or expanded)		x	No missing or spalled sections of concrete observed within the spillway.	
Cracking / Spalling present on Upstream (surface) of Dam (Indicate if new, existing or expanded)		x	No missing or spalled sections of concrete observed on visible surfaces of dam face.	
Cracking / Spalling present on Downstream (surface) of Dam (Indicate if new, existing or expanded)		х	No missing or spalled sections of concrete observed on visible surfaces of dam face.	
Active leakage through dam (Indicate location and rate of leakage in liters per minute)		х	No visible leakage observed due to heavy snow and ice accumulation around dam. Leakage is likely occurring at the base of the expansion joints.	
Sealant in good condition – Top of Dam	х		Good condition	
Sealant in good condition – Upstream of Dam	х		Good condition	
Sealant in good condition – Downstream of Dam		х	Pour Condition. Base of dam at interface with bedrock not visible due to heavy snow accumulation at base of dam.	





Active leakage at Interface Between Concrete and Ground	х		Base of dam at interface with bedrock not visible due to heavy snow accumulation at base of dam.
Displacement or Misalignment of Sections of Dam		х	No displacement observed.
			North Berm
Description	Yes	No	Observations
Depressions or Sink Holes on Top of Berm		х	Note, the surface of the berm was not visible due to the accumulation of ice and snow atop berm.
Rock, Gravel or Aggregate Displacement or Washout of Berm Top Face		х	Berm not visible due to the accumulation of ice and snow atop berm. No apparent rock, gravel or aggregate displacement on top of the berm was observed
Rock, Gravel or Aggregate Displacement or Washout of Berm Upstream Face		х	Berm not visible due to the accumulation of ice and snow atop berm. Photos from our 2018 inspection when the water level was approx. 1.5 m below the max water level indicate a loss of armor stone / riprap along the exposed face of the berm.
Rock, Gravel or Aggregate Displacement or Washout of Berm Downstream Face		х	No apparent rock, gravel or aggregate displacement of berm observed. Note, the surface of the berm was not visible due to the accumulation of ice and snow atop berm.
Wet Area or Active Leakage on Downstream Side of Berm		х	No leakage visible due to heavy snow accumulation at base of berm.
			Center Berm
Description	Yes	No	Observations
Depressions or Sink Holes on Top of Berm		х	Depressions or sink holes on top of berm. Note, the surface of the berm was not visible due to the accumulation of ice and snow atop berm.
Rock, Gravel or Aggregate Displacement or Washout of Berm Top Face		х	Berm not visible due to the accumulation of ice and snow atop berm. No apparent rock, gravel or aggregate displacement on top of the berm was observed





Rock, Gravel or Aggregate Displacement or Washout of Berm Upstream Face Rock, Gravel or Aggregate Displacement or Washout of Berm		x	Berm not visible due to the accumulation of ice and snow atop berm. Photos from our 2018 inspection when the water level was approx. 1.5 m below the max water level indicate a loss of armor stone / riprap along the exposed face of the berm. No apparent rock, gravel or aggregate displacement of berm observed. Note, the surface of the berm was not visible due to the accumulation of ice and snow atop
Downstream Face Wet Area or Active Leakage on Downstream Side of Berm		х	No leakage visible due to heavy snow accumulation at base of berm.
			South Berm
Description	Yes	No	Observations
Depressions or Sink Holes on Top of Berm		х	Note, the surface of the berm was not visible due to the accumulation of ice and snow atop berm.
Rock, Gravel or Aggregate Displacement or Washout of Berm Top Face		х	Berm not visible due to the accumulation of ice and snow atop berm. No apparent rock, gravel or aggregate displacement on top of the berm was observed.
Rock, Gravel or Aggregate Displacement or Washout of Berm Upstream Face			Berm not visible due to the accumulation of ice and snow atop berm. No apparent rock, gravel or aggregate displacement on top of the berm was observed
Rock, Gravel or Aggregate Displacement or Washout of Berm Downstream Face			No apparent rock, gravel or aggregate displacement of berm observed. Note, the surface of the berm was not visible due to the accumulation of ice and snow atop berm.
Wet Area or Active Leakage on Downstream Side of Berm			No leakage visible due to heavy snow accumulation at base of berm.





Additional Comments and Observations



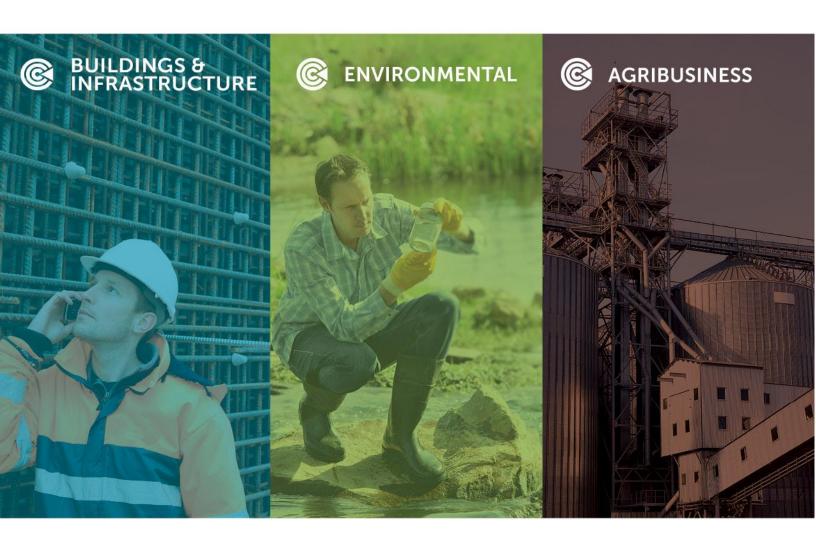


Lake Geraldine Dam Location Plan





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Lake Geraldine Dam
Dam Safety Inspection 2021 #2
IQALUIT, NUNAVUT

 $\label{eq:produced for: the city of iqaluit} \textbf{PRODUCED FOR: } \textbf{THE CITY OF } \textbf{IQALUIT}$

C/O COLLIERS PROJECT LEADERS

PRODUCED BY: CONCENTRIC ASSOCIATES INTERNATIONAL INCORPORATED

CONCENTRIC REFERENCE NUMBER: 21-9162

DATE: JULY 14, 2021



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Appendix A: Site Photographs



1. INTRODUCTION AND SCOPE OF WORK

This Dam Safety Inspection (DSI) of the Lake Geraldine Dam (LG Dam) has been prepared for the City of Iqaluit (City). As the owner of the LG Dam, the City of Iqaluit is responsible for its safe management. The purpose of this DSI is to assist the City by identifying any visual changes in the condition of the LG Dam, identifying any new concerns, and making recommendations on maintenance, repairs, or further investigations. The DSI was undertaken on July 14, 2021 by Steve Parker, P.Eng. of Concentric.

1.1 Dam Safety Guidelines

The most recent Dam Safety Guidelines (DSG), published by the Canadian Dam Association, were first released in 2007 and further revised in 2013. The DSG applies, in general, to those structures that are at least 2.5 meters in height, and which have at least 30,000 cubic meters of storage capacity. The LG Dam exceeds these minimum requirements and therefore requires annual DSI's. The DSI is considered to be an Engineering Inspection which is recommended by the DSG to be performed annually or semi-annually by a professional engineer. A Dam Safety Reviews (DSR) is required at a minimum, every 5 years. The most recent DSR was performed in 2019.

This DSI forms part of the dam's permanent record documentation along with other documentation that make up the historical record of the dam (and berms). Section 3.6 "Surveillance" of the DSG recommends more frequent visual inspections be performed. Routine inspections performed by City staff trained in dam surveillance are recommended on a weekly basis to identify any conditions that might indicate a change in the dam's performance.

1.2 Description of Structure

The LG Dam is comprised of a concrete section with an integral concrete spillway, and three earth berms; the north, center, and south berms. See below for a reference site plan and Appendix A for site photographs.

The 15.3m wide spillway has an upper elevation of 111.1 m (representing the current maximum operating level of the reservoir), while the concrete dam sections on either side of the spillway have an elevation of 112.3 m. At the maximum operating level of the reservoir, the concrete dam has approximately 0.95 m of freeboard.

The southern section of the concrete dam extends approximately 39.1 m to the south rock abutment. The northern section of the concrete dam extends 13.3 m to the north of the spillway section, where it joins the center earth berm.

The center earth berm extends north approximately 75m where it meets the access ramp and north access road. The north earth berm is located to the north of the access road ramp and extends 60m to the north rock abutment.

The south earth berm is a separate structure that is located in a valley to the south of the main concrete dam. The south berm is approximately 68.5m long. The berm sections of the dam incorporate a concrete cutoff wall which is reportedly founded in rock.



Site Plan



Table 1.1: LG Dam Summary*

Dam/Berm Segment	Length (m)	Crest Elevation	Base Elevation	Bedrock Elevation	Height of Dam/Berm (m)
North Berm	55.5	112.5	108.3	105.0	4.3
Center Berm	78.0	112.5	108.3	97.5	4.5
North Dam	13.3	112.3	102.6	97.5	11.0
Spillway	15.3	111.1	101.6	96	10.0
South Dam	39.1	112.3	102.6	67.5	11.0
South Berm	68.5	112.5	111.5	110.0	1.0

^{*}Tabular data based upon Meco "Dam Safety Management Plan", July 2020

1.3 Scope of Work

As per the requirements of the Dam Safety Guide, the primary task of this DSI is to help identify any significant changes in condition from previous inspections and reviews. A visual inspection can identify issues related to dam safety and provides the City of Iqaluit with the opportunity to mitigate any observed concerns or issues. This DSI report is the primary deliverable, and has been prepared in accordance with the Dam Safety Guide document.



The following is a summary of the scope of work for this assignment:

- Conduct a visual on-site assessment of the dam and berms above the water line;
- Prepare a photographic record documenting general and representative conditions;
- Identify, characterize, and risk-assess any significant visual changes in condition;
- Prepare a written report summarizing our observations, items of concern, and recommendations;
- Indicate any recommended repairs and outstanding recommendations from previous inspections and reviews;
- Submit final documents in electronic format.

2. HISTORY & BACKGROUND

2.1 Reservoir

The City of Iqaluit derives its water supply from Lake Geraldine, which is retained by a structure consisting of a cast in place concrete section incorporating an integral spillway, and three earth berms. All concrete structures are reported to be founded on bed rock, and engage the rock abutment at the south end of the concrete structure.

Lake Geraldine is a natural body of water in an irregularly shaped basin. It is fed by rainfall and snow/ice melt from a watershed with an area of approximately 385 hectares.

2.2 History

In the late 1950's, the demand for a reliable year-round source of water resulted in the construction of a cast in place concrete gravity dam, and a section of earth berm with a central cast in place concrete cut off wall. The project was designed and built by the Department of National Defense. According to the literature, the original construction took place circa 1958.

Since that time, as the City has grown and water demands have risen, the dam has been raised four times to increase the storage capacity. In recent years, the City of Iqaluit has been pumping additional water into the reservoir in the fall of the year from a river located east of the reservoir.

The first height increase of the concrete dam and berms (0.3m) reportedly took place in 1979. This involved a concrete extension, which was dowelled into the existing structure.

The second height increase of the concrete dam and berms took place in 1985 and increased the height of the spillway structure by approximately 1.15m. The berm portion was widened and heightened as well to accommodate the increased storage capacity of the reservoir. The extension of the concrete dam was constructed of concrete dowelled into the existing structure, and incorporated a steel formwork frame over the spillway section.

The third extension was done in 1995 and increased the height of the concrete structures by a further 1.5m of concrete, with a corresponding increase in berm geometry. Based on analysis done prior to the extension, it was determined that the concrete structures

Lake Geraldine Dam Safety Inspection, July 14, 2021



would not have an adequate factor of safety against overturning if the extension was simply "dowelled-in" as before. The 1995 alteration therefore included an extensive rock-anchoring program for the concrete portions to provide the required stability to the structure.

The latest extension was completed in two phases over 2005/06. Additional rock anchors were installed thought the concrete structures in 2005 in preparation for a further height extension of 2m in 2006. The existing berms were enlarged, and the existing cut-of-walls were extended in height. A new berm (south berm) and cut off wall were installed to the south of the main dam structure.

The last major repair program undertaken was completed in August 2017, various repairs were undertaken to maintain the concrete structures, berms and access roads. These repairs included:

- Placement of additional aggregate material and regrading of the north and south access roads.
- Repair of a sink hole in the south access road.
- Installation of additional riprap/armor stone on the upstream face of the center and north berms.
- Installation of additional aggregate and regrading of the top of the center and north berms.
- Replacement of the expansion joint sealant material on the downstream face of the concrete structures.
- Crack repair and sealing on the downstream face of the concrete structures.

In August 2019 various repairs were undertaken to repair the upstream face (below the water line) of the dam. These repairs included:

- Repair of the expansion joint.
- Polyurethane crack injection.
- Localized concrete repairs.

3. DAM SAFETY INSPECITON

3.1 Site Inspections and Staff Interviews

A visual site inspection of the LG Dam was performed on July 14, 2021 by Steve Parker, P.Eng. of Concentric. The inspection was non-invasive in nature, and did not include an underwater survey or assessment.

A summary of observed conditions is as follows:

- Valleys still contain ice and snow on Lake Geraldine (see photograph 1 and 2).
- The reservoir level was at the top of the spillway at the time of our review. The water level reported by Environment and Natural Resources Canada was 111.1 m.
- No significant changes were noted in the general condition of the concrete structures.



- Minor active seepage/leakage was observed within the visible portions of the dam (see photograph 3 6) at the expansion joints and cracks within the mass of the concrete structure. Visual access at the base of the concrete structures was partially obstructed by the remaining snow accumulated at the base of the dam.
- No significant changes such as sloughing, slides, bulging or displacement were noted in the earthen berms. Visual access at the base of the berms was partially obstructed by the remaining snow accumulated at the base of the berms.
- The aggregate stock piles located near the north berm have been exhausted and only a minimal amount of aggregate material remains.
- Moderate erosion of the stone and gravel was noted at the interface between the north end of the concrete structures and the south end of the center berm (see photograph 7).
- Minor localized erosion within the north access road was observed at the time of our review.
- Displacement of the armor stone/riprap on the upstream face of the north and center berms is continuing. This erosion is consistent with the natural wave action within the reservoir (see photograph 8).
- Minor displacement of the stone at the crest of the north and center berms on the upstream face of the berm.
- Members of the public continue to access the LG Dam, and Lake Geraldine. Debris such as the hood of a snowmobile was found within the reservoir (see photograph 8).
- The valve chamber adjacent to the south side of the concrete spillway was visible at the time of our review. No significant changes were noted in the general condition of the valve chamber structures. We did not inspect or exercise the valve controls. The 2015 DSI identified that the valve controls within the chamber appeared to be in an advanced state of corrosion and it remains unclear if this issue has been addressed and or the valves tested in recent years.
- The location of the piezometer and temperature strings boreholes were verified on site.
- Standing water and snow accumulation downstream of the north berm (see photograph 9).
- Seepage through the center berm at the valley was noted. This seepage also runs through the access road.

3.2 Dam Safety Analysis

A dam safety analysis was not completed as part of this inspection however, there were no obvious indicators that the concrete structures have had significant changes since the last DSI in May 2021.

3.3 Operation, Maintenance, and Surveillance

This DSI falls under the requirements of a visual inspection by an engineer as stated in Section 3.6 "Surveillance" of the Dam Safety Guide. The lack of a centralized repository of operational and maintenance records has been an ongoing issue. This, along with



other issues regarding the operation and maintenance of the dam and reservoir, is noted within the "Dam Safety Management Plan" dated July 16, 2020 and prepared by MECO.

Concentric is not aware of a staffed monitoring system or automated monitoring equipment. This has been previously identified and is still an outstanding issue however, installation of automated monitoring systems to record temperature and water pressure data is scheduled for 2022.

3.4 Recommendations and Required Action

Conditions on site remain consistent with our observations in May 2021 however, minor leakage from cracks and the expansion joints within the concrete dam were visible (due to the snow melt). We were unable to assess potential seepage through the earthern berms due to an excess of melt water from ice and snow on site.

Repairs to the access roads, berms and dam are scheduled for the summer of 2021. This work will include the following:

- Repair and regrading of the north access road.
- Installation of additional armor stone/riprap on the upstream side of the berms to replace the material that has been displaced due to wave action.
- Concrete repairs in the downstream face of the concrete dam.
- Crack sealing in the downstream face of the concrete dam.
- Removal and replacement of the sealant installed within the expansion joints on the top and downstream face of the concrete dam.
- Repair and regrading of the top of the center and north berms.
- New signage installed at the two access roads, access ramp to the berms and around the periphery of the LG Dam. Signage should be in all required languages.
- Removal of the temporary guardrail currently installed at the concrete structures.

Based on our inspection and review, we recommend the following:

- 1. Updating of the permanent record file and its storage in a central location with an index that documents the date and contents of all records. The permanent record file needs to include:
 - a) As-built drawings and specification for work undertaken at the dam.
 - b) Weekly/monthly inspections completed by City staff.
 - c) Dam Safety Inspections and Dam Safety Reports generated by third parties on behalf of the City of Iqaluit.
 - d) All maintenance records.
 - e) Correspondence with regulatory agencies.
 - f) Dam operation, maintenance and surveillance documents.
 - g) Reports and documentation generated by third parties on behalf of the City of Iqaluit.

Lake Geraldine Dam Safety Inspection, July 14, 2021



- 2. Implementation of a monitoring program to record data from the installed network of piezometers and thermistors used to monitor hydrogeologic and thermal environments within the backfill and foundations. This work is tentatively scheduled for implementation in summer of 2022.
- The installation of video surveillance.
- 4. Use and restocking of the aggregate stock piles on site as required.
- 5. Exercising and testing of the valves within the valve chamber is required as part of preventative measures. The condition of the valves within the valve chamber at the base of the dam were previously identified as being in an advanced state of corrosion. To our knowledge no maintenance or testing has been completed on the controls valve in the last 5+ years. There is a significant potential for the valves to fail and not operate correctly when needed in an emergency.
- 6. Underwater survey of the concrete dam and spillway in 2022 2023.
- 7. Concrete delamination survey to identify areas of concrete delamination within the downstream portion of the dam structure in 2022.

4. LIMITATIONS

This report was prepared for the sole use of the City of Iqaluit.

This report was prepared exclusively for the purposed project and site locations outlined in this report. The report is based on information provided to, or obtained by Concentric as indicated in the report, and applies solely to site conditions existing at the time of the site investigations.

The conditions of the site may change over time or may have already changed due to natural forces or human intervention, and Concentric takes no responsibility for the impact that such changes may have on the accuracy or validity of the observations, conclusions and recommendations set out in this report.

The report does not extend to any latent defect or other deficiency which could not have been reasonably discoverable or discovered within the scope of the report. Information supplied by the City of Iqaluit or third parties for use in this report has not been verified by Concentric unless stated otherwise.

Concentric's report represents a review of available information with an established work scope, schedule, and budget. The material in the report reflects Concentric's judgement in light of the information available to it at the time of preparation. Any uses that a third party makes of this report, or any reliance on decisions made based on it, are the responsibilities of such third parties.

Concentric accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made based on this report.

Should there be any questions, please contact the undersigned.

Yours sincerely,

CONCENTRIC



Steve Parker, P.Eng. Project Manager Kathleen Perry-Theriault, P.Eng. Project Manager

Project No.: 21-9162 The City of Iqaluit Lake Geraldine Dam Safety Inspection, July 14, 2021



APPENDIX A

Site Photographs





Photograph 1 – Overview of concrete structure.



Photograph 2 – Overview of centre berm, north berm in the distance.





Photograph 3 – Water seepage at base of J5 joint, south of spillway.



Photograph 4 – Water leakage at J4 joint, and horizontal joint, south of spillway.





Photograph 5 – Water leakage at J3 corner, south of spillway.



Photograph 6 – Water leakage between J0 and J1, north of spillway.





Photograph 7 – Moderate erosion of granular, south end of the center berm (adjacent to J0)



Photograph 8 –Steep slope of rip rap on upstream side of berm. Snowmobile debris within reservoir.





Photograph 9 – Surface water and snow cover, downstream of north berm.



Photograph 10 – Seepage at valley of center berm.

Project No.: 21-9162 The City of Iqaluit Lake Geraldine Dam Safety Inspection, July 14, 2021



APPENDIX B

Lake Geraldine Dam Inspection Checklist





Lake Geraldine Dam Inspection Checklist

Inspector Name: Steve Parker

Inspection Date: July 14 2021

Weather: Passing Clouds 8° C

Height of Lake

Geraldine Reservoir: 111.1 m https://wateroffice.ec.gc.ca/report/real_time_e.html?stn=10UH013

General Observations					
Description	Yes	No	Observations		
Snow and Ice Present on dam & berms	x		Less than 5% snow cover located in low lying areas (valleys)		
Snow and Ice Present on the Lake	х		Less than 5% ice cover on opposite side of reservoir		
Vandalism and Debris (on site and lake)	х		Typical garbage, empty cans, discarded ATV and Snowmobile parts, various locations		
Gates on Dam Locked (north and south ends on top of concrete dam)	х		Gates on north and south end of dam locked.		
Gates and Fencing Intact and Secure (north and south ends on top of concrete dam)	х		Gates and fencing secured to dam structure.		
North Access Road Gate Secured	х		Gate closed and locked.		
South Access Road Gate Secured		х	Gate open.		
Dam Signage in good condition		х	Sign in poor condition at south berm. Sign in poor condition at base of access ramp to center/ north berm.		





Valve Chamber Condition and Damage (Indicate if there is any cracking, displacement, physical damage, cover is in place, etc)		х	No significant deterioration observed.
		Concrete	Dam and Spillway
Description	Yes	No	Observations
Cracking / Spalling present on top (surface) of Dam (Indicate if new, existing or expanded)		x	No missing or spalled sections of concrete observed.
Cracking / Spalling present on Upstream (surface) of Dam (Indicate if new, existing or expanded)		х	No missing or spalled sections of concrete observed on visible surfaces of dam face.
Cracking / Spalling present on Downstream (surface) of Dam (Indicate if new, existing or expanded)	х		Localized areas of minor deteriorated/ cracked concrete observed throughout. Recommend a survey to establish quantities. J4
Active leakage through dam (Indicate location and rate of leakage in liters per minute)	х		Leakage observed at bottom of expansion joint J5.
Sealant in good condition – Top of Dam	х		Good condition
Sealant in good condition – Upstream of Dam	х		Good condition
Sealant in good condition – Downstream of Dam		х	Pour Condition. Sections missing. Recommend replacement of sealant.





Active leakage at Interface Between Concrete and Ground	х		Leaking at J5.
Displacement or Misalignment of Sections of Dam		х	No displacement observed.
		N	North Berm
Description	Yes	No	Observations
Depressions or Sink Holes on Top of Berm	Х		A few localized depression/ sink holes.
Rock, Gravel or Aggregate Displacement or Washout of Berm Top Face	Х		Localized areas of minor washout.
Rock, Gravel or Aggregate Displacement or Washout of Berm Upstream Face	х		Rip rap too steep above waterline. Height of rip rap approx. 1 foot lower.
Rock, Gravel or Aggregate Displacement or Washout of Berm Downstream Face		х	No apparent rock, gravel or aggregate displacement of berm observed.
Wet Area or Active Leakage on Downstream Side of Berm	х		water present at base of berm. Source unknown.
		С	enter Berm
Description	Yes	No	Observations
Depressions or Sink Holes on Top of Berm	х		A few localized depression/ sink holes.
Rock, Gravel or Aggregate Displacement or Washout of Berm Top Face	х		Localized areas of minor washout.





Rock, Gravel or Aggregate Displacement or Washout of Berm Upstream Face	x		Rip rap too steep above waterline. Height of rip rap approx. 1 foot lower.
Rock, Gravel or Aggregate Displacement or Washout of Berm Downstream Face		x	No apparent rock, gravel or aggregate displacement of berm observed.
Wet Area or Active Leakage on Downstream Side of Berm	х		water present at base of berm. Source unknown.
		S	outh Berm
Description	Yes	No	Observations
Depressions or Sink Holes on Top of Berm		x	
Rock, Gravel or Aggregate Displacement or Washout of Berm Top Face		х	
Rock, Gravel or Aggregate Displacement or Washout of Berm Upstream Face		×	
Rock, Gravel or Aggregate Displacement or Washout of Berm Downstream Face		x	
Wet Area or Active Leakage on Downstream Side of Berm		х	





Additional Comments and Observations		



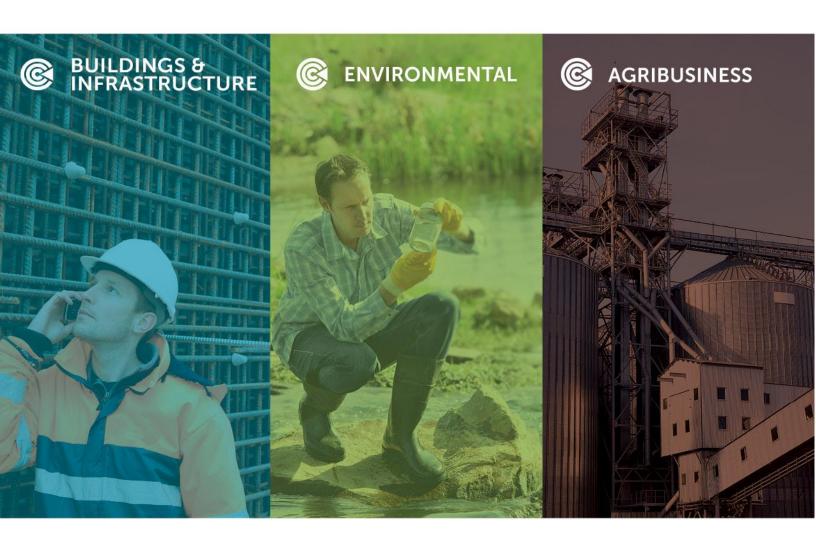


Lake Geraldine Dam Location Plan





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LAKE GERALDINE DAM
DAM SAFETY INSPECTION 2021 # 3
IQALUIT, NUNAVUT

PRODUCED FOR: THE CITY OF IQALUIT

C/O COLLIERS PROJECT LEADERS

PRODUCED BY: CONCENTRIC ASSOCIATES INTERNATIONAL INCORPORATED

CONCENTRIC REFERENCE NUMBER: 21-9162

DATE: AUGUST 18, 2021



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1.1 Dam Safety Guidelines

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This DSI forms part of the dam's permanent record documentation along with other documentation that make up the historical record of the dam (and berms). Section 3.6 "Surveillance" of the DSG recommends more frequent visual inspections be performed. Routine inspections performed by City staff trained in dam surveillance are recommended on a weekly basis to identify any conditions that might indicate a change in the dam's performance.

1.2 Description of Structure

The LG Dam is comprised of a concrete section with an integral concrete spillway, and three earth berms; the north, center, and south berms. See below for a reference site plan and Appendix A for site photographs.

The 15.3m wide spillway has an upper elevation of 111.1 m (representing the current maximum operating level of the reservoir), while the concrete dam sections on either side of the spillway have an elevation of 112.3 m. At the maximum operating level of the reservoir, the concrete dam has approximately 0.95 m of freeboard.

The southern section of the concrete dam extends approximately 39.1 m to the south rock abutment. The northern section of the concrete dam extends 13.3 m to the north of the spillway section, where it joins the center earth berm.

The center earth berm extends north approximately 75m where it meets the access ramp and north access road. The north earth berm is located to the north of the access road ramp and extends 60m to the north rock abutment.

The south earth berm is a separate structure that is located in a valley to the south of the main concrete dam. The south berm is approximately 68.5m long. The berm sections of the dam incorporate a concrete cutoff wall which is reportedly founded in rock.



Site Plan



Table 1.1: LG Dam Summary*

Dam/Berm Segment	Length (m)	Crest Elevation	Base Elevation	Bedrock Elevation	Height of Dam/Berm (m)
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Center Berm	78.0	112.5	108.3	97.5	4.5
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^{*}Tabular data based upon Meco "Dam Safety Management Plan", July 2020

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- Conduct a visual on-site assessment of the dam and berms above the water line;
- Prepare a photographic record documenting general and representative conditions;
- Identify, characterize, and risk-assess any significant visual changes in condition;
- Prepare a written report summarizing our observations, items of concern, and recommendations;
- Indicate any recommended repairs and outstanding recommendations from previous inspections and reviews;
- Submit final documents in electronic format.

2. HISTORY & BACKGROUND

2.1 Reservoir

The City of Iqaluit derives its water supply from Lake Geraldine, which is retained by a structure consisting of a cast in place concrete section incorporating an integral spillway, and three earth berms. All concrete structures are reported to be founded on bed rock, and engage the rock abutment at the south end of the concrete structure.

Lake Geraldine is a natural body of water in an irregularly shaped basin. It is fed by rainfall and snow/ice melt from a watershed with an area of approximately 385 hectares.

2.2 History

In the late 1950's, the demand for a reliable year-round source of water resulted in the construction of a cast in place concrete gravity dam, and a section of earth berm with a central cast in place concrete cut off wall. The project was designed and built by the Department of National Defense. According to the literature, the original construction took place circa 1958.

Since that time, as the City has grown and water demands have risen, the dam has been raised four times to increase the storage capacity. In recent years, the City of Iqaluit has been pumping additional water into the reservoir in the fall of the year from a river located east of the reservoir.

The first height increase of the concrete dam and berms (0.3m) reportedly took place in 1979. This involved a concrete extension, which was dowelled into the existing structure.

The second height increase of the concrete dam and berms took place in 1985 and increased the height of the spillway structure by approximately 1.15m. The berm portion was widened and heightened as well to accommodate the increased storage capacity of the reservoir. The extension of the concrete dam was constructed of concrete dowelled into the existing structure, and incorporated a steel formwork frame over the spillway section.

The third extension was done in 1995 and increased the height of the concrete structures by a further 1.5m of concrete, with a corresponding increase in berm geometry. Based on analysis done prior to the extension, it was determined that the concrete structures

Lake Geraldine Dam Safety Inspection, August 18, 2021



would not have an adequate factor of safety against overturning if the extension was simply "dowelled-in" as before. The 1995 alteration therefore included an extensive rock-anchoring program for the concrete portions to provide the required stability to the structure.

The latest extension was completed in two phases over 2005/06. Additional rock anchors were installed thought the concrete structures in 2005 in preparation for a further height extension of 2m in 2006. The existing berms were enlarged, and the existing cut-of-walls were extended in height. A new berm (south berm) and cut off wall were installed to the south of the main dam structure.

The last major repair program undertaken was completed in August 2017, various repairs were undertaken to maintain the concrete structures, berms and access roads. These repairs included:

- Placement of additional aggregate material and regrading of the north and south access roads.
- Repair of a sink hole in the south access road.
- Installation of additional riprap/armor stone on the upstream face of the center and north berms.
- Installation of additional aggregate and regrading of the top of the center and north berms.
- Replacement of the expansion joint sealant material on the downstream face of the concrete structures.
- Crack repair and sealing on the downstream face of the concrete structures.

In August 2019 various repairs were undertaken to repair the upstream face (below the water line) of the dam. These repairs included:

- Repair of the expansion joint.
- Polyurethane crack injection.
- Localized concrete repairs.

3. DAM SAFETY INSPECTION

3.1 Site Inspections and Staff Interviews

A visual site inspection of the LG Dam was performed on August 18, 2021 by Nick McMaster of Concentric. The inspection was non-invasive in nature, and did not include an underwater survey or assessment.

A summary of observed conditions is as follows:

- The reservoir level was at the top of the spillway at the time of our review. The water level reported by Environment and Natural Resources Canada was 111.366 m.
- No significant changes were noted in the general condition of the concrete structures.



- Moderate erosion of the stone and gravel was noted at the interface between the north end of the concrete structures and the south end of the center berm (see photograph 3).
- Four minor, localized areas of spalling were observed in the downstream face of the concrete dam (see photograph 5)
- Minor (hairline) cracks were observed in the top face of the concrete dam, these cracks are consistent with our previous inspections (see photograph 6).
- Minor active seepage/leakage was observed within the visible portions of the dam (see photograph 7) at the expansion joints and cracks within the mass of the concrete structure.
- Sealant within the expansion joints on the downstream face of the dam at the lower half of the dam are in poor condition and minor seepage was observed (see photograph 7).
- No active seepage through the berms was observed within the North and south berms (see photograph 8).
- Standing water and minor seepage was noted in the of the valley at the base of the center berm, Environment Canada weather data indicates that intermittent rain fall occurred on and the days preceding up to our site review on August 18. The center berm spans a small valley and typically we see a small amount of seepage at this location. We estimate the flow to have been <2 liters per second which is consistent with historical seepage at this location.
- No significant changes such as sloughing, slides, bulging or displacement were noted in the earthen berms.
- The aggregate stock piles located near the north berm have been replaced.
- Localized erosion within the north access road was observed at the time of our review.
- Displacement of the armor stone/riprap on the upstream face of the north and center berms is continuing. This erosion is consistent with the natural wave action within the reservoir.
- Minor displacement of the stone at the crest of the north and center berms on the upstream face of the berm.
- The valve chamber adjacent to the south side of the concrete spillway was visible at the time of our review. No significant changes were noted in the general condition of the valve chamber structures. We did not inspect or exercise the valve controls. The 2015 DSI identified that the valve controls within the chamber appeared to be in an advanced state of corrosion and it remains unclear if this issue has been addressed and or the valves tested in recent years.

3.2 Dam Safety Analysis

A dam safety analysis was not completed as part of this inspection however, there were no obvious indicators that the concrete structures have had significant changes since the last DSI in July 2021.



3.3 Operation, Maintenance, and Surveillance

This DSI falls under the requirements of a visual inspection by an engineer as stated in Section 3.6 "Surveillance" of the Dam Safety Guide. The lack of a centralized repository of operational and maintenance records has been an ongoing issue. This, along with other issues regarding the operation and maintenance of the dam and reservoir, is noted within the "Dam Safety Management Plan" dated July 16, 2020 and prepared by MECO.

Concentric is not aware of a staffed monitoring system or automated monitoring equipment. This has been previously identified and is still an outstanding issue however, installation of automated monitoring systems to record temperature and water pressure data is scheduled for 2022.

3.4 Recommendations and Required Action

Conditions on site remain consistent with our observations in May and July 2021 however, minor leakage from cracks and the expansion joints within the concrete dam were visible.

Repairs to the access roads and reinstatement of the aggregate stock piles have been completed by the contractor (Tower Construction). Repair of berms and dam are scheduled for late August / September 2021. This work will include the following:

- Installation of additional armor stone/riprap on the upstream side of the berms to replace the material that has been displaced due to wave action.
- Concrete repairs in the downstream face of the concrete dam.
- Crack sealing in the downstream face of the concrete dam.
- Removal and replacement of the sealant installed within the expansion joints on the top and downstream face of the concrete dam.
- Repair and regrading of the top of the center and north berms.
- New signage installed at the two access roads, access ramp to the berms and around the periphery of the LG Dam. Signage should be in all required languages.
- Removal of the temporary guardrail currently installed at the concrete structures.

Based on our inspection and review, we recommend the following:

- 1. Updating of the permanent record file and its storage in a central location with an index that documents the date and contents of all records. The permanent record file needs to include:
 - a) As-built drawings and specification for work undertaken at the dam.
 - b) Weekly/monthly inspections completed by City staff.
 - c) Dam Safety Inspections and Dam Safety Reports generated by third parties on behalf of the City of Igaluit.
 - d) All maintenance records.
 - e) Correspondence with regulatory agencies.
 - f) Dam operation, maintenance and surveillance documents.

Lake Geraldine Dam Safety Inspection, August 18, 2021



- g) Reports and documentation generated by third parties on behalf of the City of Iqaluit.
- 2. Implementation of a monitoring program to record data from the installed network of piezometers and thermistors used to monitor hydrogeologic and thermal environments within the backfill and foundations. This work is tentatively scheduled for implementation in summer of 2022.
- 3. The installation of video surveillance.
- 4. Use and restocking of the aggregate stock piles on site in 2025.
- 5. Exercising and testing of the valves within the valve chamber is required as part of preventative measures. The condition of the valves within the valve chamber at the base of the dam were previously identified as being in an advanced state of corrosion. To our knowledge no maintenance or testing has been completed on the controls valve in the last 5+ years. There is a significant potential for the valves to fail and not operate correctly when needed in an emergency.
- 6. Underwater survey of the concrete dam and spillway in 2022 2023.
- 7. Concrete delamination survey to identify areas of concrete delamination within the downstream portion of the dam structure in 2022.

4. **LIMITATIONS**

This report was prepared for the sole use of the City of Igaluit.

This report was prepared exclusively for the purposed project and site locations outlined in this report. The report is based on information provided to, or obtained by Concentric as indicated in the report, and applies solely to site conditions existing at the time of the site investigations.

The conditions of the site may change over time or may have already changed due to natural forces or human intervention, and Concentric takes no responsibility for the impact that such changes may have on the accuracy or validity of the observations, conclusions and recommendations set out in this report.

The report does not extend to any latent defect or other deficiency which could not have been reasonably discoverable or discovered within the scope of the report. Information supplied by the City of Iqaluit or third parties for use in this report has not been verified by Concentric unless stated otherwise.

Concentric's report represents a review of available information with an established work scope, schedule, and budget. The material in the report reflects Concentric's judgement in light of the information available to it at the time of preparation. Any uses that a third party makes of this report, or any reliance on decisions made based on it, are the responsibilities of such third parties.

Concentric accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made based on this report.

Should there be any questions, please contact the undersigned.



Yours sincerely,

CONCENTRIC

Nick McMaster Technologist Kathleen Perry-Theriault, P.Eng. Project Manager



APPENDIX ASite Photographs





Photograph 1 – Overview of concrete structure.



Photograph 2 – Typical berm condition, center and north berms.





Photograph 3 – Moderate erosion of the earthen berm at the north end of the concrete dam – south end of the center berm.



Photograph 4 – Typical condition of the north access road.





Photograph 5 – Area of minor concrete spalling. North end, downstream face of the concrete dam.



Photograph 6 – Hairline crack in the top face of the concrete dam at the north end.





Photograph 7 – Typical seepage, downstream face of the concrete dam at the south end.



Photograph 8 – Downstream face of the north berm, no active seepage was noted during our site visit.





Photograph 9 – Deteriorated sealant joint on the top surface of the dam along an expansion joint in the south half of dam.





Lake Geraldine Dam Inspection Checklist

Inspector Name: Nick McMaster

Inspection Date: August 18, 2021

Weather: Passing Clouds 8° C

Height of Lake

Geraldine Reservoir: 111.365 m https://wateroffice.ec.gc.ca/report/real_time_e.html?stn=10UH013

General Observations				
Description	Yes	No	Observations	
Snow and Ice Present on dam & berms		x	None	
Snow and Ice Present on the Lake		х	None	
Vandalism and Debris (on site and lake)	x		Typical garbage, empty cans, discarded ATV and Snowmobile parts, various locations	
Gates on Dam Locked (north and south ends on top of concrete dam)	х		Gates on north and south end of dam locked.	
Gates and Fencing Intact and Secure (north and south ends on top of concrete dam)	Х		Gates and fencing secured to dam structure.	
North Access Road Gate Secured	х		Gate closed and locked.	
South Access Road Gate Secured		х	Gate open.	
Dam Signage in good condition		х	Sign in poor condition at south berm. Sign in poor condition at base of access ramp to center/ north berm.	





Valve Chamber Condition and Damage (Indicate if there is any cracking, displacement, physical damage, cover is in place, etc)		х	Hairline cracks noted.			
Concrete Dam and Spillway						
Description		No	Observations			
Cracking / Spalling present on top (surface) of Dam (Indicate if new, existing or expanded)		x	No missing or spalled sections of concrete observed. 3 cracks noted extending downstream and upstream sides @ north end 2 cracks noted extending downstream and upstream sides @ south end			
Cracking / Spalling present on Upstream (surface) of Dam (Indicate if new, existing or expanded)		x	No missing or spalled sections of concrete observed on visible surfaces of dam face. 3 cracks @ north end (see above)			
Cracking / Spalling present on Downstream (surface) of Dam (Indicate if new, existing or expanded)	х		Localized areas of minor deteriorated/cracked concrete observed throughout. Recommend a survey to establish quantities. See above. 4 localized spalled areas noted north of J1, no delamination present			
Active leakage through dam (Indicate location and rate of leakage in liters per minute)	х		Leakage observed at bottom of expansion joint J5. Seepage @ some cracks, see photos.			
Sealant in good condition – Top of Dam	х		J6 – debonded, J5 – cohesive failure, J4 – cohesive failure J3, J2, J1 not visible due to water in spillway			
Sealant in good condition – Upstream of Dam	х		None below water line. Filled with crack injection in 2019, see photos.			
Sealant in good condition – Downstream of Dam		х	Pour Condition. Sections missing. Recommend replacement of sealant.			





Active leakage at Interface Between Concrete and Ground	х		Leaking at J5.		
Displacement or Misalignment of Sections of Dam		х	No displacement observed.		
		N	North Berm		
Description Yes No Observations					
Depressions or Sink Holes on Top of Berm	х		A few localized depression/ sink holes.		
Rock, Gravel or Aggregate Displacement or Washout of Berm Top Face	х		Localized areas of minor washout.		
Rock, Gravel or Aggregate Displacement or Washout of Berm Upstream Face	х		Rip rap too steep above waterline. Height of rip rap approx. 1 foot lower. Various pockets washed out (rip rap).		
Rock, Gravel or Aggregate Displacement or Washout of Berm Downstream Face		х	No apparent rock, gravel or aggregate displacement of berm observed.		
Wet Area or Active Leakage on Downstream Side of Berm	х		water present at base of berm. Source unknown. Puddle noted but no obvious flow from lake.		
		С	enter Berm		
Description	Yes	No	Observations		
Depressions or Sink Holes on Top of Berm	х		A few localized depression/ sink holes.		
Rock, Gravel or Aggregate Displacement or Washout of Berm Top Face	х		Localized areas of minor washout.		





Rock, Gravel or Aggregate Displacement or Washout of Berm Upstream Face	x		Rip rap too steep above waterline. Height of rip rap approx. 1 foot lower.		
Rock, Gravel or Aggregate Displacement or Washout of Berm Downstream Face		x	No apparent rock, gravel or aggregate displacement of berm observed.		
Wet Area or Active Leakage on Downstream Side of Berm	х		water present at base of berm. Source unknown.		
South Berm					
Description	Yes	No	Observations		
Depressions or Sink Holes on Top of Berm		x			
Rock, Gravel or Aggregate Displacement or Washout of Berm Top Face		х			
Rock, Gravel or Aggregate Displacement or Washout of Berm Upstream Face		×			
Rock, Gravel or Aggregate Displacement or Washout of Berm Downstream Face		x			
Wet Area or Active Leakage on Downstream Side of Berm		х			





Additional Comments and Observations		



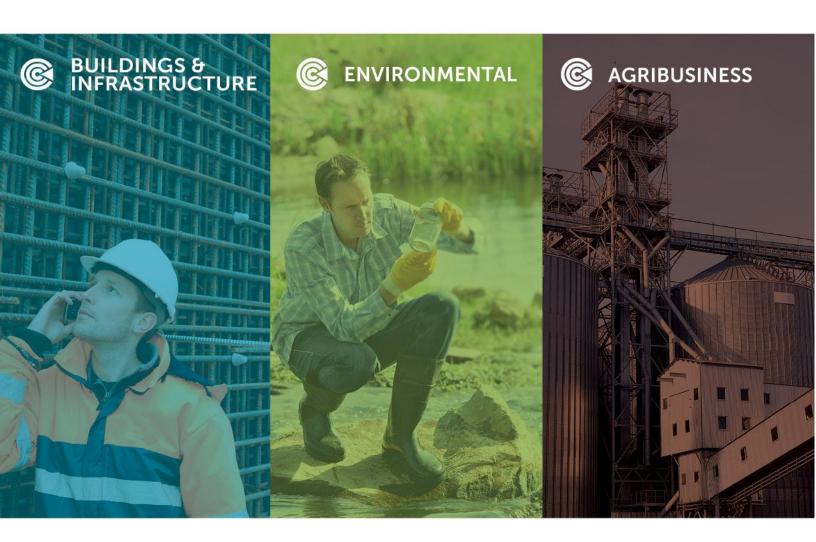


Lake Geraldine Dam Location Plan





concentriceng.com



Lake Geraldine Dam
Dam Safety Inspection 2021 #4
IQALUIT, NUNAVUT

PRODUCED FOR: THE CITY OF IQALUIT

C/O COLLIERS PROJECT LEADERS

PRODUCED BY: CONCENTRIC ASSOCIATES INTERNATIONAL INCORPORATED

CONCENTRIC REFERENCE NUMBER: 21-9162

DATE: SEPTEMBER 16, 2021



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Appendix A: Site Photographs

Appendix B: Lake Geraldine Dam Inspection Checklist



1. INTRODUCTION AND SCOPE OF WORK

This Dam Safety Inspection (DSI) of the Lake Geraldine Dam (LG Dam) has been prepared for the City of Iqaluit (City). As the owner of the LG Dam, the City of Iqaluit is responsible for its safe management. The purpose of this DSI is to assist the City by identifying any visual changes in the condition of the LG Dam, identifying any new concerns, and making recommendations on maintenance, repairs, or further investigations. The DSI was undertaken on September 16, 2021 by Allan Murray, P. Eng. of Concentric.

1.1 Dam Safety Guidelines

The most recent Dam Safety Guidelines (DSG), published by the Canadian Dam Association, were first released in 2007 and further revised in 2013. The DSG applies, in general, to those structures that are at least 2.5 meters in height, and which have at least 30,000 cubic meters of storage capacity. The LG Dam exceeds these minimum requirements and therefore requires annual DSI's. The DSI is considered to be an Engineering Inspection which is recommended by the DSG to be performed annually or semi-annually by a professional engineer. A Dam Safety Reviews (DSR) is required at a minimum, every 5 years. The most recent DSR was performed in 2019.

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The 15.3m wide spillway has an upper elevation of 111.1 m (representing the current maximum operating level of the reservoir), while the concrete dam sections on either side of the spillway have an elevation of 112.3 m. At the maximum operating level of the reservoir, the concrete dam has approximately 0.95 m of freeboard.

The southern section of the concrete dam extends approximately 39.1 m to the south rock abutment. The northern section of the concrete dam extends 13.3 m to the north of the spillway section, where it joins the center earth berm.

The center earth berm extends north approximately 75m where it meets the access ramp and north access road. The north earth berm is located to the north of the access road ramp and extends 60m to the north rock abutment.

The south earth berm is a separate structure that is located in a valley to the south of the main concrete dam. The south berm is approximately 68.5m long. The berm sections of the dam incorporate a concrete cutoff wall which is reportedly founded in rock.



Site Plan



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In the late 1950's, the demand for a reliable year-round source of water resulted in the construction of a cast in place concrete gravity dam, and a section of earth berm with a central cast in place concrete cut off wall. The project was designed and built by the Department of National Defense. According to the literature, the original construction took place circa 1958.

Since that time, as the City has grown and water demands have risen, the dam has been raised four times to increase the storage capacity. In recent years, the City of Iqaluit has been pumping additional water into the reservoir in the fall of the year from a river located east of the reservoir.

The first height increase of the concrete dam and berms (0.3m) reportedly took place in 1979. This involved a concrete extension, which was dowelled into the existing structure.

The second height increase of the concrete dam and berms took place in 1985 and increased the height of the spillway structure by approximately 1.15m. The berm portion was widened and heightened as well to accommodate the increased storage capacity of the reservoir. The extension of the concrete dam was constructed of concrete dowelled into the existing structure, and incorporated a steel formwork frame over the spillway section.

The third extension was done in 1995 and increased the height of the concrete structures by a further 1.5m of concrete, with a corresponding increase in berm geometry. Based on analysis done prior to the extension, it was determined that the concrete structures



would not have an adequate factor of safety against overturning if the extension was simply "dowelled-in" as before. The 1995 alteration therefore included an extensive rock-anchoring program for the concrete portions to provide the required stability to the structure.

The latest extension was completed in two phases over 2005/06. Additional rock anchors were installed thought the concrete structures in 2005 in preparation for a further height extension of 2m in 2006. The existing berms were enlarged, and the existing cut-of-walls were extended in height. A new berm (south berm) and cut off wall were installed to the south of the main dam structure.

The last major repair program undertaken was completed in August 2017, various repairs were undertaken to maintain the concrete structures, berms and access roads. These repairs included:

- Placement of additional aggregate material and regrading of the north and south access roads.
- Repair of a sink hole in the south access road.
- Installation of additional riprap/armor stone on the upstream face of the center and north berms.
- Installation of additional aggregate and regrading of the top of the center and north berms.
- Replacement of the expansion joint sealant material on the downstream face of the concrete structures.
- Crack repair and sealing on the downstream face of the concrete structures.

In August 2019, various repairs were undertaken to repair the upstream face (below the water line) of the dam. These repairs included:

- Repair of the expansion joint.
- Polyurethane crack injection.
- Localized concrete repairs.

In August and September 2021, various repairs were undertaken to maintain the concrete structures, berms, and access roads. These repairs included:

- Placement of additional aggregate material and regrading of the north access road.
- Installation of additional rip rap on the upstream face of the north, center, and south berms.
- Installation of new granular fill atop north, center, and south berms.
- Polyurethane crack injection on the downstream side of the concrete dam.
- Repair of washout between concrete structure and center beam.
- Replacement of on site stock pile rip rap, granular material and medium size fill.
- Localized concrete repairs on the downstream side of the concrete dam.
- Supply and install new permanent signage (not complete at the time of this report).



3. DAM SAFETY INSPECTION

3.1 Site Inspections and Staff Interviews

A visual site inspection of the LG Dam was performed on September 16, 2021 by Allan Murray, P. Eng. of Concentric. The inspection was non-invasive in nature, and did not include an underwater survey or assessment.

A summary of observed conditions is as follows:

- The reservoir level was at the top of the spillway at the time of our review. The water level reported by Environment and Natural Resources Canada was 111.296 m (see photograph 1 & 2).
- No significant changes were noted in the general condition of the concrete structures (see photograph 3 & 4).
- Typical litter and refuse was noted throughout the site.
- The south access gate atop the concrete dam has some minor damage, the chain link fencing will need minor repairs at the top of the fence (see photograph 5)
- Four minor, localized areas of spalling were observed in the downstream face of the concrete dam (noted in our previous inspection).
- Minor active seepage/leakage was observed within the visible portions of the dam (see photograph 6) at the expansion joints and cracks within the mass of the concrete structure.
- Sealant within the expansion joints on the downstream face of the dam at the lower half of the dam are in poor condition and minor seepage was observed (see photograph 7).
- Active leakage was observed at the interface between the concrete and the ground at the south end of the concrete dam structure (see photograph 8 & 9).
- A small amount of standing water was noted on the south side of the access ramp (north access road), at the base of the center berm. Environment Canada weather data indicates that intermittent rain fall occurred on and the day preceding our site review on September 16, 2012. There did not appear to be any active flow which would suggest that this pooling of moisture at this location is an accumulation of rain water. This item will be re-assessed in future site inspections (see photograph 10).
- No active seepage through the berms was observed within the North and south berms (see photograph 11 & 12).
- The edge of the roadway atop the north berm is susceptible to erosion on the downstream (west) slope of the berm (see photograph 13).
- The edge of the roadway atop the center berm is susceptible to erosion on the downstream (west) slope of the berm (see photograph 14).
- No significant changes such as sloughing, slides, bulging or displacement were noted in the earthen berms.
- The valve chamber adjacent to the south side of the concrete spillway was visible at the time of our review. No significant changes were noted in the general condition



of the valve chamber structures. We did not inspect or exercise the valve controls. The 2015 DSI identified that the valve controls within the chamber appeared to be in an advanced state of corrosion and it remains unclear if this issue has been addressed and or the valves tested in recent years.

3.2 Dam Safety Analysis

A dam safety analysis was not completed as part of this inspection however, there were no obvious indicators that the concrete structures have had significant changes since the last DSI in August 2021.

3.3 Operation, Maintenance, and Surveillance

This DSI falls under the requirements of a visual inspection by an engineer as stated in Section 3.6 "Surveillance" of the Dam Safety Guide. The lack of a centralized repository of operational and maintenance records has been an ongoing issue. This, along with other issues regarding the operation and maintenance of the dam and reservoir, is noted within the "Dam Safety Management Plan" dated July 16, 2020 and prepared by MECO.

Concentric is not aware of a staffed monitoring system or automated monitoring equipment. This has been previously identified and is still an outstanding issue however, installation of automated monitoring systems to record temperature and water pressure data is scheduled for 2022. Training of City staff on the visual inspection and monitoring of the dam is tentatively scheduled in 2022.

3.4 Recommendations and Required Action

Conditions on site remain consistent with our observations in May, July, and August 2021 however, minor leakage from cracks and the expansion joints within the concrete dam were visible.

Repairs to the access roads and reinstatement of the aggregate stock piles along with repair of berms and dam were completed in August 2021. Installation of the new signage and repair of the sealant material is scheduled to be completed in September 2021.

Based on our inspection and review, we recommend the following:

- 1. Updating of the permanent record file and its storage in a central location with an index that documents the date and contents of all records. The permanent record file needs to include:
 - a) As-built drawings and specification for work undertaken at the dam.
 - b) Weekly/monthly inspections completed by City staff.
 - c) Dam Safety Inspections and Dam Safety Reports generated by third parties on behalf of the City of Iqaluit.
 - d) All maintenance records.
 - e) Correspondence with regulatory agencies.
 - f) Dam operation, maintenance and surveillance documents.



- g) Reports and documentation generated by third parties on behalf of the City of Iqaluit.
- 2. Implementation of a monitoring program to record data from the installed network of piezometers and thermistors used to monitor hydrogeologic and thermal environments within the backfill and foundations. This work is tentatively scheduled for implementation in summer of 2022.
- 3. The installation of video surveillance. While it may be difficult and costly to install and implement a video surveillance program given the site conditions at the LG Dam, video surveillance is the most important element of a dam safety program and is recommended by the 2013 Dam Safety Guidelines.
- 4. Use and restocking of the aggregate stock piles on site as required.
- 5. Exercising and testing of the valves within the valve chamber is required as part of preventative measures. The condition of the valves within the valve chamber at the base of the dam were previously identified as being in an advanced state of corrosion. To our knowledge no maintenance or testing has been completed on the controls valve in the last 5+ years. There is a significant potential for the valves to fail and not operate correctly when needed in an emergency.
- 6. Underwater survey of the concrete dam and spillway in 2022 2023.
- 7. Concrete delamination survey to identify areas of concrete delamination within the downstream portion of the dam structure in 2022.
- 8. Flattening of the downstream slope and installation of rip rap on the downstream slope on the north and central berms to reduce the risk of erosion of the roadway atop the berms.

4. **LIMITATIONS**

This report was prepared for the sole use of the City of Iqaluit.

This report was prepared exclusively for the purposed project and site locations outlined in this report. The report is based on information provided to, or obtained by Concentric as indicated in the report, and applies solely to site conditions existing at the time of the site investigations.

The conditions of the site may change over time or may have already changed due to natural forces or human intervention, and Concentric takes no responsibility for the impact that such changes may have on the accuracy or validity of the observations, conclusions and recommendations set out in this report.

The report does not extend to any latent defect or other deficiency which could not have been reasonably discoverable or discovered within the scope of the report. Information supplied by the City of Iqaluit or third parties for use in this report has not been verified by Concentric unless stated otherwise.

Concentric's report represents a review of available information with an established work scope, schedule, and budget. The material in the report reflects Concentric's judgement in light of the information available to it at the time of preparation. Any uses that a third party makes of this report, or any reliance on decisions made based on it, are the responsibilities of such third parties.



Concentric accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made based on this report.

Should there be any questions, please contact the undersigned.

Yours sincerely,

CONCENTRIC

Allan Murray, P.Eng President Kathleen Perry-Theriault, P.Eng. Project Manager



APPENDIX ASite Photographs



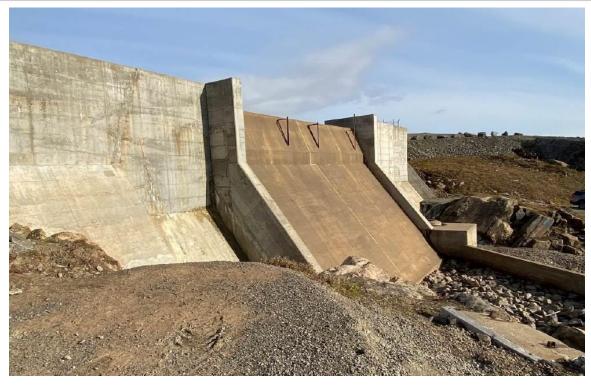


Photograph 1 – Overview of upstream concrete section, looking northwest.



Photograph 2 – Overview of upstream concrete section, looking southeast.





Photograph 3 – Overview of downstream concrete section, looking southeast.



Photograph 4 – Overview of downstream concrete section, looking northwest.





Photograph 5 – South Access Gate locked and signage in place, damaged fence wire.



Photograph 6 – Two area of minor seepage. Downstream (west) face of the concrete dam.





Photograph 7 – Deteriorated sealant and leakage within concrete dam structure, leakage location L1.



Photograph 8 – Partial elevation at south end of concrete structure, leakage location at arrow.





Photograph 9 – Partial elevation at south end of concrete structure, leakage location at arrow.



Photograph 10 – Area with a small amount of water on the south side of the access ramp, base of center berm.





Photograph 11 – Overview of south beam, looking northwest.



Photograph 12 – North and center berms and north access road ramp, looking southeast.





Photograph 13 – North beam looking northwest, edge of roadway susceptible to erosion.



Photograph 14 – Overview of center berm, note steel slope and edge of roadway susceptible to erosion.



APPENDIX B

Lake Geraldine Dam Inspection Checklist



Lake Geraldine Dam Inspection Checklist

Inspector Name: ADM

Inspection Date: September 16 2021

Weather: Mix of Sun/Cloud +7C

Height of Lake

Geraldine Reservoir: Within Approx. 50mm of Spillway

https://wateroffice.ec.gc.ca/report/real_time_e.html?stn=10UH013

	General Observations					
Description	Yes	No	Observations			
Snow and Ice Present on dam & berms		х				
Snow and Ice Present on the Lake		х				
Vandalism and Debris (on site and lake)	х		Typical Litter and Refuse			
Gates on Dam Locked (north and south ends on top of concrete dam)	х					
Gates and Fencing Intact and Secure (north and south ends on top of concrete dam)	х		Minor fence repairs required, south gate.			
North Access Road Gate Secured	х		Gate closed and locked.			
South Access Road Gate Secured		x	Gate open.			
Dam Signage in good condition		x	Sign in poor condition at south berm. Sign in poor condition at base of access ramp to center/ north berm.			



Valve Chamber Condition and Damage (Indicate if there is any cracking, displacement, physical damage, cover is in place, etc)		x	No significant deterioration observed.			
Concrete Dam and Spillway						
Description Yes No Observations						
Cracking / Spalling present on top (surface) of Dam (Indicate if new, existing or expanded)		х				
Cracking / Spalling present on Upstream (surface) of Dam (Indicate if new, existing or expanded)		х				
Cracking / Spalling present on Downstream (surface) of Dam (Indicate if new, existing or expanded)	х		Similar to previous observations.			
Active leakage through dam (Indicate location and rate of leakage in liters per minute)	х		Leakage observed at 2 locations.			
Sealant in good condition – Top of Dam	х		Fair - good condition			
Sealant in good condition – Upstream of Dam	х		Fair - good condition			
Sealant in good condition – Downstream of Dam		х	Pour Condition. Sections missing. Recommend replacement of sealant.			



Active leakage at Interface Between Concrete and Ground	х		Observed at 1 Location (same leakage location for many years).
Displacement or Misalignment of Sections of Dam		х	No displacement observed.
			North Berm
Description	Yes	No	Observations
Depressions or Sink Holes on Top of Berm		x	
Rock, Gravel or Aggregate Displacement or Washout of Berm Top Face		х	Road edge susceptible to erosion/washout.
Rock, Gravel or Aggregate Displacement or Washout of Berm Upstream Face		x	
Rock, Gravel or Aggregate Displacement or Washout of Berm Downstream Face		x	Road edge susceptible to erosion/washout.
Wet Area or Active Leakage on Downstream Side of Berm	х		Surface water present at base of berm 1 location
			Center Berm
Description	Yes	No	Observations
Depressions or Sink Holes on Top of Berm		x	
Rock, Gravel or Aggregate Displacement or Washout of Berm Top Face		х	Road edge susceptible to erosion/washout.



Rock, Gravel or Aggregate Displacement or Washout of Berm Upstream Face		х	
Rock, Gravel or Aggregate Displacement or Washout of Berm Downstream Face		х	Road edge susceptible to erosion/washout.
Wet Area or Active Leakage on Downstream Side of Berm	х		Surface water present at base of roadway south of berm, 1 location.
		L	South Berm
Description	Yes	No	Observations
Depressions or Sink Holes on Top of Berm		x	
Rock, Gravel or Aggregate Displacement or Washout of Berm Top Face		х	
Rock, Gravel or Aggregate Displacement or Washout of Berm Upstream Face		х	
Rock, Gravel or Aggregate Displacement or Washout of Berm Downstream Face		х	
Wet Area or Active Leakage on Downstream Side of Berm		х	



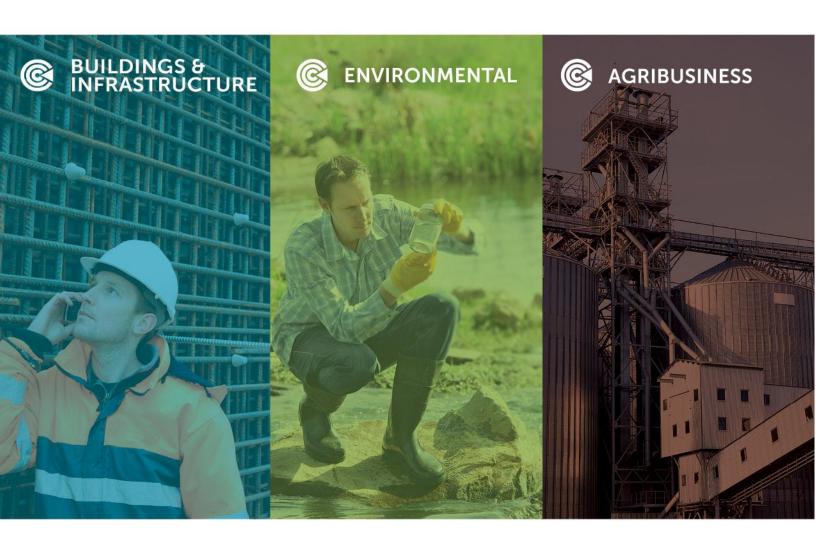
Additional Comments and Observations



APPENDIX B DAM SAFETY REVIEW



concentriceng.com



LAKE GERALDINE DAM
2021 DAM SAFETY REVIEW
IQALUIT, NUNAVUT

PRODUCED FOR: THE CITY OF IQALUIT

PRODUCED BY: CONCENTRIC ASSOCIATES INTERNATIONAL INCORPORATED

CONCENTRIC REFERENCE NUMBER: 21-9162

DATE: OCTOBER 14, 2021

The City of Iqaluit

Lake Geraldine Dam - 2021 Dam Safety Review



EXECUTIVE SUMMARY

In April 2021, Concentric was retained by the City of Iqaluit to prepare a Dam Safety Review (DSR) for the Lake Geraldine Dam.

On site visual inspection and review of the Lake Geraldine Dam and Berms (LG Dam) was undertaken during the period of May through September 2021 in general accordance with the Dam Safety Guidelines (*DSG*), 2013 edition, prepared by the Canadian Dam Association.

The most recent Risk Assessment performed by MECO has determined that the dam's previous classification of "very high" consequence was not adequate. An "extreme" dam classification was determined given the potential for loss of life in the event of a dam failure.

As a result of the DSR, the following recommendations have been made regarding Lake Geraldine Dam:

- 1. Conduct a Dam Safety Review (DSR) in 2026.
- 2. Update Permanent Record File, Logbook and Operation and Surveillance Manual.
- 3. Review EPP and ERP, issue to local authorities, and update the list of EPP document holders. Provide training to personnel and external responders. See Appendix B for a single page summary of the roles and responsibilities.
- 4. Conduct concrete delamination survey of downstream portion of the concrete dam.
- 5. Perform crack injection and sealant repairs in 2022.
- 6. Conduct an underwater inspection of the submerged portion of the concrete dam in 2023.
- 7. Increase the height of the concrete core wall within the earthen berms by an estimated 0.3 m.
- 8. Raise the crest of the south, center, and north berms by 1.0 m.
- 9. Install small weirs at known weep locations in an effort to record flow rates of piping through the earthen berms/concrete dam.
- 10. Route the warm water return line into the reservoir at the spillway and infuse the discharged water with air to mitigate potential ice loading of the dam.
- 11. Install porous water sensors (piezometers) and data loggers and implement a monitoring system to record temperature and water pressure data in 2022.
- 12. Install survey monuments and implement a biannual survey program.
- 13. Install remote surveillance cameras.
- 14. Conduct a Dam Safety Inspection (DSI) yearly.



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Lake Geraldine Dam - 2021 Dam Safety Review



1. INTRODUCTION & SCOPE OF WORK

In accordance with the Canadian Dam Association publication *Dam Safety Guidelines* (DSG), published in 1999, significant modifications to the Lake Geraldine Dam in 2005 triggered the requirement for a Dam Safety Review (DSR) in 2006. Since the 2006 DSR, no significant modifications have been made. This DSR has been prepared because of the requirement of the 1999 DSG to conduct a DSR every five (5) years.

The 1999 DSG has since been superseded by the 2007 DSG, which was revised once more in 2013. The DSG applies, in general, to those structures that are at least 2.5 meters in height and which have at least 30,000 cubic meters of storage capacity. The Lake Geraldine Dam exceeds both of these minimums.

The DSG document is far reaching in terms of applicability and requirements for conformance. This is understandable as the type and complexity of structures that fall under the jurisdiction of the document varies considerably, from relatively small and simple berms or dikes to massive and complex dams associated with potable water supply, hydroelectric generating facilities, irrigation, flood control, etc.

The DSG requires that all structures exceeding the height and volume minimums described above be classified according to their "consequence category", that is, the consequence of dam failure in terms of incremental loss of life, environmental and cultural values, and infrastructure and economics. The category assigned ranges from Low to Extreme. The consequence category dictates the requirement and frequency of Dam Safety Reviews.

A Dam Safety Review (DSR) is a formal review process, conducted at regular intervals, that involves completion of items in accordance with the Dam Safety Guidelines. The DSR forms part of the record documentation of the history, condition, repairs, alterations, monitoring, operating, safety, and emergency procedures.

The frequency of DSR's varies depending on potential consequences of dam failure, the presence of changes in external hazards, the result of surveillance, and the demonstrated performance. For dam structures where there are significant implications for population at risk, loss of life, incremental environmental and cultural values, and infrastructure and economical losses, the frequency of DSR's will increase.

It is required in the DSG document that, in the interval between DSR's, a Dam Safety Inspection (DSI) be performed on an annual basis. The DSI comprises a visual inspection to identify any changes in condition, or any observed concerns.

Lake Geraldine Dam - 2021 Dam Safety Review



The results of the DSI are incorporated into the DSR documentation. A DSI may trigger repairs, or changes in standard operating procedures.

The level of detail required to conduct a DSR is influenced by several factors as follows:

- Basis of previous assessments.
- Complexity of the dam.
- · Continuity of surveillance and records.
- Internal and external hazards.
- Operating history.
- Dam performance and age.
- Need for public protection during operation.
- Safeguarding of the potable water supply.

A summary of the methodology to complete the work is presented below:

- 1. Acquisition and assembly of chronological documentation, including but not limited to:
 - Design Documents.
 - Repair Specifications.
 - Past Condition Assessment Reports, including past DSIs and DSRs.
 - Records of Alteration.
- 2. Review of all available record documentation.
- 3. Perform a site inspection to assess the current condition of the structures. No invasive work was performed; the condition assessment was visual in nature.
- 4. Interview maintenance and management personnel as required and appropriate.
- 5. Review the DSR requirements.
- 6. Submit the DSR report.

2. HISTORY & BACKGROUND

2.1 Reservoir

The City of Iqaluit derives its potable water supply from Lake Geraldine, which is retained by a structure consisting of a cast in place concrete gravity dam incorporating a spillway section and a cast in place concrete

The City of Iqaluit

Lake Geraldine Dam - 2021 Dam Safety Review



cut-off wall and berms. All concrete structures are reported to be founded on rock and engage rock at their abutments.

Lake Geraldine is a natural body of water in an irregularly shaped basin. It is fed by rainfall and snow/ice melt from a watershed with an area of approximately 385 hectares.

2.2 History

In the late 1950's, the demand for a reliable year-round source of water resulted in the construction of a cast in place concrete gravity dam and a section of earth berm with a central cast in place concrete cut off wall. The project was designed and built by the Department of National Defense. According to the literature, the original construction took place circa 1958.

Since that time, as the City has grown and water demands have risen, the dam has been raised four times to increase the storage capacity.

The first height increase of 0.3m reportedly took place in 1979. This involved a concrete extension, which was dowelled into the existing structure.

The second increase took place in 1985 and increased the height of the spillway structure by approximately 1.15m. The berm portion was widened and heightened as well to accommodate the increased storage capacity. Again, the extension was constructed of concrete dowelled into the existing structure and incorporated a steel formwork frame over the spillway section.

The third extension was done in 1995 and increased the height of the gravity dam structure by a further 1.5m of concrete, with a corresponding increase in berm geometry. Based on analysis done prior to the extension, it was determined that the gravity dam would not have an adequate factor of safety against overturning if the extension was simply "dowelled-in" as before. The 1995 alteration therefore included an extensive rock-anchoring program for the gravity dam portion to provide the required stability to the structure and resistance to overturning.

The latest extension was completed in two phases over 2005/06. Additional rock anchors were installed thoughout the gravity dam in 2005 in preparation for a further height extension of 2m in 2006. The existing berms were enlarged and the existing cut-of-walls were

Lake Geraldine Dam – 2021 Dam Safety Review



extended in height. A new (south) berm and cut off wall were installed to the south of the existing dam structures.

In the time span of the available historical data, which extends back to 1984, there have been numerous events relating to the safety and serviceability of the dam structures.

In the following chronological summary, record documents have been referenced. After each reference, a number appears in parenthesis. That number corresponds to tabulated record document numbers in Section 2.4, where details are provided on the document source.

- In November 1984, joint and patch repairs were made to localized areas on the upstream side of the spillway structure by diving contractors. Reporting was minimal.
- In June 1990, an inspection report (4) of the structure by diving contractors was made following construction blasting. The 1984 repair areas were also assessed. The 1984 repairs were noted to have generally deteriorated. No conclusions were made. Reporting was minimal.
- In June 1990, a visual inspection report (5) was prepared for the City by an engineering consultant, as a result of the construction blast. No significant damage was noted, and no recommendations were made for repair.
- In July 1990, a dam inspection and stability report (6, 7) was conducted for the City by an engineering consultant. Recommendations were made regarding repair of leaking joints, and provisions to increase stability should the dam be raised in the future.
- In September 1990, a diving contractor performed crack repairs and prepared an inspection report (8). Repair material used was oakum. These repairs appeared to generally address areas observed in the June 1990 diving inspection. Reporting was minimal.
- In October 1997, a visual inspection report (11) was prepared for the City by an engineering consultant. Leaking cracks were identified; however, these were not viewed as being structurally significant. It was recommended that leaking cracks be chemically grouted. This work was not done.
- In June 1998, a study (12) was prepared for the Department of Public Works by an engineering consultant to assess the hydrological impact of a dam failure on a proposed downstream hospital site.
- A diving inspection was reportedly carried out in 1999. A report was not submitted. A video record was provided. The video provides images of the water intake, but no record of the condition of the dam.



- In 2001, a DSR (13) was conducted for the Lake Geraldine Dam and Sewage Lagoon.
- In 2002, the dam was visually assessed, a diving inspection performed, and a DSI (14) was prepared, which cited the need for grouting repairs to actively leaking cracks.
- In 2003, grouting repairs were undertaken (15), primarily to seal actively leaking cracks, including a larger flow crack on the south transition of spillway and gravity sections. A DSI report was prepared.
- A geotechnical report was completed in 2005 prior to the vertical expansion (17).
- A DSI report (20, 21) was prepared in 2005 and 2006.
- A DSR (22) was conducted in 2006 because of the modifications (vertical extension) to the Lake Geraldine Dam in 2005 and 2006
- No DSIs were conducted in 2007 or 2008.
- DSIs (26, 28, 31, and 32) were conducted in 2009, 2010, 2011 and 2012.
- An underwater survey (27) was conducted in 2010.
- An Inundation Study for the Emergency Preparedness Plan was conducted in 2011/2012.
- Grouting repairs (30) were completed in 2011.
- Repairs to the North Berm (33) were conducted in 2012 due to a washout event in 2010.
- In August 2012, Concentric provided periodic monitoring of water accumulation areas on both sides of the vehicle access ramp. These areas were initially identified in 2010.
- In 2011 and 2012, Concentric investigated the suspect areas and conducted limited invasive openings to determine if a source was the 2006 cut-off wall interface. These investigations were inconclusive.
- In August 2012, monitoring confirmed little or no water accumulation in summer months. The water accumulations were most evident in late winter and early spring.
- In June 2013, Concentric prepared a scope of work for a proposed 12 month monitoring term, commencing August 2013.
- DSI was conducted in 2014.
- An underwater survey was conducted in 2014.
- DSIs were conducted in 2015 and 2017.
- Repairs to the dam and berms were completed in August/September 2017. This work included:
 - Regrading and repairs to the north and south access road.



- Regrading and repairs to the center and north berms.
- Installation of new rip-rap material on the upstream face of the center berm.
- Installation of new rip-rap material downstream of the spillway.
- Localized crack sealing in the concrete dam.
- Localized concrete repairs.
- Localized sealant replacement on the top and downstream face of the concrete dam.
- In the summer of 2019, repairs to the upstream face of the dam were completed, this work included:
 - Localized injection repairs.
 - Localize concrete repairs.
- A number of engineering studies and reports on the LG Dam were commissioned in 2020, this documentation included:
 - Emergency Response Plan.
 - Dam Safety Management Plan.
 - Technical Analysis & Risk Assessment.
 - Operation, Maintenance & Surveillance Manual.
- In the summer of 2020, borehole monitoring stations were installed at 11 locations within the south, center, and north berms and concrete dam. This work included the installation of temperature monitoring sensors in 7 of the boreholes. The remaining boreholes were installed for piezometers to monitor water pressure. Installation of the piezometers and sensor data loggers are tentatively scheduled for summer 2022.
- A DSI report was prepared in 2020.
- Repairs to the dam and berms were completed in August/September 2021. This work included:
 - Regrading and repairs to the north access road.
 - Regrading and repairs to the center and north berms.
 - Installation of new rip-rap material on the upstream face of the center berm.
 - Localized crack injection on the downstream side of the concrete dam.
 - Localized concrete repairs.

2.3 Description of Structure

The dam is comprised of a concrete section (incorporating a concrete spillway) and earth berms to the north and south. The 15.3m wide



spillway has an upper elevation of 111.33m (the new operating level of the reservoir) while the concrete sections on either side of the spillway have an elevation of 112.28 m. At the operating level of the reservoir, the concrete dam has approximately 0.95 m of freeboard.

The southern section of the concrete dam extends approximately 39.1 m to the south rock abutment. The northern section of the concrete dam extends 13.3 m to the north of the spillway section, where it joins the south end of the center earth berm. The north berm extends approximately 135 m to the north rock abutment. A new earth (south) berm (approximately 68.5m long) was installed in a valley to the south of the existing structures in 2006. The berm sections of the dam incorporate a concrete cutoff wall which is reportedly founded in rock and has an upper elevation of 112.30 m (approximately 0.97m of freeboard). The concrete section of the dam is also reportedly founded in rock.

2.4 Relevant Record Documents

The following is a record of historical documentation and has been referenced in the preparation of this report.

TABLE I
RELEVANT RECORD DOCUMENTATION
LAKE GERALDINE DAM

No.	Date	Description	Author
1	December 1957	Water Storage Dam at Lake Geraldine (3 Drawings)	DND
2	August 1984	Lake Geraldine Water Supply Report	OMM
3	January 1985	Water Supply Improvement Report	OMM
4	June 1990	General Diving Report	Arctic Divers
5	June 1990	Dam Inspection for Blast Damage	Hardy BBT
6	July 1990	Dam Inspection & Leakage Repair	Acres
7	July 1990	Dam Stability	Acres
8	September 1990	Diving Report	Arctic Divers
9	February 1995	Lake Geraldine Storage Report	OMM
10	June 1995	Lake Geraldine Storage Design Drawings & Specifications	ОММ
11	October 1997	Dam Inspection	Trow
12	June 1998	Dam Failure Study	EBA
13	March 2001	Dam Safety Review	Trow
14	October 2002	Dam Safety Inspection	Trow
15	August 2003	Lake Geraldine Dam Repairs 2003	Dillon
16	2003	Dam Safety Inspection	Concentric
17	March 2005	Geotechnical Investigation	Trow
18	May 2005	Lake Geraldine Dam Rock Anchors 2005 (Specifications and 4 Drawings)	Trow
19	February 2006	Lake Geraldine Dam Earth and Concrete Work 2006 (Specifications and 11 Drawings)	Trow
20	2005	Dam Safety Inspection	Concentric
21	2006	Dam Safety Inspection	Concentric
22	December 2006	Dam Safety Review	Concentric



No.	Date	Description	Author
23	2007	Permanent Record File (PRF)	Concentric
24	2007	Operations, Maintenance, and Surveillance (OMS) Manual	Concentric
25	2007	Logbook	Concentric
26	October 2009	Dam Safety Inspection	Concentric
27	August 2010	Underwater Survey	Concentric
28	November 2010	Dam Safety Inspection	Concentric
29	February 2011	Permanent Record File Update	Concentric
30	August 2011	Grouting Repairs	Concentric
31	September 2011	Dam Safety Inspection	Concentric
32	July 2012	Dam Safety Inspection	Concentric
33	September 2012	North Berm Repairs	Concentric
34	2012	Emergency Preparedness Plan (EPP)	Others
35	2013	DSI and DSR	Concentric
35	October 2014	Dam Safety Inspection	McMillen
36	November 2015	Dam Safety Inspection	Concentric
37	July 2017	Lake Geraldine Dam Repair Program 2017	Concentric
38	July 2018	Emergency Preparedness Plan (EPP) Issued	AMEC
39	August 7, 2018	PRF Update	Concentric
40	August 29, 2018	DSI	Concentric
41*	August 2019	Lake Geraldine Dam Repair Program 2019	Concentric
42*	July 16, 2020	Lake Geraldine Dam Operations Manual and Surveillance Manual	Meco
43*	July 16, 2020	Technical Analysis and Risk Assessment, Lake Geraldine Dam	Meco
44*	July 16, 2020	Emergency Response Plan for Dam Safety, Lake Geraldine Dam	Meco
45*	July 16, 2020	Dam Safety Management Plan, Lake Geraldine Dam	Meco
45	November 2020	DSI, Lake Geraldine Dam	Concentric
46	May 11, 2021	DSI, Lake Geraldine Dam	Concentric
47	July 14, 2021	DSI, Lake Geraldine Dam	Concentric
48	July 9, 2021	Lake Geraldine Dam Repair Program 2021	Concentric
49	August 18, 2021	DSI, Lake Geraldine Dam	Concentric
50	September 16, 2021	DSI, Lake Geraldine Dam	Concentric

3. COMMENTARY ON DAM SAFETY REVIEW REQUIREMENTS

According to the *Dam Safety Guidelines*, the DSG document applies to those structures that are at least 2.5 meters in height, and which have at least 30,000 cubic meters of storage capacity. The Lake Geraldine Dam exceeds these minimums.

The DSG document requires a systematic review, which includes the following items. For each item, the applicable Section number from the Dam Safety Guidelines is shown in parenthesis.

1.	Dam Classification	(DSG Section 2)
2.	Operation & Testing	(DSG Section 3)
3.	Maintenance	(DSG Section 3)
4.	Surveillance & Monitoring	(DSG Section 3)
5.	Emergency Preparedness	(DSG Section 4)



6.	Comp	liance With Previous Reviews	(DSG Section 5)
7.	Site I	nspection	(DSG Section 5)
8.	Analy	sis and Assessment:	(DSG Section 6)
	8.1. 8.2. 8.3. 8.4. 8.5. 8.6.	Hydrotechnical Seismic Geotechnical Structural Mechanical and Electrical Other Considerations	(DSG Section 6.4) (DSG Section 6.5) (DSG Section 6.6) (DSG Section 6.7) (DSG Section 6.8) (DSG Section 6.9)
	8.6.	Other Considerations	(DSG Section 6.9)

4. LAKE GERALDINE DAM DSR

4.1 Dam Classification (DSG Section 2)

Introduction:

Dam classification is determined by the consequences of dam failure. The consequences of dam failure should be evaluated in terms of life safety. The population at risk (PAR) in the inundated area provides an indication of the number of people exposed to the hazard and accounts for demographic and land-use factors for the inundated area. Other potential consequences of dam failure considered when classifying a dam include economic losses, environmental losses, cultural losses, and incremental and total consequences.

The consequences of a dam failure were previously assessed as "Extreme" in Section 3.3 of the Emergency Preparedness Plan (EPP) prepared by AMEC Environment & Infrastructure in July 2018:

Based on the Canadian Dam Association (CDA) 2007 Dam Safety Guidelines, the Lake Geraldine Dam can be classified as an EXTREME CONSEQUENCE dam. Criteria from CDA (2007) for Extreme Consequence Classification include:

- permanent population at risk;
- potential Loss of Life is greater than 100; and
- extreme losses affecting critical infrastructure and services such as hospitals, schools, roads and access, utilities and industrial complexes.

(Emergency Preparedness Plan (EPP), Section 3.3, AMEC, July 2018)

Comments:

Under the 2013 DSG, the suggested frequency for Dam Safety Reviews is every five (5) years for those structures with a "very high" dam



consequence classification. The most recent risk assessment has classified the dam as having an "Extreme" dam classification which carries the same five (5) year DSR frequency. If surveillance or other observations indicate abnormal performance, a review should be initiated sooner than indicated. It is recommended that the next Dam Safety Review be conducted in 2026.

4.2 Operation, Maintenance, and Surveillance (DSG Section 3)

Introduction:

In 2007, a Permanent Record File (PRF) was created. Concentric last updated the Permanent Record File (PRF) in 2018. Since 2018, no permanent record files have been provided to Concentric for review. The original file contains the following:

- Annual Updates Pages.
- Introduction.
- Chronological history and background of the structure.
- Operation, Maintenance, and Surveillance Manual (OMS).
- Permanent Log Book (PLB).
- All Dam Safety Inspections and Dam Safety Reviews.
- As-built drawings from original construction and all subsequent construction phases.
- Emergency Preparedness Plan
- Reports and engineering studies.

Comments:

As with the previous DSG, the following files should be included in the PRF:

- Instructions given by regulatory agencies, dam designer or other authority, and the record of compliance and details of any remedial action.
- Readings on any instrumentation and summary reports of dam performance.
- This Dam Safety Review report and all other inspection reports.
- This permanent record file should be made available for review as part of each Dam Safety Review.
- Records of dam safety incidents, associated lessons learned, and follow-up actions.
- Records of staff training.

Lake Geraldine Dam – 2021 Dam Safety Review



• Records of flow control equipment tests, emergency preparedness plans, drills and tests, and follow-up actions.

4.3 Emergency Preparedness (DSG Section 4)

Introduction:

The 2013 DSG outlines the establishment of a clear emergency response structure that is understood by all responders, supported by the following four components:

- An internal, dam-specific emergency response place (ERP), including actions the dam owner will take in response to unusual or emergency conditions
- An emergency preparedness plan (EPP), developed by the dam owner for external use, defining the hazards posed by the dam, the roles and responsibilities of all parties, and notifications to be made
- Municipal, community, or regional emergency plans, developed by responding agencies for their own use to warm and evacuate residents within the floodplains
- A maintenance, testing, and training program to ensure that the processes are effectively integrated and kept up to date.

(2013 DSG, Section 4.1, pg. 39)

A dam owner should establish a formal internal ERP that documents the procedures that operations staff should follow in the event of an emergency. The ERP should outline the key emergency response roles and responsibilities, in the order of priority along with the required notifications and contact information.

Where dam failure or a major floor could result in loss of life, the dam owner should prepare and maintain an EPP for use by external agencies. The EPP should describe the hazards, the associated notifications to be issued, and in general terms the action expected of other responders. The EPP should be issued to those key response agencies affected, and all registered copies should be updated on a regular basis.

The most recent edition of the ERP was prepared by Mitchelmore Engineering Company Ltd (Meco) and is dated July 16, 2020. The most recent edition of the EPP was prepared by AMEC Environmental & Infrastructure and is dated July 2018.

In addition to the development of an EPP and ERP, the dam owner is responsible for:



- Ensuring that the site command post (SCP) and emergency operations centre (EOC) are functional, and that staff is adequately trained,
- Updating telephone numbers and names of contact persons in the ERP and EPP on an annual basis,
- Maintain a list of EPP document holders,
- Forwarding updates and amendments to holders of the EPP,
- Coordinate and participate in periodic testing of the EPP with downstream agencies and stakeholders, and
- Maintain a record of EPP testing.

Comments:

While the EPP and ERP documents have been created, it is not clear whether the above listed owner responsibilities have been executed. It is recommended that the EPP and ERP documents be reviewed for to ensure they are up to date. Additionally, the EPP should be issued to local authorities and key response agencies and the list of EPP document holders be updated. Training should be provided to all dam personnel and external responders to ensure they are thoroughly familiar with all elements of the ERP and EPP.

Information and procedures within the ERP and EPP should be reviewed on an annual basis and updated as required or as conditions / operations at the dam and reservoir change.

Appendix B contains the Emergency Response Plan 1 page summary. This document summarizes the responsibilities for each party and also includes emergency response flow charts. We recommend that the City keep this page up to date and hold training exercises in coordination with all response agencies.

4.4 Site Inspection (DSG Section 5)

Introduction:

A visual site inspection of the dam structures was performed in May, July, August, and September 2021. The inspections were non-invasive in nature and did not include an underwater assessment.

Comments:

A summary of observed conditions is as follows:

 The visible portions of the concrete structures are generally in good condition, with localized areas considered to be in fair condition. A



delamination survey is recommended to better establish the condition of the areas in fair condition.

- There was no evidence of distress or overstressing of any portion of the visible concrete structures.
- The north and central berms appeared to be in a stable condition. Slopes greater than 2H:1V were observed throughout the north and center berms on both the downstream and upstream faces of the berms. The edge of the roadway atop the north and center berms is susceptible to erosion on the downstream slope of the berm. Maintenance work completed in August 2021 included the replacement of eroded materials from atop and within the upstream faces of the berms.
- The reservoir level during our four previous inspections in 2021 has been generally at or slightly below the level of the spillway. Pumping of additional water from the Apex river east of the dam was undertaken in summer 2021.
- Light seepage/leakage from within the center berm continues to occur and is generally consistent with historical seepage/leakage at this location.
- No significant changes were noted in the general condition of the concrete dam. Localized crack injection and concrete repairs were completed in August 2021.
- Light seepage within the concrete dam was noted at three locations during our review in September 2021.
- Drilling of boreholes for temperature and piezometer sensors was completed in 2020. Temperature sensor strings were installed in seven boreholes locations, the remaining 4 boreholes are designated for use with piezometers to monitor pore water pressure. Installation of the piezometer sensors and data loggers are tentatively scheduled for the summer of 2022.

Additional details and photographs of the concrete dam and earthen berms is contained in our previous DSI reports completed in 2021. Based on our visual review, we recommend the following:

- A concrete delamination survey of the exposed surfaces of the concrete dam to ascertain the extent of future concrete repairs is recommended.
- Additional crack sealing and sealant repairs (not completed in 2021) should be completed in 2022.
- An underwater inspection of the submerged portion of the concrete dam and spillway structures should be conducted in 2023.



4.5 Analysis and Assessment (DSG Section 6)

The intent of this section is to determine if the existing dam configuration satisfies performance criteria given in the DSG for safety and serviceability, in response to likely loads impinging on the structure. We have followed the format in the DSG document for convenience and clarity.

A detailed technical analysis and risk assessment was commissioned by the City of Iqaluit in 2019, this analysis was completed by Mitchelmore Engineering Company Ltd (Meco), the final report was issued in July 2020.

4.5.1 Hydrotechnical (DSG Section 6.4)

Introduction:

According to the DSG, dams shall be designed or evaluated for a maximum flood termed the Inflow Design Flood (IDF). The IDF is selected on the basis of the potential consequences of failure and the probable maximum flood (PMF). The PMF is defined as the most severe flood that may reasonably be expected to occur at a particular location.

The most recent hydrotechnical analysis of the LG Dam and reservoir completed in 2019/20 by Meco indicated the following:

Sources of data for the analysis include Environment Canada and published literature. PMF estimation considers precipitation, i.e., probable maximum precipitation (PMP) and snow accumulation, i.e., probable maximum snow accumulation (PMSA), and combinations of the two, to define an event that produces a maximum reasonable occurrence at the reservoir. The governing combination of events that produced the maximum PMF effect at the Lake Geraldine reservoir was a Spring PMP combined with a 1-in-100-year snowpack.

The design storm has a duration of 31.5 hours with the maximum event occurring over an 8 to 12 hour period. The storm can be described as a rainfall event where 188 mm of rain falls over a 24 hour period, with a peak 31.4 mm in a one hour period. The average annual rainfall for Iqaluit is 187 mm. Prior to the design rainfall event, the spillway is spilling through the City of Iqaluit from melting snow following a winter where the snowpack was 488 mm, twice the average annual snow. The peak inflow during the IDF is estimated at 21.9 m3/s and the reservoir will reach a maximum elevation of 111.9 m, or 0.57 m of surcharge in the reservoir with a peak outflow



through the City approximately 10.6 m3/s, which is about three times the pre-PMP flow.

A statistical assessment of potential windstorms to generate waves was completed to determine if the dam has adequate freeboard. The City of Iqaluit maximum recorded wind speeds typically occur in March when the reservoir is ice covered and no waves are generated. However, wind can occur at any time and there was no justification to not assume a strong Spring or Summer wind speed. The recommended design wind speed during the design flood is between 80 and 105 kilometers per hour, compare with 131 to 216 kilometers per hour for normal operation.

The freeboard analysis determined freeboard at Lake Geraldine Dam is inadequate for normal operation and during the flood condition. Using the lower end of the statistical wind estimate results in a 0.1 m increase in crest elevation compared with a 1.0 m crest raise for the higher wind speeds. It is our understanding that there has been erosion of the upstream slope from wind events recently that suggests the higher wind speeds may be appropriate. Lake Geraldine rockfill dam should be modified to include a crest that is 1.0 m higher than the current crest. This can be achieved with a combination of raising the crest and a riprap parapet.

Climate change is occurring and presents a risk to the viability of any dam. In 2017, the Western University of Ontario developed an interactive map which provides the projected IDF curves for representative concentration pathways (RCP) scenarios. The RCP IDF curves result in an increase in precipitation of between 34% and 56% when compared to historical IDF curves.

(Technical Analysis & Risk Assessment, Section 3.2, Meco, July 16, 2020)

Comments:

Based on our review of the most recent analysis and modeling of a worst-case scenario concludes that there is a potential for damage to the earthen berms. The most recent analysis recommended that the freeboard along the crest of the earthen berms be raised by 1.0 meter. We recommend proceeding with this recommendation.



4.5.2 Seismic (DSG Section 6.5)

Introduction:

Damage to dams can result from shaking caused by an earthquake, liquefaction, settlement, cracking, or displacements induced by shaking, or in extreme cases surface rupture along the fault that caused the earthquake. The seismic loading for designing new dams and evaluating existing ones is determined by the intensity of ground shaking expected at the dam site and is not strictly governed by the magnitude of the earthquake alone.

The level of earthquake ground motion at the location of the dam for which the dam or other structure is designed or evaluated is defined as the earthquake design ground motion (EDGM). The 2013 DSG indicates that the annual exceedance probability of the EDGM for dams with an "Extreme" classification is 1/10,000.

The most recent seismic analysis of the LG Dam was commissioned by the City of Iqaluit in 2019. J. L. Richards and Associates Limited (JLR) was retained as a sub-consultant by Meco to provide structural engineering design services as part of the risk assessment portion of the scope services. JLR undertook a seismic and stability analysis of the concrete gravity dam to determine if the dam meets the required factors of safety for overturning and sliding as outlined in the Canadian Dam Association (CDA) Dam Safety Guidelines and concluded the following:

Ground motion values from the extrapolated values from NRCan have been determined in order to carry out the dam stability analysis of the Lake Geraldine Dam. Extrapolation of the NBCC values for low probabilities could result in spectral values that are conservative or potentially unconservative. In order to avoid carrying out analyses with overly conservative assumptions for a very stiff structure, the PGA values have been used in lieu of S(Ta) values.

It is further noted that Iqaluit is historically an area of low seismicity. As shown on the attached map obtained from the NRCan website, no seismic activity of significant magnitude has been reported within a 50 km radius of the City of Iqaluit between 1627-2015. As such, it is expected that the seismic load combinations will not represent the governing load combinations for the stability of the dam structures.

(Technical Analysis & Risk Assessment, Appendix B, Meco, July 16, 2020)

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Comments:

The most recent seismic analysis indicates that Iqaluit is historically an area of low seismic activity and that no seismic activity of significant magnitude has been reported within a 50 km radius of the City of Iqaluit between 1627-2015. Seismic load combinations do not represent the governing load combinations for the stability of the dam structures.

4.5.3 Geotechnical (DSG Section 6.6)

Introduction:

As prescribed in the 2013 DSG, engineering analyses need to be performed to demonstrate that the dam, foundation, and abutments will remain solid under all hazards and loading conditions, including geotechnical hazards. For geotechnical considerations, the overall dam system includes the dam berms and appurtenant structures, their foundations, abutments, and the reservoir rim.

Geotechnical assessments begin with a geological interpretation of the area and a geotechnical site investigation. These investigations commonly consist if borehole drilling and sampling, in situ testing, and groundwater monitoring to identify the geological and hydrogeological sequences. The samples from these investigations are then tested in the laboratory to define the engineering properties of the material and to establish appropriate design parameters.

Geotechnical hazards include the following:

- Hydraulic fracturing
- Piping
- Internal erosion
- Surface erosion
- Slope instability
- Static and dynamic liquefaction
- Seepage
- Deformation

Loading conditions include the following:

- End of construction
- Rapid drawdown
- Reservoir surcharge



- Wind and wave action
- Steady-state seepage
- Earthquakes

(2013 DSG, Section 6.6, pg. 71)

The most recent geotechnical investigation of the LG and berms was commissioned by the City of Iqaluit in 2019. Canadrill Limited Geotechnical Division (Canadrill) was retained as a sub-consultant by Meco to provide geotechnical evidence to support detailed analysis of overall dam stability. Detailed information of the geotechnical investigation can be found in Appendix D of the Technical Analysis & Risk Assessment prepared by Meco, dated July 16, 2020, and is summarized below:

- Surface geology consists of medium brown sand with silt and gravel, varying to gravel with sand. Frequent boulder and cobble sizes are encountered. Material is generally characterized as a coarse diamicton.
- Bedrock geology is generally characterized as granodiorite or granite. Bedrock at the rockfill dam sites is generally described as good to very good quality while the bedrock at the concrete spillway is generally described as poor quality.
- The geotechnical investigation did not detect any distinction between embankment fill and foundation material. It was concluded that the embankment fill was borrowed locally and behaves like a disturbed and compacted local fill.
- Instrumentation and borehole details are summarized [in the report]. Water levels near the toe of the concrete dam were measured at the base of concrete with a slight uplift of about one (1) metre. There are no initial water levels at BH101 and BH107.
- Initial monitoring indicates the active layer near the corewall at the North Berm extends to 5.0 mbg and to bedrock at the Central Berm. The normal depth of the active zone in Iqaluit is 2.1m.
- The observations at BH107 are anomalous. The depth to bedrock drops nearly 9 m from BH105 and there was caving reported at elevation of ~103 metres, approximately 6.5 metres above bedrock. Water was encountered at the



bedrock/rockfill interface in BH107, but a piezometer at the interface could not be installed due to caving. Pooled water was observed downstream of BH107 during the drilling.

- The bedrock below the spillway is highly fractured or possibly rockfill. Both boreholes in the rock experienced caving. Water levels measured in the boreholes were at or within the concrete / foundation interface.
- At the South Berm, bedrock is at a shallow depth and the active layer is about 2.0 metres deep.
- Thermistor instrumentation indicate the active layer near the corewall of the central berm is below the bedrock. Thermistor data at the North Berm indicate the active layer is 5.0 metres near the corewall and is close to normal at the South Berm. The variance in Active Layer is attributed to the lower height of dam at the north and south berms, whereas the Central Berm retains water throughout the year.

(Technical Analysis & Risk Assessment, Section 3.3, Meco, July 16, 2020)

The most recent geotechnical assessment of the LG Dam and berms was undertaken in 2019 by Meco. Information from two geotechnical investigations completed by Trow (now exp) in 2006 and Canadrill in 2019 were used to analyze the dam and berms.

The geotechnical assessment conducted by Meco concluded the following:

- The concrete corewall will fail at the cold joint from the 2005 crest raise, if the rockfill on either side of the concrete is washed away.
- The thermal effect of the warm water in the reservoir results in thawing of the ground downstream of the corewall during summer. At the central berm, the thermal model indicated the active layer extends to a depth of about 7.9 m (Elevation 104.6 m), which is below the assumed bedrock surface. This was verified in initial results from the geotechnical investigation.
- At the Central Berm, peak seepage occurs in the summer when the downstream slope is completely thawed, and flow is concentrated along the bedrock surface. This was also verified during the geotechnical investigation. During re-freezing in the



autumn, seepage is gradually reduced and eventually ceases when the thawed zone becomes discontinuous. This observation is to be verified through surveillance.

- At the North Berm, the thermal model indicated the active layer extends to a depth of about 7.5 m which is below the measured depth of 5.0 m. Seepage at the North Berm is modelled to be greater than at the Central Berm, based primarily on the assumption that the corewall is not founded entirely on bedrock.
- The slope stability model predicts that the rockfill slopes are stable but may become unstable if seepage increases to a level that can introduce seepage forces to the embankment fill. Seepage water can also undermine rockfill, causing oversteepening and instability.

(Technical Analysis & Risk Assessment, Section 3.5, Meco, July 16, 2020)

Comments:

An assessment of risk of internal erosion was also completed by Meco. The results indicate that the relative annual probabilities of failure by piping for all modes of piping at the Central Berm are low. At the North Berm, piping through the foundation is more likely and estimated at two orders of magnitude greater than at the Central berm. At the North Berm, the risk is restricted to failure under the concrete corewall where it is not founded on bedrock. All other piping failure modes at the North Berm are relatively low.

Monitoring of piping was mentioned in the previous risk assessment report with the installation small weirs at known weep locations in an effort to record flow rates at these locations.

4.5.4 Structural (DSG Section 6.7)

Introduction:

The DSG states that the assessment of existing structures should be carried out using a full range of normal to extreme load cases consistent with the site conditions, consequences of failure, applicable regulations, and current good practice in the industry.

Detailed information of the structural assessment undertaken in 2019-20 by JLR can be found in Appendix E of the *Technical Analysis & Risk Assessment* prepared by Meco, dated July 16, 2020, and is summarized below.



Comments:

The most recent structural assessment of the concrete dam and spillway found that the spillway structure is marginally compliant to stability criteria recommended in the CDA Guidelines for sliding. The gravity dam concrete structure is compliant to stability criteria recommended in the CDA Guidelines for sliding.

Both structures rely on the capacity of inclined anchors to resist overturning. The ability of the anchors cannot be verified through tests and the CDA Guidelines do not recommend reliance on passive anchors for stability. Additional factors to consider are the relative fractured condition of the bedrock foundation, the potential for foundation weakening from permafrost losses and uncertainty in actual ice loading.

The most recent structural assessment concludes and recommends the following:

Stability of the spillway dam is governed by the following conditions:

• Ice loading on the dam (Usual Load – Winter). Under this load combination, the rock anchors at the heel of the dam are engaged to 73% of the design service load stated on the 2006 drawings to meet the acceptance criteria for the position of the resultant (ie. in overturning).

Stability of the gravity dam is governed by the following conditions:

• Ice loading on the dam (Usual Load – Winter). Under this load combination, the rock anchors at the heel of the dam are engaged to 66% of the service design load stated on the 2006 drawings to meet the acceptance criteria for the position of the resultant (ie. in overturning).

With respect to overturning, the anchors are being heavily relied on for a significant portion of the resistance in the winter load cases. While the accepted criteria for the position of the resultant in the middle third of the dam is met, this assumes that the anchors installed to the design service load specifications on the drawings are able to engage 66% to 73% of this capacity. Based upon the foundation conditions reported by Canadrill, it is understood that there is water below the concrete dam, which suggests that the foundation conditions (ie. permafrost level) may have change since the time of construction and/or installation of the anchors. Because the anchors are passive and embedded in the dam, there is no means

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of verifying that they are intact and continuing to behave in the manner intended by the original design or as modelled by our analysis. This is further reason to recommend an ice mitigation system to reduce ice loading on the dam.

(Technical Analysis & Risk Assessment, Appendix E, Meco, July 16, 2020)

4.5.5 Mechanical and Electrical (DSG Section 6.8)

Mechanical and electrical equipment at dams consists of the flow control equipment, auxiliary equipment, power supplies, and control systems which are relevant to more complex structures and not present at this site.

4.5.6 Other Considerations (DSG Section 6.9)

When dam improvements are performed, project specifications should be strictly adhered to. This section of the DSG refers to all the factors that must be assessed should an improvement to the dam be completed.

No major improvements have been implemented on the dam since the last DSR; therefore, this section of the DSG is deemed to be met.

5. SUMMARY RECOMMENDATIONS & REQUIRED ACTION

Based on our onsite review and review of the record information available, we summarize the recommendations and outstanding recommendations of the DSR as follows:

- 1. Conduct a Dam Safety Review (DSR) in 2026.
- 2. The Permanent Record File, Logbook, and Operation and Surveillance manual should be updated as new documentation is generated for the dam. The following files should be included in the PRF:
 - Instructions given by regulatory agencies, dam designer or other authority, and the record of compliance and details of any remedial action,
 - Readings on any instrumentation and summary report of dam performance,
 - This DSR and all other inspection reports,
 - Records of dam safety incidents, associated lessons learned, and follow-up actions,
 - Records of staff training,
 - Record of flow control equipment tests, emergency preparedness plan, drills and tests, and follow-up actions.



- 3. Review EPP and ERP documents, issue EPP to local authorities and key response agencies, update list of EPP document holders, and provide training to all dam personnel and external responders on the EPP and ERP. See Appendix B for a single page summary of the ERP.
- 4. A concrete delamination survey of the exposed surfaces of the concrete dam to ascertain the extent of future concrete repairs is recommended.
- 5. Additional crack sealing and sealant repairs (not completed in 2021) should be completed in 2022.
- 6. An underwater inspection of the submerged portion of the concrete dam and spillway structures should be conducted in 2023.
- 7. It is recommended that the height of the concrete core wall within the earthen berms be increased by an estimated 0.3 m. The top of core is at the same elevation as the top of concrete dam. Concrete is less resistant to erosion during overtopping and can survive overtopping longer than rockfill. Increasing the corewall elevation by 0.3 m will improve the likelihood of surviving an overflow event.
- 8. It is recommended that the crest of the south, center and north berms be raised by 1.0 m. Freeboard analysis along the earthen berms identified that the crest of the rockfill dam is inadequate for severe wind conditions. The extreme wind requires a crest elevation that is 1.0m above the current crest. The added crest can be achieved through a combination of crest height and upstream rockfill parapet.
- 9. It is recommended that small weirs are installed at known weep locations in an effort to record flow rates of piping through the earth berms/ concrete dam.
- 10. The warm water return line should be routed into the reservoir at the spillway and the discharged water should be infused with air to mitigate potential ice loading of the dam. The stability analysis of the concrete dam identified ice loading as a risk factor for the concrete gravity dam and spillway. The warm water line to the reservoir from the treatment plant should be re-routed to discharge to a location beneath the spillway. Routing the discharge line beneath the spillway sill can promote ice loss and a reduction of ice loading on the dam. Infusing air into the warm water being discharged into the reservoir could enhance water flow and ice loss as well.
- 11. We recommend installation of porous water sensors (piezometers) and data loggers be completed in 2022 as well as the implementation of a monitoring system to record temperature and water pressure data.
- 12. The installation of survey monuments to monitor vertical and horizontal movement within the concrete dam, center and north berms is recommended as well as a bi-annual survey program.
- 13. Installation of three remote surveillance camera is recommended. It is understood that the installation of surveillance cameras at the LG Dam may be difficult given the conditions of the site; however, visual surveillance is the most important element of a dam safety program and is a recommended by the 2013 DSG. Installation of remote cameras



would enhance (daily) monitoring of the dam and berms and allow observations of the dam throughout the day. With high-quality cameras and the low cost of high-speed communications, it is possible to supplement on-site visual monitoring with monitoring via remote cameras. These tools are useful for monitoring areas of concern or providing surveillance of the site throughout the day.

14. A Dam Safety Inspection (DSI) is required yearly.

6. LIMITATIONS

This report was prepared for the sole use of the City of Iqaluit.

This report was prepared exclusively for the purposed project and site locations outlined in this report. The report is based on information provided to, or obtained by Concentric as indicated in the report, and applies solely to site conditions existing at the time of the site investigations.

The conditions of the site may change over time or may have already changed due to natural forces or human intervention, and Concentric takes no responsibility for the impact that such changes may have on the accuracy or validity of the observations, conclusions and recommendations set out in this report.

The report does not extend to any latent defect or other deficiency which could not have been reasonably discoverable or discovered within the scope of the report. Information supplied by the City of Iqaluit or third parties for use in this report has not been verified by Concentric unless stated otherwise.

Concentric's report represents a review of available information with an established work scope, schedule, and budget. The material in the report reflects Concentric's judgement in light of the information available to it at the time of preparation. Any uses that a third party makes of this report, or any reliance on decisions made based on it, are the responsibilities of such third parties.

Concentric accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made based on this report.

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Should there be any questions, please contact the undersigned.

Yours sincerely,

Concentric Associates International Incorporated

Kathleen Perry-Theriault, P. Eng. Project Manager

Steve Parker, P. Eng. Technical Advisor



PERMIT TO PRACTICE

Concentric Associates International Inc.

Signature.

Date ______10/14/2021

PERMIT NUMBER: P 492

The Association of Professional Engineers, Geologists and Geophysicists of the NWT / NU



APPENDIX A

Site Photographs





Photograph 1 – Overview of upstream concrete section, looking northwest.



Photograph 2 – Overview of upstream concrete section, looking southeast.





Photograph 3 – Overview of downstream concrete section, looking southeast.



Photograph 4 – Overview of downstream concrete section, looking northwest.





Photograph 5 – Overview of south beam, looking northwest.



Photograph 6 – North and center berms and north access road ramp, looking southeast.

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APPENDIX B

ERP-on-a-Page

Emergency Response Plan Lake Geraldine Dam

Iqaluit Asbac

Notification Flow Chart

City of Iqaluit (CAO or designate) Director of Public Works Superintendent of Water / Wastewater Superintendent of Operations

Notification Message Template

Utilidor Foreman

Operators

Prior to performing notifications, fill out the template below:

"This is (full name and position) of the City of Iqaluit. We are issuing a notification of a:

of a: (select appropriate activation level)

 \square DAM EMERGENCY (a potential dam failure is developing)

□ DAM FAILURE (a dam failure is imminent or has occurred) at Lake Geraldine Dam.

with this notice immediately."

You are advised to take appropriate action as per your Emergency Response Plan for this type of emergency.

This is not an exercise or simulation, and time is of the essence. Please comply

Provide details of the specific situation and at least two (2) phone numbers where you can be reached by NUNAVUT EMO at any time during the emergency. Ask the NUNAVUT EMO dispatcher to call you back immediately to confirm the numbers were transferred correctly.

"[Provide details of the specific situation]. My cell phone number is (+1 (867) XXX-XXXX) and the landline at the Incident Management Post is (+1 (867) XXX-XXXX). Please call me back immediately after this call ends to ensure you recorded my number correctly"

EXTERNAL NOTIFICATIONS CONTACT LIST

Nº	Org.	Position	Status	Name	Office	Mobile	Home/Other
1	GN EMO	Director of EMO	Primary	Ed Zebedee	+1 (867) 975-5448	+1 (867) 222-0208	n/a
2	Iqaluit Health Services	Environmental Health Officer	Primary	Greg Thibault	+1 (867) 222-0163	+1 (867) 222-0163	+1 (867) 975-4817
3	Nunavut Fire	Fire Marshall	Primary	Michael Leduc	+1 (867) 222-0132		+1 (867) 975-5310
4	Red Cross	Disaster Responder Supervisor	Secondary	Michel Rheault			+1 (867) 975-5310
5	Intergovernmental Affairs	Acting Dir. Of Communications	Primary	Angela Petru	+(514) 521-4291		+1 (867) 975-6004
6	Iqaluit Health Services	Director - Support Services	Primary	Sonia Marchand	+1 (867) 222-8571		+1 (667) 975-8600
7	Residents	Call Dispatch - public announcement	Primary		+1 (867) 979-4422		
8	Iqaluit Fire Dept.	Fire Chief	Primary	Nelson Johnson			

Internal Notifications Contact List

Nº	Organization	Position	Status	Name	Office	Mobile
1	City of Iqaluit	CAO	Primary	Amy Elgersma	(867) 979-5667	n/a
1a	City of Iqaluit	Director of Public Works	Alternate	Amy Elgersma	(867)	(867) 222-2956
2	City of Iqaluit	Superintendent of Water/Wastewater	Primary	Shane Turner	(867) 979-5667	
3	City of Iqaluit	Superintendent of Operations	Primary	Joseph Brown	(867) 979-5667	
4	City of Iqaluit	Utilidor Foreman	Primary	Pat Wolfe	(867) 979-5667	
5	City of Iqaluit	Liaison Officer	Primary	Robyn Mackay		
6	City of Iqaluit	Safety Officer	Primary	Krista Thompson		(867) 222-2972
7	City of Iqaluit	Information Officer	Primary	Andrea Spitzer		
8	Health Authority	Env. Health Officer	Primary	Greg Thibault	(867) 222-1063	(867) 975-4817
9	Protective Services	Dir. of Nunavut Emer- gency Management	Primary	Ed Zebedee	(867) 722-0132	(867) 975-5448
10	Fire Department	Nunavut Fire Marshall	Primary	Nelson Johnson	(867) 722-0132	(867) 975-5310

VERSION CONTROL

Last Revision Date:	February 20, 2020
Revision №:	1

GENERAL

This Emergency Response Plan (ERP) for Dam Safety is one of four (4) primary documents governing operations at LGD i.e.:

- 1. An **Operations, Maintenance, and Surveillance (OMS) Manual for Dam Safety at the Lake Major Dam,** which describes how day-to-day tasks related to dam safety at LMD are performed, and by whom. The OMS manual contains Procedures for normal, flood, and emergency operations;
- 2. An **Emergency Preparedness Plan (EPP) for Dam Safety**, which provides inundation maps and other information to assist external response agencies in the preparation of their local emergency plans to deal specifically with a dam failure at LMD;
- 3. An **Emergency Response Plan (ERP) for Dam Safety**, which provides general information related to Halifax Water response to a dam safety emergency; and.
- 4. A **Dam Safety Management Plan (DSMP) for Dam Safety**, a framework for dam safety activities, decisions, and supporting processes which encompasses all elements of dam safety for Halifax Water.

OPERATION LEVELS

Activation	Cond	ition
Level	Hydrologic Event	Other Events
NORMAL CONDITION (Green)	Water level is at or below the spillway crest	n/a
FLOOD SITUATION (Blue) Out-of-bank water levels	A 'Flood Warning' has been issued by regulatory authority, or the City of Iqaluit, but situation is not threatening dam integrity.	Not applicable. Note: City of Iqaluit has discretion to declare a 'Level Blue' for any other abnormal flows.
DAM ALERT (Yellow) Abnormal condition poses a threat	 The level of Lake Geraldine is approaching 111.60m. The spillway is ice covered and lake level greater than 111.33 and is rising. Wave action is eroding the embankment upstream of the concrete core wall. 	Abnormal condition that may affect dam performance has been identified, e.g.: a) Signs of potential interna erosion; b) Earthquake occurrence; c) Increased leakage; d) Minor structural deformation or deterioration.
DAM EMERGENCY (Orange) Potential dam failure is developing	 The level of Lake Geraldine is approaching 112.0m. The reservoir level is expected to exceed the top of the embankment core (112.28m). 	 a) - Sinkholes downstream of the dam are increasing in size. b) - Seepage rate downstream of the dam increasing and silt laden. c) - vertical deformation of the crest of the embankment. d) - Concrete core wall exposed and at risk of buckling.
DAM FAILURE (Red) Dam failure is imminent or has occurred	Dam overtopping is occurring or imminent.	a) Sinkhole size is increasing and associated leakage.b) Concrete core wall is exposed and at risk of toppling.

SOURCES OF MATERIAL, EQUIPMENT, LABOUR, AND ENGINEERING RESOURCES

CONSTRUCTION MATERIALS

CON	STRUCTION PIATERIALS		
Nº	Owner	Location	Phone
1	Nunavut Construction Ltd.	Iqaluit, Nunavut	867 979-7711
2	Almiq Contracting	Iqaluit, Nunavut	867 975-2225
3	-	-	-
Ear	TH MOVING EQUIPMENT		
Nº	Owner	Location	Phone
1	Nunavut Construction Ltd.	Iqaluit, Nunavut	867 979-7711
2	Almiq Contracting	Iqaluit, Nunavut	867 975-2225
Con	TRACTORS		
Nº	Owner	Location	Phone
1	Nunavut Construction Ltd.	Iqaluit, Nunavut	867 979-7711
2	Almiq Contracting	Iqaluit, Nunavut	867 975-2225
Equ	IPMENT RENTALS		
Nº	Owner	Location	Phone
1	-	-	-
2	-	-	-
Spec	CIALTY SERVICES		
Nº	Owner	Location	Phone
1	-	-	-
2	-	-	-
Engi	INEERING EXPERTISE		
Nº	Owner	Location	Phone
1	Meco	Dartmouth, NS	+1 (902) 444-3131
2	-	-	-
Еме	RGENCY SERVICES		
Nº	Owner	Location	Phone

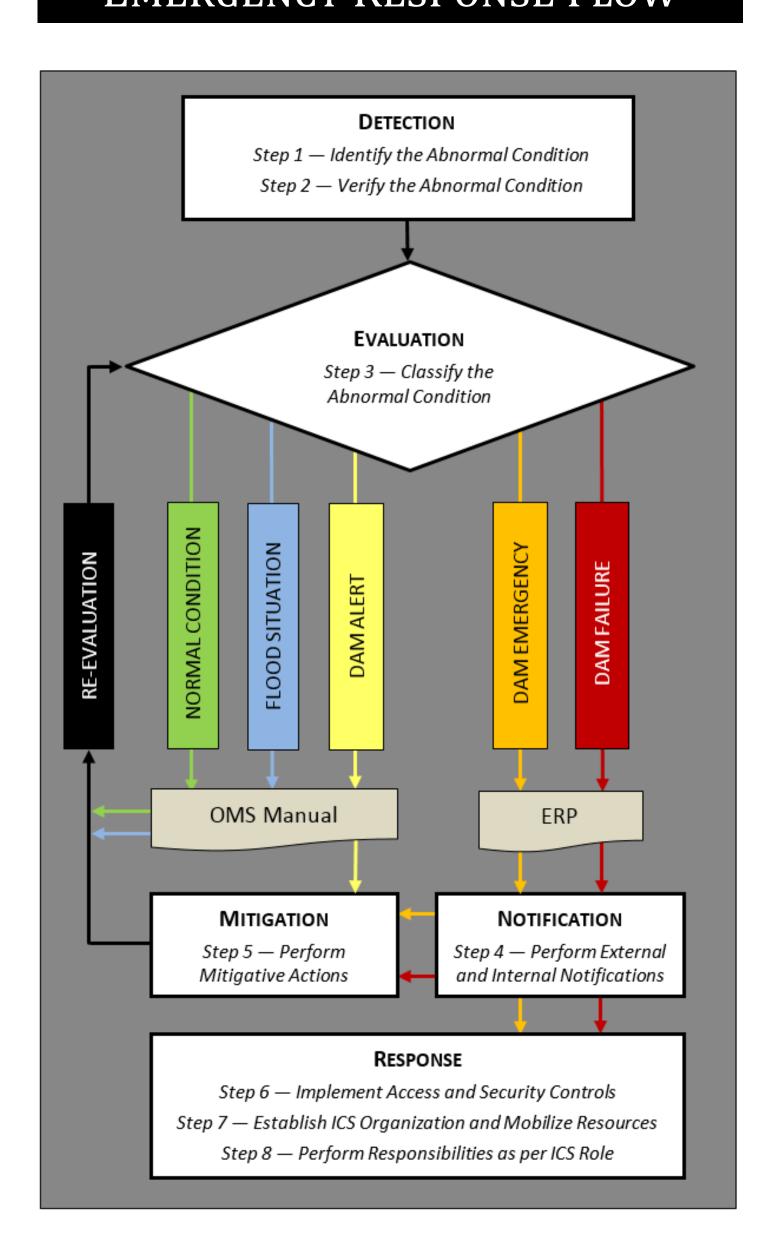
Dartmouth, NS

+1 (902) 444-3131

SITE LAYOUT



EMERGENCY RESPONSE FLOW



ICS CANDIDATES CONTACT LIST

ICS Role	Status	Name	Office	Mobile	Home/Other
Safety Officer	Primary	Krista Thompson			
	Alternate				
Public Information Officer	Primary	Andrea Spitzer			
	Alternate				
Liaison Officer	Primary	Robyn Mackey			
	Alternate				
Planning Section Chief	Primary	Amy Elgersma			
	Alternate				
Operations Section Chief	Primary	Nelson Johnson			
	Alternate				
Logistics Section Chief	Primary	Robyn Mackey			
	Alternate				
Finance Section Chief	Primary	Sherri Rowe			
	Alternate				

Incident Organization Chart

Incident Name:		Operational Period:	Date From: Time From:	Date To: Time To:
Organization Chart	INCIDENT MANA	AGER		
		LIAISON	OFFICER	
	L	SAFETY	OFFICER	
		INFORMATIO	ON OFFICER	
OPERATION SECTION CHIEF	PLANNING SECTION CHIEF	LOGIST	ICS SECTION CHIEF	FINANCE/ADMIN SECTION CHIEF
STAGING AREA MANGER	RESOURCE UNIT		CE BRANCH DIRECTOR	TIME UNIT
BRANCH/DIVISION/GROUP	SITUATION UNIT		MEDICAL UNIT LEADER FOOD UNIT LEADER	COST UNIT
BRANCH/DIVISION/GROUP	DOCUMENTATION UNIT	SUPPOR	RT BRANCH DIRECTOR SUPPLY UNIT LEADER	PROCUREMENT UNIT
BRANCH/DIVISION/GROUP	DEMOBILIZATON UNIT		FACILITIES UNIT LEADER	COMPENSATON/CLAIMS UNIT



APPENDIX C WEST 40 LANDFILL AIRSPACE SURVEY



AECOM Canada Ltd. 101-18817 Stony Plain Road NW Edmonton, AB T5S 0C2 Canada

T: 780.486.7000 F: 780.486.7070 aecom.com

Joseph Brown
Superintendent of General Operations
City of Iqaluit
P.O. Box 460
Iqaluit NU X0A 0H0

October 12, 2021

Our Reference
60658262

2021 Waste Generation and West 40 Landfill Airspace Projections

Dear Joseph:

The 2021 survey of the West 40 Landfill was completed July 27, 2021 and the following data presents the findings of this survey. The airspace consumption for 2021compares the waste surface from August 17, 2020 to the July 27, 2021 surface and includes deposited waste and cover soil placement.

The remaining landfill airspace is determined by comparing the surveyed waste surface to the proposed final landfill cap design developed in 2017.

Airspace Consumption

- 1. Based on Survey Data
 - Total Airspace consumed: 11,651 cubic metres (m³)
 - Time Span
 - 48 weeks
 - 11.3 months
 - 240 weekdays (based on the 5 day work week)
 - Average Airspace consumed:
 - 242.7 m³ per week
 - 1,031 m³ per month
 - 48.5 m³ per day

Based on the monthly average of 1,031 m³ per month it is estimated that in the year 2021 the City of Iqaluit will generate/consume approximately 12,372 m³.



The following table compares the results of the various surveys conducted from 2017 to 2020. As noted in the table there was a significant reduction of waste deposited in 2021. This is likely the result of decreased activity due to COVID. A three year following average is provided for airspace consumption estimation.

	Airspace Consumed	Average m³ per day	Projected m³ per week	Projected m³ per month	Projected m³ per year	Rolling 3yr Average m³ per year
Oct 2, 2017 to July 26, 2018	11,265	43	262	1,135	13,620	
July 26, 2018 to Oct. 22, 2018	5,323	72	409	1,774	21,288	
Oct 22, 2018 to Oct 07, 2019	17,679*	71	353	1,537	18,444	17,784
Oct 07, 2019 to Aug. 17, 2020	15,720	69	349	1,526	18,312	19,348
Aug 17, 2020 to July 17, 2021	11,651	49	243	1,031	12,372	16,376
AVERAGE		61	323	1,401	16,807	

Landfill Airspace

The attached drawings provide the results of the landfill volume surveys.

Based on the survey the landfill has an estimated effective waste disposal capacity of 92,713 m³ as of July 27, 2021 for the total landfill and 43,299 m³ for the northern portion of the landfill.

Based on the monthly average airspace consumption of 1,031 m³ it is estimated an additional 5,155 m³ of airspace will be consumed by December 30, 2021. It is estimated there will be 87,558 m³ of airspace remaining in the total West 40 Landfill at the end of 2021, and 38,144 m³ remaining in the northern portion of the landfill at the end of 2021.

The attached Table 1.1 provides the updated estimated waste generation and airspace consumption based on the four growth scenarios of 1% to 4% of airspace consumption increase for the **total landfill**. Using the 3 year rolling average of 16,376 m³ in 2021, the table assumes an annual waste disposal amount of 16,540 m³ in 2022 which is a 1% increase from the 2021 rolling average. The projections reflect the updated landfill net airspace estimate of 87,558 m³ for total landfill. Using the total landfill airspace, and assuming an annual growth rate of 1% the landfill has projected capacity into the first quarter of 2026. At a growth rate of 4% the airspace is fully utilized by the fourth quarter of 2025.

The attached Table 1.2 provides projected airspace capacity for the **northern portion** of the landfill with the updated net airspace estimate of 38,144 m³. Assuming a disposal volume of 16,540 m³ in 2022 and 1% to 4% growth the northern portion of the landfill is projected to have airspace until the end of 1st quarter of 2023. The northern portion of the landfill is the location that disposal is presently occurring.

AECOM

Based on these projections if the new waste management landfill is not operational and able to accept waste by 2023, steps will be necessary to get the southern portion of the landfill into a condition to accept residential waste. To allow access to the full disposal capacity in the northern portion the Sprung structure, office building and radio tower will have to be removed in 2022.

Yours sincerely, AECOM Canada Ltd.

Prepared by

Approved by

Checked by

Jim Clare, RET

John MacKenzie Project Manager Steve Johnson, P.Eng. Waste Services Manager

Encl:

Landfill Plans

Table 1.1 Table 1.2

CC:

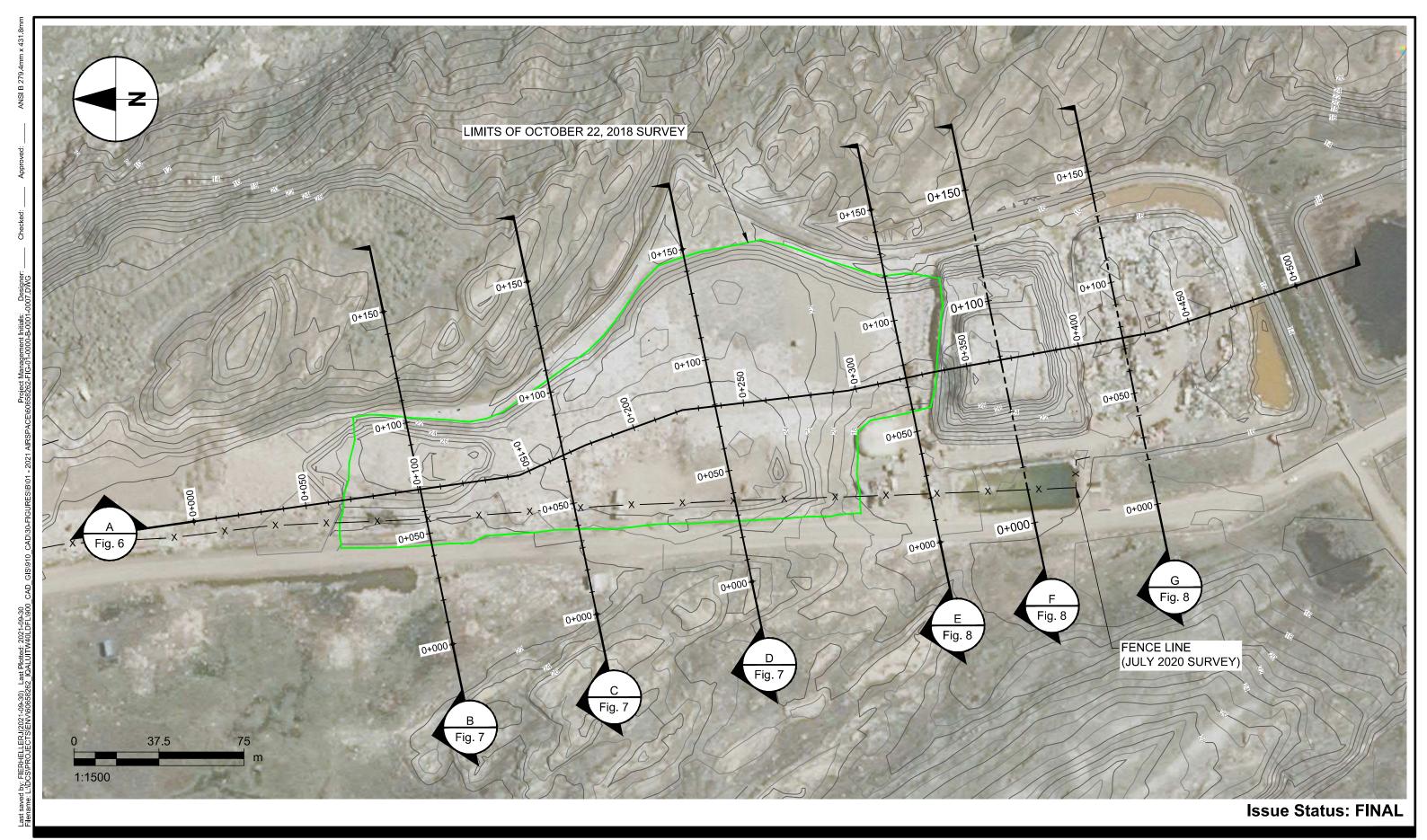
Josh Benoit Jared Wright Amy Elgersma PERMIT TO PRACTICE

est de

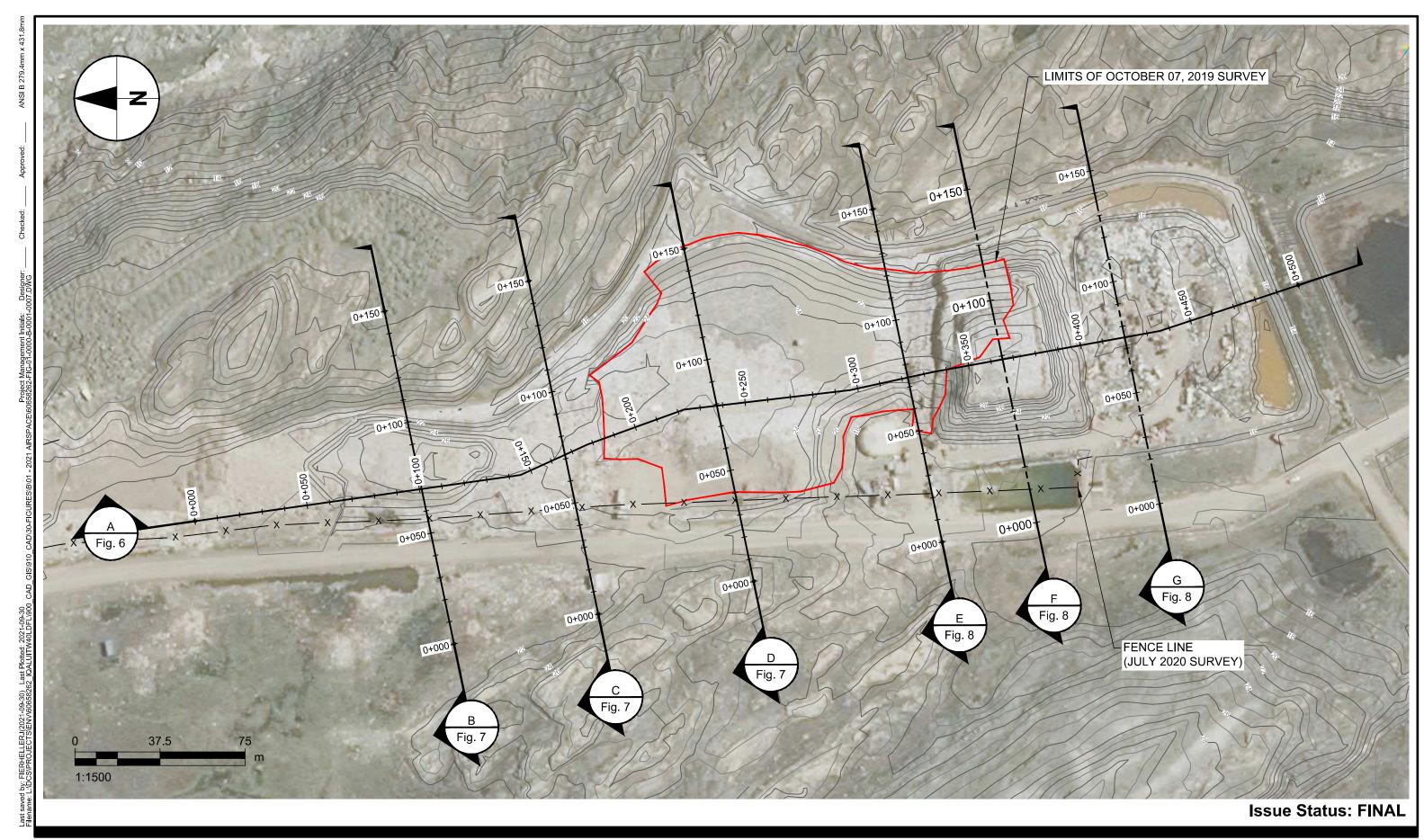
Signature

PERMIT NUMBER: P639 NWT/NU Association of Professional

Engineers and Geoscientists

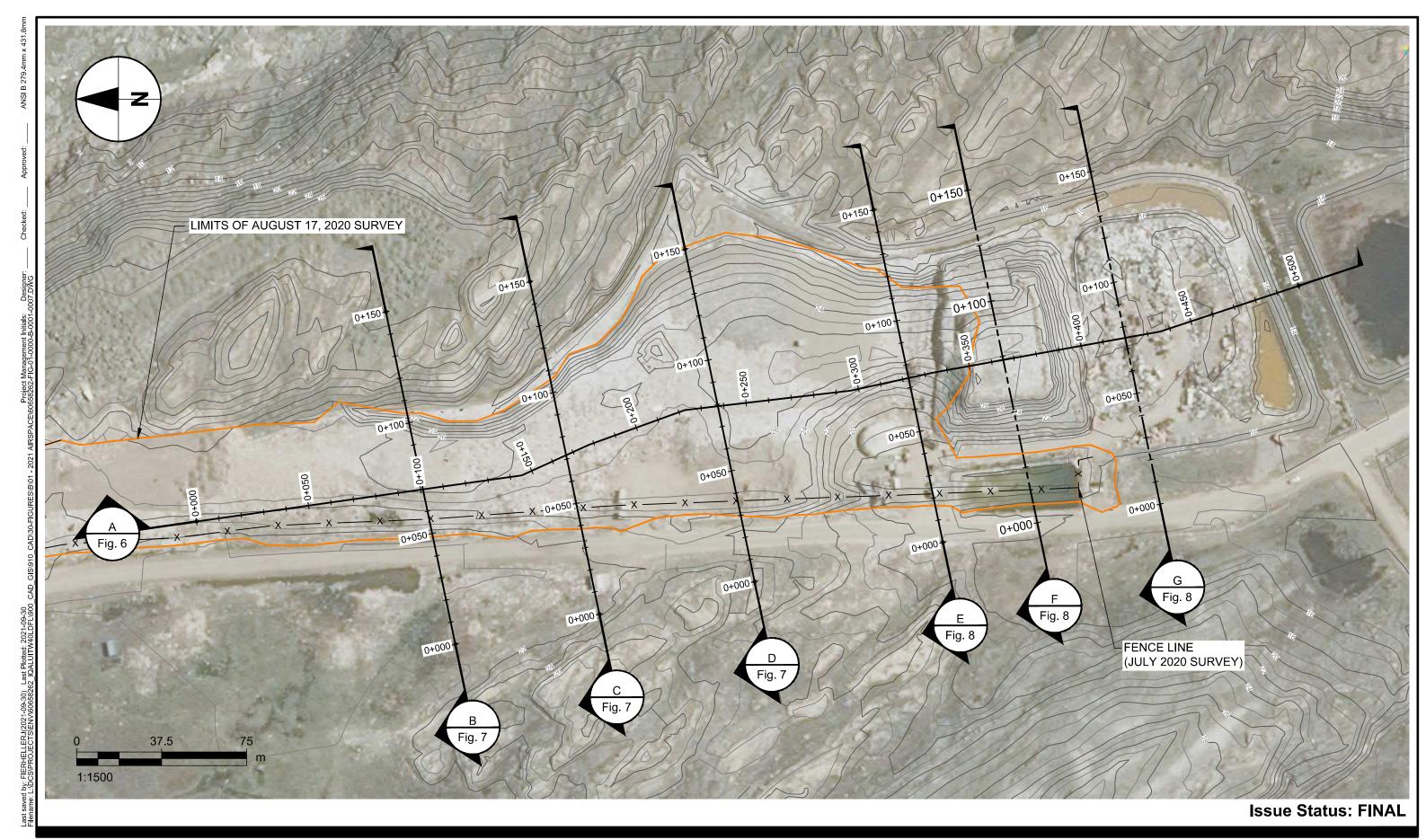


City of Iqaluit, Nunavut Project No.: 60658262 Date: 2021-09-30 Iqaluit West 40 Landfill October 22, 2018 Survey Area Plan



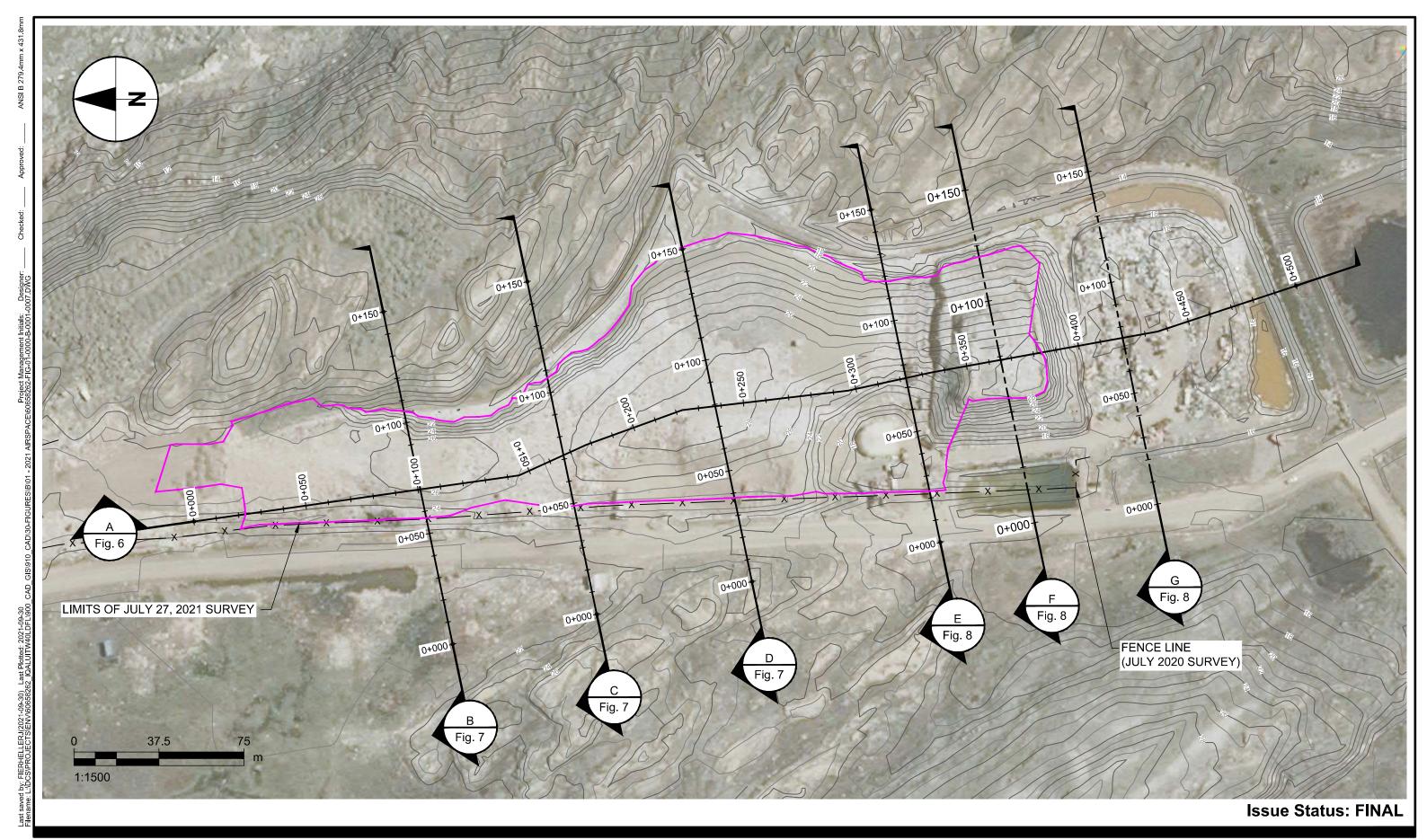
City of Iqaluit, Nunavut
Project No.: 60658262 Date: 2021-09-30

Iqaluit West 40 Landfill October 07, 2019 Survey Conditions Plan



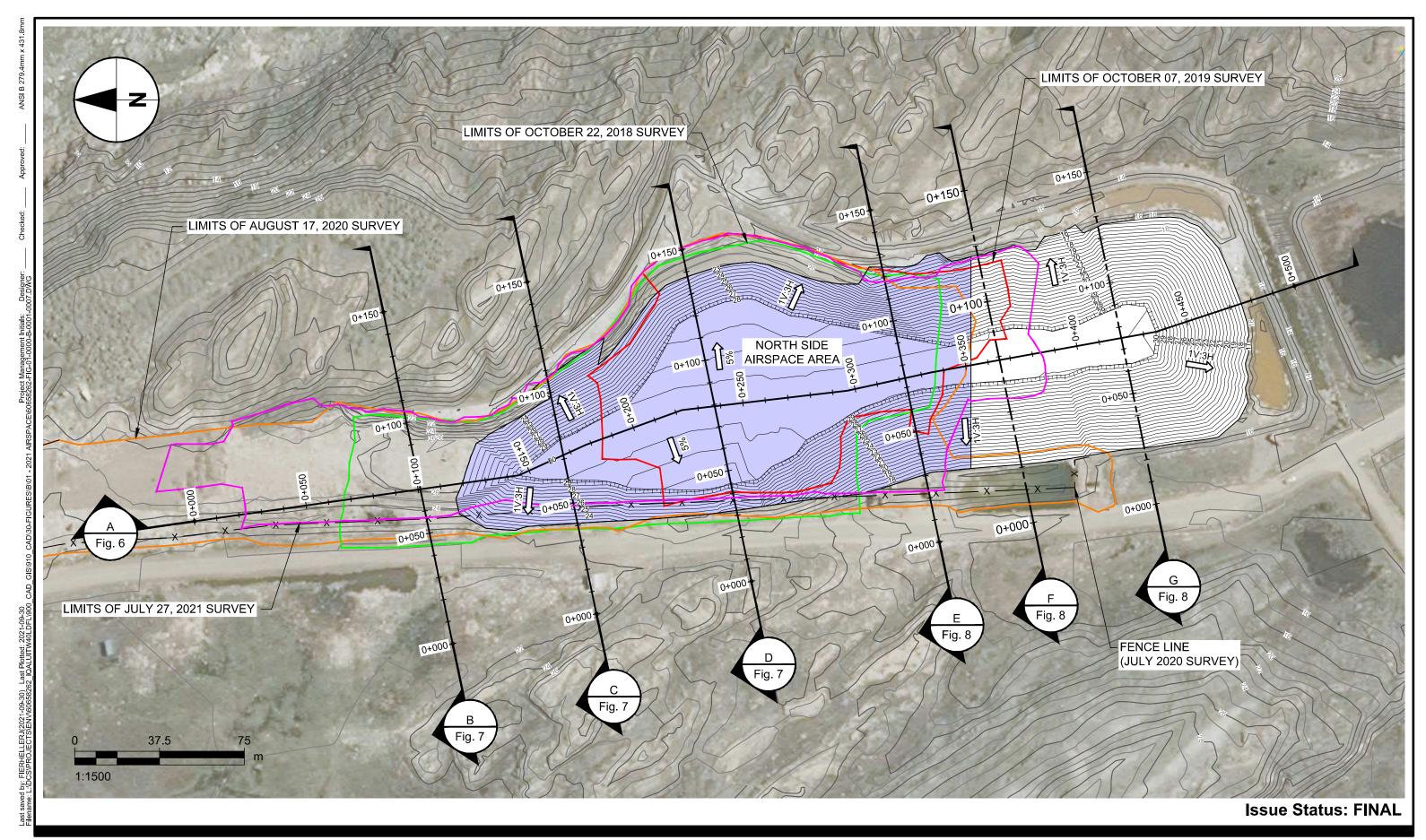
City of Iqaluit, Nunavut
Project No.: 60658262 Date: 2021-09-30

Figure: 3



City of Iqaluit, Nunavut
Project No.: 60658262 Date: 2021-09-30

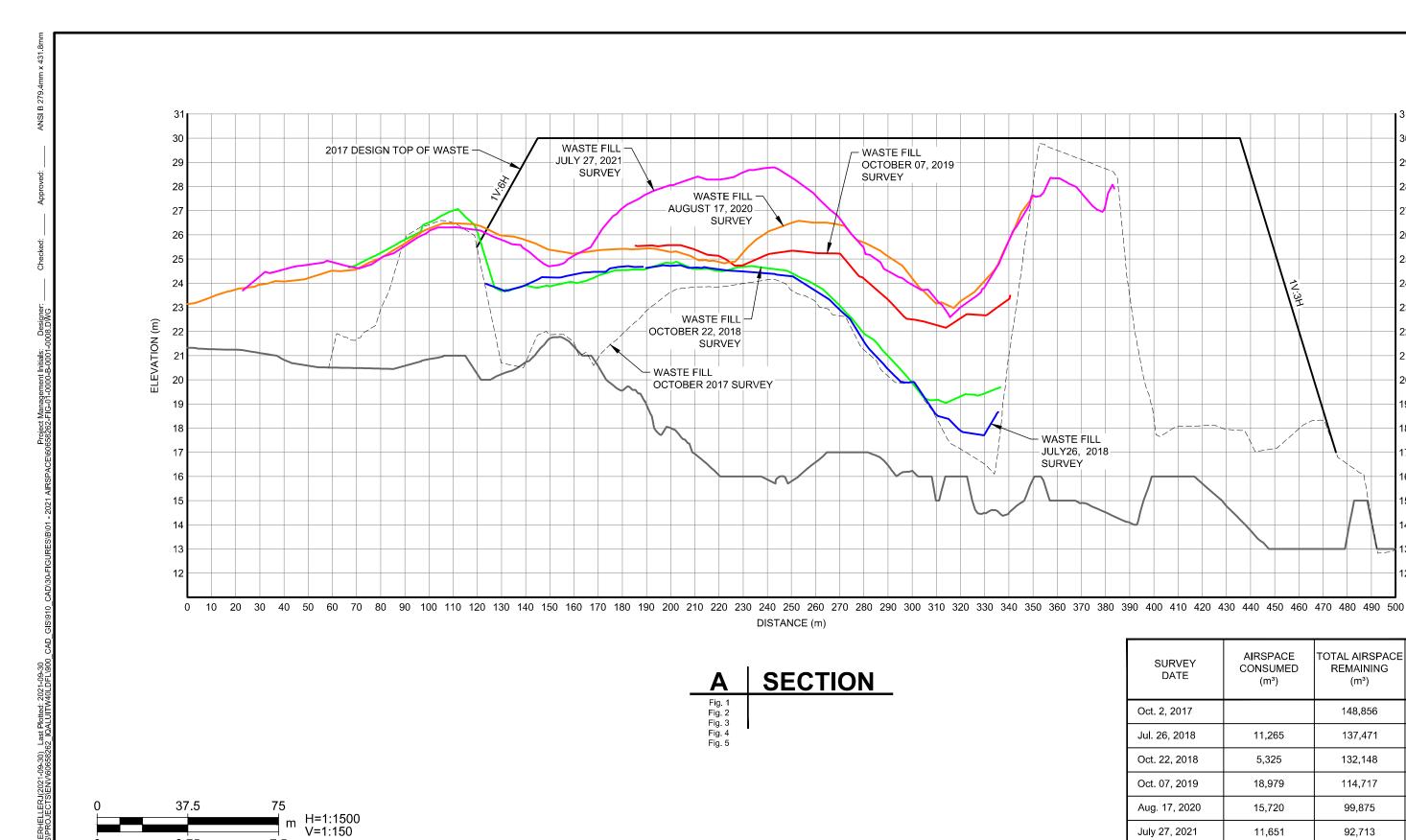
Iqaluit West 40 Landfill July 27, 2021 Survey Conditions Plan



City of Iqaluit, Nunavut
Project No.: 60658262 Date: 2021-09-30

Iqaluit West 40 Landfill Design Top of Waste Plan

AECOM



Issue Status: FINAL

NORTH SIDE

AIRSPACE

 (m^3)

101,435

90,050

84,728

66,956

52,108

43,299

 (m^3)

ELEVATION (m)

22

Iqaluit West 40 Landfill 2021 West 40 Landfill Airspace

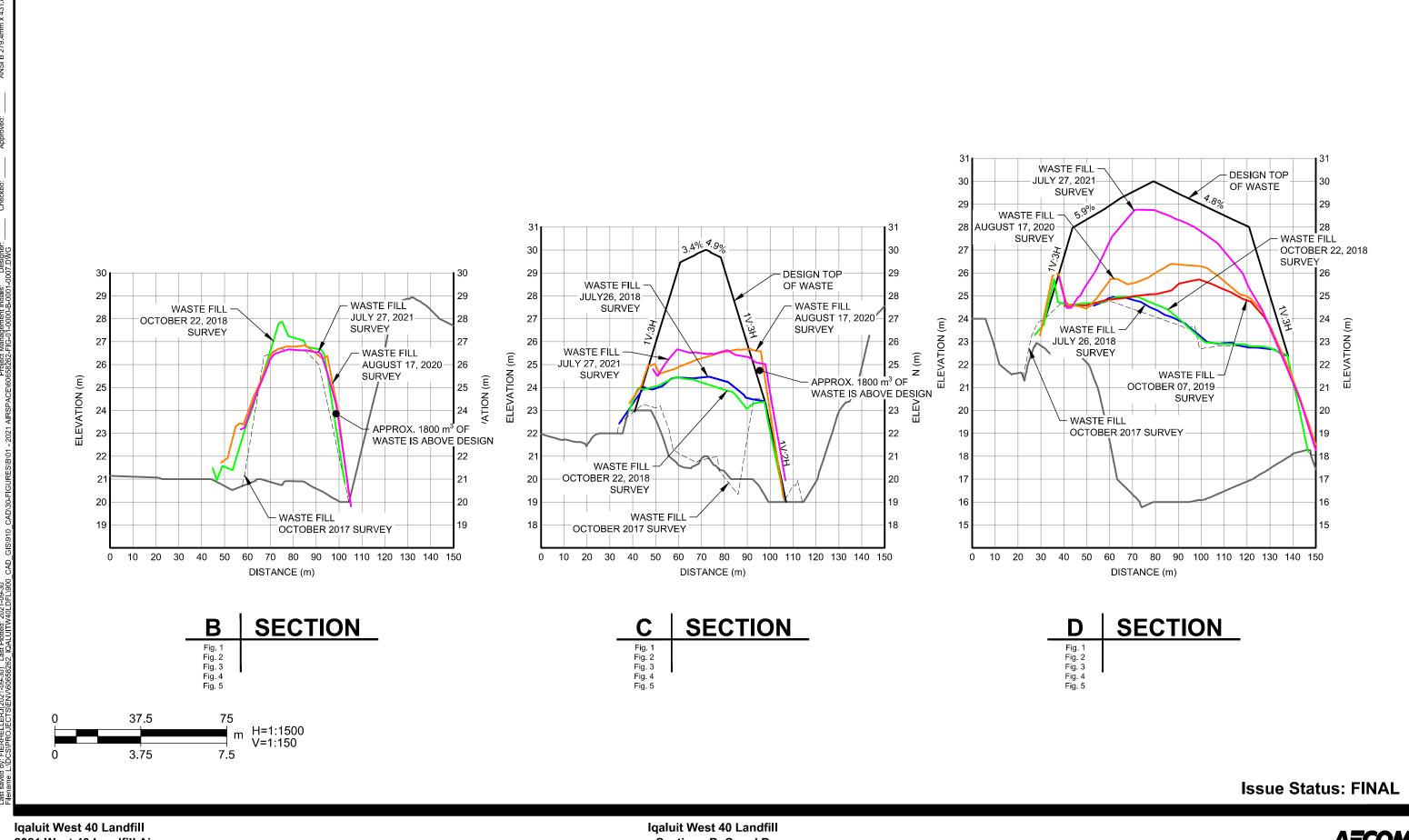
City of Iqaluit, Nunavut Project No.: 60658262 Date: 2021-09-30

3.75

Iqaluit West 40 Landfill Section A



Figure: 6



2021 West 40 Landfill Airspace

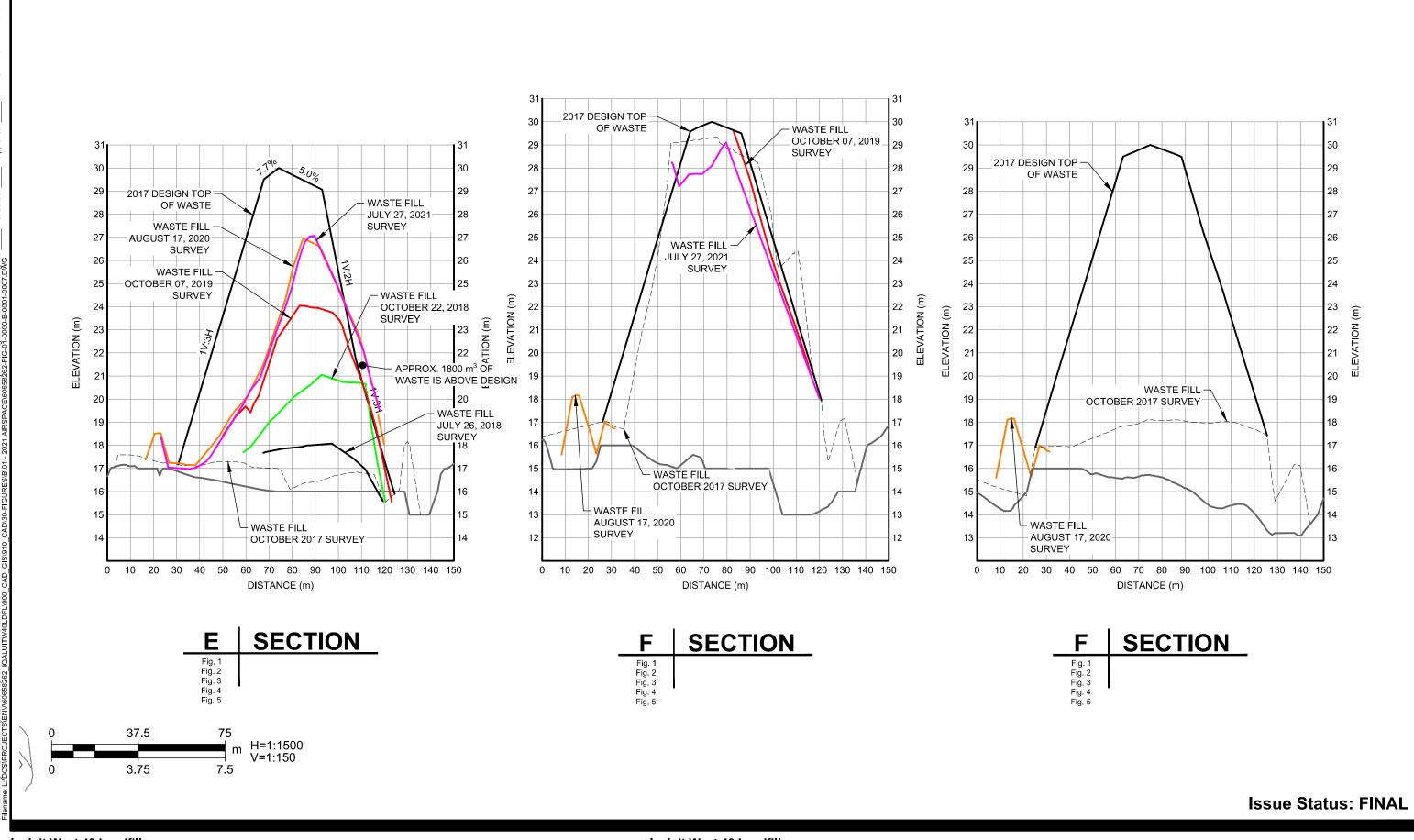
City of Iqaluit, Nunavut

Project No.: 60658262 Date: 2021-09-30

Sections B, C and D



Figure: 7



City of Iqaluit, Nunavut

Project No.: 60658262 Date: 2021-09-30

Iqaluit West 40 Landfill Sections E, F and G

TABLE 1.1 IQALUIT WEST 40 LANDFILL WASTE GENERATION & LANDFILL AIRSPACE PROJECTIONS

TOTAL LANDFILL

[An	nual Waste Ge	eneration m ³		End o	of Year Remain	ing Airspace m	1 ³
-		Project Grov	vth rate			Project Grov	wth rate	
	1%	2%	3%	4%	1%	2%	3%	4%
YEAR								
2017								
2018	17784	17784	17784	17784	77400	77400	77400	77400
2019	16500	16500	16500	16500	79359	79359	79359	79359
2020	16700	16700	16700	16700	93244	93244	93244	93244
2021	16376	16376	16376	16376	87588	87588	87588	87588
2022	16540	16704	16867	17031	71048	70884	70721	70557
2023	16705	17038	17373	17712	54343	53847	53347	52845
2024	16872	17378	17894	18421	37471	36469	35453	34424
2025	17041	17726	18431	19158	20430	18743	17022	15266
2026	17211	18080	18984	19924	3219	662	-1963	-4658
2027	17383	18442	19554	20721	-14165			
2028	17557	18811	20140	21550				
2029	17733	19187	20745	22412				
2030	17910	19571	21367	23308				
2031	18089	19962	22008	24240				
2032	18270	20361	22668	25210				
2033	18453	20769	23348	26219				
2034	18637	21184	24049	27267				
2035	18824	21608	24770	28358				
2036	19012	22040	25513	29492				
2037	19202	22481	26279	30672				
2038	19394	22930	27067	31899				

TABLE 1.2 IQALUIT WEST 40 LANDFILL WASTE GENERATION & LANDFILL AIRSPACE PROJECTIONS

NORTHERN PORTION OF LANDFILL

	An	ınual Waste Ge	eneration m ³		End	of Year Remain	ing Airspace n	1 ³
		Project Grov	vth rate			Project Grov	wth rate	
	1%	2%	3%	4%	1%	2%	3%	4%
YEAR								
2017								
2018	17784	17784	17784	17784	77400	77400	77400	77400
2019	16500	16500	16500	16500	79359	79359	79359	79359
2020	16700	16700	16700	16700	45477	45477	45477	45477
2021	16376	16376	16376	16376	38144	38144	38144	38144
2022	16540	16704	16867	17031	21604	21440	21277	21113
2023	16705	17038	17373	17712	4899	4403	3903	3401
2024	16872	17378	17894	18421	-11973	-12975	-13991	-15020
2025	17041	17726	18431	19158	-29014	-30701	-32422	-34178
2026	17211	18080	18984	19924	-46225	-48782	-51407	-54102
2027	17383	18442	19554	20721	-63609			
2028	17557	18811	20140	21550				
2029	17733	19187	20745	22412				
2030	17910	19571	21367	23308				
2031	18089	19962	22008	24240				
2032	18270	20361	22668	25210				
2033	18453	20769	23348	26219				
2034	18637	21184	24049	27267				
2035	18824	21608	24770	28358				
2036	19012	22040	25513	29492				
2037	19202	22481	26279	30672				
2038	19394	22930	27067	31899				

APPENDIX D SAMPLING RESULTS

Igaluit

				TESTING REC	QUIREMENTS	i	CP	REPORT NUN	BER (Lab Use)
(ADUCEZN	O.Reg 153	Table	Medium/Fine		MISA Guidelines	Uan	70.5	7
-	9	RPI ICC Yes No	Agricultura Record of Site C		Reg 153) Reg 153)	O.Reg 558 Leachate An Disposal Site:	alysis		
1000	ENVIRONMENTAL LABORATORIES Client committed. Quality assured.	Provincial Water Qualit		Johann (O.1	(eg 100)	Landfill Monitoring			
		Sewer Use By-Law:	26 ATES			Other:			
Are	any samples to be submitted intended for Human Consump			Yes 🗆	No (If ye	s, submit all Drinking Wate	r Samples on a Dri	nking Water Chain of	Custody)
	Indicate Laboratory Samples are sub		gston		Richmon		☐ Barrie	London	
Organia	-1 0 1 0 1 1 1	And the second s	2	P	ANALYSES RI	EQUESTED (Print Test in Bo			JND SERVICE
Contac	56%			2)			nated	KEQUESTED	(see back page)
En	manuel Kayode Igal	uit		15			tamir	☐ Platinum	200% Surcharge
TAI.	367-222-4612 Nu,	wit XOAOHO		Quote			Con	Gold	100% Surcharge
Г	0.4.11	In : (1)					Suspected Highly Contaminated	Silver Bronze	50% Surcharge 25% Surcharge
l ux.	Kayode @ Igaluit · Ca P.O. No.: 460	Froject Walle.		Per			l l H	Standard	5-7 days
Email:	(aude @ 16 about - (g P.O. No.: 460	Additional Info:		3			beds		
E. 1	* Sample Matrix Legend: WW=Waste	Water SW=Surface Water GW=G	roundwater I S-1		-Calid Cludge	S-Sail Sad=Sadiment DC-D		Specific Date:	
Lab		Sample Date Collected		Liquid Sidage, 33-		Test For Each Sample	aint Grips, r-riter,	Field	# Bottles/ Field
No:	Sample Identification S.P.I		Collected	E		eck Mark In The Box Provided		pH Temp.	Sample Filtered(Y/N)
(1)	INTP Raw (2) Raw (Total)	DW Jan 19,21			le	st A	1-020	682 3.9	9
3	MTP Potable (4) Potable	(total) DuJan 19,21			T	est As	SC	6.59 5.7	9
	WWTP Influent	WW Jan 10 pl			T	est F		7.38 3.41	6
	WWTP Effluent	WW Jan 19,21				Test F		6.92 360	6
							2-0	20%	
								er.	
			<u> </u>					0	
			+		+				
	- V.				+				
			+		+				
	SAMPLE SUBMISSION INFORMATION	SHIPPING INFORI	MATION	REPORTING /	INVOICING	SAMPLE RECE	IVING INFORMATION	ON (LABORATORY U	ISE ONLY)
	Sampled by: Submitted by:	Client's Courier	Invoice	Report by Fax		Received By (print): She		Signature:	22 011217
Print:	Emmanuel Kayade Emmanuel Kaya			Report by Emai		Date Received (yy-mm-dd)			100
Sign:	CHARACO Washington	Drop Off	# of Pieces	Invoice by Ema			01000		130
Jigiti	21-01-19 21601-19		# OI FIECES			Laboratory Prepared Bottle	s. L Yes	No No	
Commi	Date (yy-mm-dd)/Time: Date (yy-mm-dd)/Time:	Caduceon (Pick-up)		Invoice by Mail		Sample Temperature °C:	4.1	Labeled by:	
Commen	(1) 2 Pet, 2R, 2M, 2 Hg, 1Ba (3) 2 Pet, 1N/P,1M, 1Hg,	ct & ZPct,	2R, 21	M, 2Hg/	1Bae+			Page	of
	(3) ZPe+, INIP, 1M, 1Hg,	IBACT (9 7	-P-t/1	INIP, IT	1, 1Hg	Back		G 90228	



QUOTATION FOR ANALYTICAL SERVICES

Quote #:

YD20 Igaluit A City of Igaluit

Organization:

Mike Hatfield

Contact: Telephone:

867-979-6363

Facsimile:

Email:

M.Hatfield@city.lgaluit.nu.ca

Project #: Address:

TEST A - Drinking Water Box 460, Iqaluit NU, X0A 0H0

Additional Info:

QUOTE # ('S) MUST BE ON C OF C TO APPLY if not listed, General pricing will be applied.

Additional Info:

Replacing Quote YD18_lqaluit_A

Date:

1-Jan-20

Valid Until: 31-Dec-20

ltem #	Quantity	Analysis Request	Matrix	Unit Cost, \$	Amount,
1	1	Acidity (Subcontracted)	DW	34.15	34.15
2	1	Alkalinity	DW	14.75	14.75
3	1	Bicarbonate/ Carbonate	DW	17.85	17.85
4	1	Chloride/Sulphate	DW	24.25	24.25
5	1	Conductivity	DW	9.65	9.65
6	1	Hydroxide	DW	14.75	14.75
7	1	Redox Potential	DW	16.05	16.05
8	1	TDS	DW	17.85	17.85
9	1	TSS	DW	17.85	17.85
10	1	TOC	DW	24.25	24.25
11	1	TIC	DW	24.25	24.25
12	1	TOTAL METALS ICPOES AI, Ba, Be, Cr, Co, Cu, Fe, Li, Mn, Mo, Ni, Sn, Sr, Ti, V, Zn + Hardness ICPMS Sb, As, Cd, Pb, Se, Ag, Tl, U CVAAS Hg	DW	93.85	93.85
13	1	DISSOLVED METALS ICPOES AI, Ba, Be, Cr, Co, Cu, Fe, Li, Mn, Mo, Ni, Sn, Sr, Tl, V, Zn + Hardness ICPMS Sb, As, Cd, Pb, Se, Ag, Tl, U CVAAS Hg	DW	93.85	93.85
14	1	Fecal Coliforms	DW	16.60	16.60
15	1	рН	DW	9.20	9.20
16	1	Turbidity	DW	14.75	14.75
17	1	Ottawa Airport Pick Up		25.00	25.00
o not include chinni	ng unless otherwise state			Subtotal	468.90

Environmental Surcharge of \$1.50 per sample set

HST 60.96 Total Cost 529.86

Kristine Cavanagh

Customer Service Representative

Caduceon Environmental Laboratories

kcavanagh@caduceonlabs.com

Cell: 819-230-9605 Office 613-526-0123



GENERAL CHAIN OF CUSTODY FORM

Page	of	

Please use our Drinking Water Chain of Custody Form for regulated drinking water samples REPORT TO: PROJECT INFORMATION: INVOICE TO: (if different from Report) Client: Client: TM Quote #: Caduceon Environmental Laboratories Caduceon Environmental Laboratories Client P.O. #: P210121_TM Address: 2378 Holly Lane Address: 285 Dalton Avenue Ottawa ON, K1V 7P1 Kingston ON Client Project #: Greg Clarkin K7K 6Z1 Contact: Email: qclarkin@caduceonlabs.com tyapici@caduceonlabs.com Email: mmccormick@caduceonlabs.com 613-526-0123 Fax: 613-526-1244 Phone: 6135442001 Fax: 6135442770 Phone: REPORTING/INVOICING FORMAT TURN AROUND TIME (TAT)* **ANALYSIS REQUESTED** LABORATORY USE ONLY FIELD FILTERED? CONTAINERS ☐1 Business Day ☐2 Business Days WORK ORDER NUMBER: ∏Fax **☑**Email □Mail FIELD TEMP (if applicable) FIELD pH (if applicable) **QC DATA REPORTED** ☐3 Business Days ✓ Standard □No □Yes SAMPLE DISPOSAL SPECIFIC DATE: Ь * Prior arrangements must be made for ☐Hold ☐Dispose ☐Return NUMBER Acidity rush/weekend/holiday work METALS ! SAMPLING SAMPLE DESCRIPTION DATE MATRIX** (This Will Appear On The Report) TIME TEMP Btl. Type Lab ID: (mm-dd-yy) DW X 1/19/21 B21-2046-1 1/19/21 WW B21-2046-3 X **Matrix: B=Biota, GW=Ground Water, O=Oil, P=Paint, S=Soil, SL=Sludge, □O.Reg. 153: (1 □2 □3 □4 □5 □6 □7 □8 □9 □) SW=Surface Water, W=Water, WW=Wastewater, SD=Sediment Industrial / Commercial Residential / Parkland □ Agricultural REGULATION □Coarse Soil □Fine Soil □Surface ☐Subsurface High Concentrations Expected □O.Reg. 558 □PWQO □MISA □CofA □MMER □EEM □None Sewer Use: Sanitary Storm Municipality: COMMENTS/FIELD NOTES: ☐Other: Relinquished to Testmark By (Signature) Date Time Sampled By Date Time Shipped By Shipping Reference Client Received By Date Received at Testmark By Date Time Time



Final Report

C.O.C.: G90228 REPORT No. B21-02046

Report To:

City of Iqaluit

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 20-Jan-21

DATE REPORTED: 28-Jan-21 SAMPLE MATRIX: Drinking Water

PO Box 460,

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123 Fax: 613-526-1244

JOB/PROJECT NO.: Test A (WTP)

P.O. NUMBER:

WATERWORKS NO.

			Client I.D.		Test A- Potable WTP	Test A- Potable (Total)	Test A- Raw WTP	Test A- Raw WTP (Total)
			Sample I.D.		B21-02046-1	B21-02046-2	B21-02046-3	B21-02046-4
			Date Collecte	ed	19-Jan-21	19-Jan-21	19-Jan-21	19-Jan-21
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Hardness (as CaCO3)	mg/L	1	SM 3120	20-Jan-21/O	21		21	
Hardness (as CaCO3)	mg/L	1	SM 3120	21-Jan-21/O		21		22
Alkalinity(CaCO3) to pH4.5	mg/L	5	SM 2320B	20-Jan-21/O	15		13	
Bicarbonate(as CaCO3)	mg/L	5	SM 2320B	20-Jan-21/O	15		13	
Carbonate (as CaCO3)	mg/L	5	SM 2320B	20-Jan-21/O	< 5		< 5	
Hydroxide	mg/L	5	EPA 310.2	20-Jan-21/O	< 5		< 5	
Acidity (as CaCO3)	mg/L	5	Subcontract	26-Jan-21	< 5 ¹		< 5 1	
pH @25°C	pH Units		SM 4500H	20-Jan-21/O	7.15		6.99	
Conductivity @25°C	µmho/cm	1	SM 2510B	20-Jan-21/O	45		46	
TDS(ion sum calc.)	mg/L	1	Calc.	21-Jan-21/O	22		23	
Total Suspended Solids	mg/L	3	SM2540D	22-Jan-21/K	< 3		< 3	
Turbidity	NTU	0.1	SM 2130	22-Jan-21/O	0.5		0.4	
REDOX potential	mV		In-House	22-Jan-21/R	361		564	
Chloride	mg/L	0.5	SM4110C	20-Jan-21/O	1.6		3.3	
Sulphate	mg/L	1	SM4110C	20-Jan-21/O	3		3	
Aluminum	mg/L	0.01	SM 3120	20-Jan-21/O	0.01		< 0.01	
Aluminum	mg/L	0.01	SM 3120	21-Jan-21/O		0.01		0.01
Antimony	mg/L	0.0001	EPA 200.8	20-Jan-21/O	< 0.0001		< 0.0001	
Antimony	mg/L	0.0001	EPA 200.8	21-Jan-21/O		< 0.0001		< 0.0001
Arsenic	mg/L	0.0001	EPA 200.8	20-Jan-21/O			0.0001	
Arsenic	mg/L	0.0001	EPA 200.8	21-Jan-21/O		< 0.0001		< 0.0001
Barium	mg/L	0.001			0.002		0.002	
Barium	mg/L	0.001				0.002		0.002
Beryllium	mg/L	0.002			< 0.002		< 0.002	
Beryllium	mg/L	0.002				< 0.002		< 0.002
Cadmium	mg/L).000015	EPA 200.8	20-Jan-21/O	< 0.000015		< 0.000015	

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an *

Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Final Report

C.O.C.: G90228 REPORT No. B21-02046

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 20-Jan-21

DATE REPORTED: 28-Jan-21 SAMPLE MATRIX: Drinking Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test A (WTP)

P.O. NUMBER:

WATERWORKS NO.

			Client I.D.		Test A- Potable WTP	Test A- Potable (Total)	Test A- Raw WTP	Test A- Raw WTP (Total)
			Sample I.D.		B21-02046-1	B21-02046-2	B21-02046-3	B21-02046-4
			Date Collecte	ed	19-Jan-21	19-Jan-21	19-Jan-21	19-Jan-21
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Cadmium	mg/L).000015	EPA 200.8	21-Jan-21/O		< 0.000015		< 0.000015
Chromium	mg/L	0.002	SM 3120	20-Jan-21/O	< 0.002		< 0.002	
Chromium	mg/L	0.002	SM 3120	21-Jan-21/O		< 0.002		< 0.002
Cobalt	mg/L	0.005	SM 3120	20-Jan-21/O	< 0.005		< 0.005	
Cobalt	mg/L	0.005	SM 3120	21-Jan-21/O		< 0.005		< 0.005
Copper	mg/L	0.002	SM 3120	20-Jan-21/O	0.011		0.058	
Copper	mg/L	0.002	SM 3120	21-Jan-21/O		0.011		0.101
Iron	mg/L	0.005	SM 3120	20-Jan-21/O	0.047		0.013	
Iron	mg/L	0.005	SM 3120	21-Jan-21/O		0.047		0.030
Lead	mg/L	0.00002	EPA 200.8	20-Jan-21/O	0.00010		0.00011	
Lead	mg/L	0.00002	EPA 200.8	21-Jan-21/O		0.00010		0.00019
Lithium	mg/L	0.01	SM 3120	20-Jan-21/O	0.01		< 0.01	
Lithium	mg/L	0.01	SM 3120	21-Jan-21/O		0.01		< 0.01
Manganese	mg/L	0.001	SM 3120	20-Jan-21/O	0.046		0.003	
Manganese	mg/L	0.001	SM 3120	21-Jan-21/O		0.046		0.004
Mercury	mg/L	0.00002	SM 3112 B	21-Jan-21/O	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Molybdenum	mg/L	0.01	SM 3120	20-Jan-21/O	< 0.01		< 0.01	
Molybdenum	mg/L	0.01	SM 3120	21-Jan-21/O		< 0.01		< 0.01
Nickel	mg/L	0.01	SM 3120	20-Jan-21/O	< 0.01		< 0.01	
Nickel	mg/L	0.01	SM 3120	21-Jan-21/O		< 0.01		< 0.01
Selenium	mg/L	0.001	EPA 200.8	20-Jan-21/O	< 0.001		< 0.001	
Selenium	mg/L	0.001				< 0.001		< 0.001
Silver	mg/L	0.0001			< 0.0001		< 0.0001	
Silver	mg/L	0.0001				< 0.0001		< 0.0001
Strontium	mg/L	0.001			0.015		0.015	
Strontium	mg/L	0.001	SM 3120 21-Jan-21/O			0.016		0.015

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Final Report

C.O.C.: G90228 REPORT No. B21-02046

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 20-Jan-21

DATE REPORTED: 28-Jan-21

SAMPLE MATRIX: Drinking Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1

Tel: 613-526-0123 Fax: 613-526-1244

JOB/PROJECT NO.: Test A (WTP)

P.O. NUMBER:

WATERWORKS NO.

			Client I.D.		Test A- Potable WTP	Test A- Potable (Total)	Test A- Raw WTP	Test A- Raw WTP (Total)
			Sample I.D.		B21-02046-1	B21-02046-2	B21-02046-3	B21-02046-4
			Date Collecte	ed	19-Jan-21	19-Jan-21	19-Jan-21	19-Jan-21
Parameter	Units	R.L.	Reference Date/Site Method Analyzed					
Thallium	mg/L	0.00005	EPA 200.8	20-Jan-21/O	< 0.00005		< 0.00005	
Thallium	mg/L	0.00005	EPA 200.8	21-Jan-21/O		< 0.00005		< 0.00005
Tin	mg/L	0.05	SM 3120	20-Jan-21/O	< 0.05		< 0.05	
Tin	mg/L	0.05	SM 3120	21-Jan-21/O		< 0.05		< 0.05
Titanium	mg/L	0.005	SM 3120	20-Jan-21/O	< 0.005		< 0.005	
Titanium	mg/L	0.005	SM 3120	21-Jan-21/O		< 0.005		< 0.005
Uranium	mg/L	0.00005	EPA 200.8	20-Jan-21/O	< 0.00005		< 0.00005	
Uranium	mg/L	0.00005	EPA 200.8	21-Jan-21/O		< 0.00005		< 0.00005
Vanadium	mg/L	0.005	SM 3120	20-Jan-21/O	< 0.005		< 0.005	
Vanadium	mg/L	0.005	SM 3120	21-Jan-21/O		< 0.005		< 0.005
Zinc	mg/L	0.005	SM 3120	20-Jan-21/O	< 0.005		0.007	
Zinc	mg/L	0.005	SM 3120	21-Jan-21/O		0.005		0.016
Total Organic Carbon	mg/L	0.2	EPA 415.2	20-Jan-21/O	1.9		2.1	
TIC	mg/L	0.5	EPA 415.1	20-Jan-21/O	4.2		3.77	
Fecal Coliform	cfu/100mL	1	MOE E3371	20-Jan-21/O	0		0	
Anion Sum	meq/L		Calc.	21-Jan-21/O	0.410		0.427	
Cation Sum	meq/L		Calc.	21-Jan-21/O	0.463		0.463	
% Difference	%		Calc.	21-Jan-21/O	6.06		4.06	
Ion Ratio	AS/CS		Calc.	21-Jan-21/O	0.886		0.922	
Sodium Adsorption Ratio	-		Calc. 21-Jan-21/O		0.0815		0.0808	
Conductivity (calc.)	µmho/cm		Calc. 21-Jan-21/O		46		48	
EC(calc.)/EC(actual)	-		Calc. 21-Jan-21/O		1.03		1.04	
TDS(calc.)/EC(actual)	-		Calc. 21-Jan-21/O		0.495		0.497	
Langelier Index(25°C)	S.I.		Calc.	21-Jan-21/O	-2.17		-2.40	

1 Subcontracted to Testmark Labs

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

					G REQUIRE					7	RE	PORT NUM	BER (Lab	Use)	
0	ADUCEZIN	O.Reg 153	Table		/Fine			SA Guidelines		UO	Me	0'4	7		
	ADUCLAN	RPI LICC	Agricultural Record of Site C		(O.Reg 15)			Reg 558 Leach	ate Analysis						
1000	ENVIRONMENTAL LABORATORIES Client committed, Quality assured.	Provincial Water Q		ondition	(O.Reg 15	>)	-	posal Site: ndfill Monitorin	na						
		Sewer Use By-Law					Oth		19						
Are	any samples to be submitted intended for Human Consum	tion under any Drinking Wa	ater Regulations?	☐ Yes	s 🔲 No	(If ye			Water Samp	oles on a [Drinking Wate	r Chain of	Custody)		
	Indicate Laboratory Samples are sub	nitted to:	Kingston	Ottawa		chmon		☐ Wind		Barrie		ndon			
Organiz	ation: Address and Invoicing Add	ess (if different)			ANALY	SES RE	QUESTE	D (Print Tes	t in Boxes)		Т	URNAROU	ND SERV	ICE	
	ity of Igaluit Box	460									REC	QUESTED (see back	page)	
Contact				5						-	E Diet	inum	2000/ 6		
Tol.	manuel Kayode laa	wit XOAOHO		note							Gold	inum 1	200% Sur 100% Sur		
8	367-222-4612 Nu,	XUNUIIO		0							Plati Gold Silve Bror Stan		50% Surc		
Fax:	Quote No.:	/ Project Name:		Per							Bror		25% Surc	harge	
F	4520-Igaluit-	Additional lafa								-	हु 🔀 Stan	ndard	5-7 days		
e. k	Cayale @ Igalut. Ca P.O. No.: 460	Additional Info:		F							Spe	cific Date:			
	* Sample Matrix Legend: WW=Wast			iquid Sludge					PC=Paint Ch						
Lab	Sample Identification S.P.	Sample Date Colle Matrix * (yy-mm-						ach Sample		,	/	ield	# Bottles/		
No:					By USI		st wark in	The Box Prov	/idea		pH	Temp.		Filtered(Y/N)	
						1-6	56	7)	321-	924	1682	3.9	9		
3	MTP Potable (4) Potable	(total) DIJan 19		+-	-	1	est	7		54	6.59	5.7	9		
	WWTP Influent	WW Jan 19	21			1	est	+			7.38	3.41	6		
	WWTP Effluent	WW Jan 19	121				Tesl	t F7			6.92	360	6		
	1.3														
											1 - 0	A			
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				+-	+	+		+							
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	SAMPLE SUBMISSION INFORMATION	SHIPPING INI	FORMATION	REPORT	ING / INVO	ICING		SAMPLE	RECEIVING	INFORMA	TION (LABOR	ATORY US	SE ONLY)		
	Sampled by: Submitted by:	Client's Courier	Invoice	Report by	Fax		Received	By (print):			Signature				
Print:				Report by		1	ALIEN CHEEK CO.	eived (yy-mi		, ,			-		
		Caduceon's Courier	# 4 5 10 10 10 10 10 10 10 10 10 10 10 10 10			-			01		C Time Rece		20		
Sign:	21-01-19 21-19	Drop Off	# of Pieces	Invoice by			Laborato	ry Prepared	BOTTIES:	L Y	es 🔲	No			
	21-01-19 2[-01-19 Date (yy-mm-dd)/Time: Date (yy-mm-dd)/Time:	Caduceon (Pick-up)		Invoice by			Sample Temperature °C: (4.)					Labeled by:			
Commer	115: ()2Pet, 2R, 7M, 2Hg, 1B	ct @ ZPe	+,2R,2	M, 21	Hg, 18	al+					Page		of		
	B) ZPEX, INIP, IM, 1Hg	IBACH (9)	+, 2R, 2, ZD-t+, 1	INIP,	1M,	Hg	184	et			G 90	228			
			,	/	,	//			The second secon	(1)	of some Telephone and the second				

QUOTATION FOR ANALYTICAL SERVICES

Quote #:

YD20_lqaluit_F

Organization:

City of Iqaluit

Contact:

Mike Hatfield

Telephone:

867-979-6363

Facsimile:

Email: Project #: M.Hatfield@city.lgaluit.nu.ca

Address:

TEST F - Sewage Lagoon Box 460, Igaluit NU, X0A 0H0

Additional Info:

QUOTE # ('S) MUST BE ON C OF C TO APPLY if not listed, General pricing will be applied.

Additional Info:

Replacing Quote YD19_lqaluit_F

Date:

1-Jan-20

Valid Until:

31-Dec-20

item #	Quantity	Analysis Request	Matrix	Unit Cost, \$	Amount, \$
1	1	BOD	WW	30.60	30.60
2	1	Total Coliform / Fecal Coliform	WW	31.65	31.65
3	1	Ammonia, NO2/NO3	WW	30.60	30.60
4	1	Total Phosphorus	WW	17.75	17.75
5	1	Orthophosphate	WW	17.75	17.75
6	1	Conductivity	WW	9.65	9.65
7	1	TSS	WW	17.75	17.75
8	1	pH	WW	9.20	9.20
9	1	TOTAL METALS ICPOES AI, Ba, Be, Cr, Co, Cu, Fe, Li, Mn, Mo, Ni, Sn, Sr, Ti, V, Zn ICPMS Sb, As, Cd, Pb, Se, Ag, Tl, U CVAAS Hg	ww	93.85	93.85
10	1	Ottawa Airport Pick Up		25.00	25.00
es do not include shippi	ng unless otherwise state	ed.		Subtotal	283.80
duamental Cores	harma of \$4 E0 nor.	namula ant		LICT	20.00

Environmental Surcharge of \$1.50 per sample set

HST 36.89 Total Cost 320.69

Kristine Cavanagh

Customer Service Representative

Caduceon Environmental Laboratories

kcavanagh@caduceonlabs.com

Cell: 819-230-9605 Office 613-526-0123



Final Report

C.O.C.: G90228 REPORT No. B21-02050

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 20-Jan-21

DATE REPORTED: 28-Jan-21

SAMPLE MATRIX: Waste Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1

Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test F

P.O. NUMBER:

WATERWORKS NO.

			Client I.D.		WWTP Influent	WWTP Effluent	
			Sample I.D.		B21-02050-1	B21-02050-2	
			Date Collecte	ed	19-Jan-21	19-Jan-21	
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
BOD(5 day)	mg/L	3	SM 5210B	22-Jan-21/K	133	92	
Total Suspended Solids	mg/L	3	SM2540D	25-Jan-21/K	115	130	
Conductivity @25°C	µmho/cm	1	SM 2510B	20-Jan-21/O	482	371	
pH @25°C	pH Units		SM 4500H	20-Jan-21/O	7.62	7.26	
Nitrite (N)	mg/L	0.1	SM4110C	21-Jan-21/O	< 0.1	< 0.1	
Nitrate (N)	mg/L	0.1	SM4110C	21-Jan-21/O	< 0.1	< 0.1	
Ammonia (N)-Total	mg/L	0.01	SM4500- NH3-H	25-Jan-21/K	49.9	32.2	
o-Phosphate (P)	mg/L	0.002	PE4500-S	25-Jan-21/K	4.46	0.241	
Phosphorus-Total	mg/L	0.01	E3199A.1	22-Jan-21/K	6.95	4.36	
Aluminum	mg/L	0.01	SM 3120	21-Jan-21/O	0.16	0.16	
Antimony	mg/L	0.0005	EPA 200.8	21-Jan-21/O	0.0005	< 0.0005	
Arsenic	mg/L	0.0005	EPA 200.8	21-Jan-21/O	< 0.0005	< 0.0005	
Barium	mg/L	0.001	SM 3120	21-Jan-21/O	0.010	0.007	
Beryllium	mg/L	0.002	SM 3120	21-Jan-21/O	< 0.002	< 0.002	
Cadmium	mg/L	0.000070	EPA 200.8	21-Jan-21/O	0.000127	0.000103	
Chromium	mg/L	0.002	SM 3120	21-Jan-21/O	0.002	< 0.002	
Cobalt	mg/L	0.005	SM 3120	21-Jan-21/O	< 0.005	< 0.005	
Copper	mg/L	0.002	SM 3120	21-Jan-21/O	0.399	0.296	
Iron	mg/L	0.005	SM 3120	21-Jan-21/O	0.420	0.357	
Lead	mg/L	0.0001	EPA 200.8	21-Jan-21/O	0.0015	0.0013	
Lithium	mg/L	0.01	SM 3120	21-Jan-21/O	< 0.01	< 0.01	
Manganese	mg/L	0.001	SM 3120	21-Jan-21/O	0.032	0.030	
Mercury	mg/L	0.00002	SM 3112 B	25-Jan-21/O	< 0.00002	< 0.00002	
Molybdenum	mg/L	0.01	SM 3120 21-Jan-21/O		< 0.01	< 0.01	
Nickel	mg/L	0.01	SM 3120 21-Jan-21/O		< 0.01	< 0.01	
Selenium	mg/L	0.005	EPA 200.8			< 0.005	

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Final Report

C.O.C.: G90228 REPORT No. B21-02050

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 20-Jan-21

DATE REPORTED: 28-Jan-21

SAMPLE MATRIX: Waste Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test F

P.O. NUMBER:

WATERWORKS NO.

					WWTP Influent	WWTP Effluent	
			Sample I.D.		B21-02050-1	B21-02050-2	
			Date Collecte	ed	19-Jan-21	19-Jan-21	
Parameter	Units	R.L.	Reference Date/Site Method Analyzed				
Silver	mg/L	0.0001	EPA 200.8	22-Jan-21/O	0.0002	< 0.0001	
Strontium	mg/L	0.001	SM 3120	21-Jan-21/O	0.025	0.023	
Thallium	mg/L	0.0003	EPA 200.8	21-Jan-21/O	< 0.0003	< 0.0003	
Tin	mg/L	0.05	SM 3120	21-Jan-21/O	< 0.05	< 0.05	
Titanium	mg/L	0.005	SM 3120	21-Jan-21/O	< 0.005	< 0.005	
Uranium	mg/L	0.0003	EPA 200.8	21-Jan-21/O	< 0.0003	< 0.0003	
Vanadium	mg/L	0.005	SM 3120	21-Jan-21/O	< 0.005	< 0.005	
Zinc	mg/L	0.005	SM 3120	21-Jan-21/O	0.169	0.103	
Total Coliform	cfu/100mL	1	MOE E3371 20-Jan-21/O 69		69000000	43000000	
Fecal Coliform	cfu/100mL	1	MOE E3371 20-Jan-21/O		7400000	1600000	

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

1 1							TEST	ING RE	EQUIREM	ENTS								RE	PORT NUM	BER Da	o Use)
0	A D II	CEZ	NI"	O.Reg		Table [Medi	um/Fine	Co	arse	M	ISA Gu	idelines					1	99	0	
	ADU		1 /	RPI	Licc	Agricultural			Reg 153)				58 Leach	ate Anal	ysis						
(*	ENVIRONMENTA		· ·	Yes		Record of Site Co	ondition	(0.	Reg 153)		_	isposal							RI	-	100
		Client committed. Quality	assured.		cial Water Quality	Objectives							Monitorin	g		1	5	4		20	18
Are an	y samples to be submitted	ted intended for Human (Consumption		Use By-Law:	agulations?			T N.			ther: _									
Alean								es	NO	(If yes	s, submi	it all D			Sample			nking Wate	r Chain of	Custody)
0		Laboratory Samples			King	ston	Ottawa		Rich							Bar	rie		ndon		
Organizati	y of Igaluit	Address and Invoic					ANALYSES				QUEST	ED (Pr	D (Print Test in Boxes						URNAROU		
Contact:	y of igaine		oox 46				2									ted	REC	UESTED	see back	page)	
	imanuel Kayo	de	galuit				uot										Contaminated	☐ Plati	num	2000/ 6	
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Fax:			Project Nam	ne: Test	λ	Per										Suspected Highly	☐ Bron		25% Surc	•	
- "					A						3					cted	Stan	dard	5-7 days		
Email:	ayode@ Igaluit.	0	Additional I	nto:		7										spe		·			
	3 (1)	* Sample Matrix Legend: W		ter. SW=Surfac	ce Water GW=Gro	nundwater I S=I i	auid Sluc	ine SS:	=Solid Slu	anh	S=Soil S	od=So	diment I	OC-Dain	t China	· E-E	iltor (Spec	ific Date:		
Lab				Sample	Date Collected	Time	quiu oiuc	190, 00			Test For I			O-I all	it Onips	, 1-1		processing the second	eld	# Bottles/	Field
No:	Sample Iden	ntification	S.P.L.	Matrix *	(yy-mm-dd)	Collected			By Using	A Che	ck Mark I	n The E	Box Provi	ded			~	pН	Temp.	Sample	Filtered(Y/N)
(7)	WTP Rav	o 2 Raw.	AWHARE	A (Tota	May 821	7.40am			1 1	7	est	1	+					6.32	26.8	8/2	
		able (4) PS				7.50gm			1	-/	231	/	-							1 ,	
0	0011 100	- able (1) 10	A	VIVIO LO.		1.30gm		_	-	-		_						6.39	8-2	男/2	
		700	(total)													100					
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	SAMPLE SUBMIS	SION INFORMATION		SH	PPING INFORM	ATION	REPOI	RTING	/ INVOICE	NG		SA	MPLER	ECEIV	NG IN	FORM	ATIO	N (LABOR	ATORY US	EGNLY	
	Sampled by:	Submitted	bye	Client's Cou			Report I			-	Receive	-		-		1		Signature	-	R	
F										17		200 A CONTRACTOR AND ADDRESS OF THE PARTY OF	AND THE RESIDENCE OF THE PARTY	Section in the second section in	Charles III and the	Carlotte State				1:00	
MARKET STATE OF THE PARK THE P	10/000				Courier		Report I	57.0			Date Re				3000	100	M 10 10 20 20 20 20 20 20 20 20 20 20 20 20 20	Time Rece		1:20	(A)
Sign:	The bourge	(Kapte)		Drop Off		# of Pieces	Invoice	by Ema	ail	-	Laborat	ory Pr	epared l	Bottles			Yes		No	_	
	21-03-08		The second secon	Caduceon (Pick-up)		Invoice	by Mail	I		Sample	Tomp	oraturo	oc.	11-3 Labeled by:		CA					
Comments:	Date (yy-mm-dd)/Time:	Date (yy-mm-dd	The second secon	(3)		0.00	1 -	D	111	9 6	LD	D _	o L	(7)	715		1				
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	M, 1+9 -	(2)				N	1,1	9.	- (2)								G 87	491		



QUOTATION FOR ANALYTICAL SERVICES

Quote #: YD20 Igaluit A

Organization: Contact:

City of Iqaluit Mike Hatfield

Telephone:

867-979-6363

Facsimile:

Email:

M.Hatfield@city.lqaluit.nu.ca **TEST A - Drinking Water**

Project #: Address:

Box 460, Igaluit NU, X0A 0H0

Additional Info:

QUOTE # ('S) MUST BE ON C OF C TO APPLY if not listed, General pricing will be applied.

Additional Info:

Replacing Quote YD18_lqaluit_A

Date:

1-Jan-20

Valid Until:

31-Dec-20

Item #	Quantity	Analysis Request	Matrix	Unit Cost, \$	Amount, \$
1	1	Acidity (Subcontracted)	DW	34.15	34.15
2	1	Alkalinity	DW	14.75	14.75
3	1	Bicarbonate/ Carbonate	DW	17.85	17.85
4	1	Chloride/Sulphate	DW	24.25	24.25
5	1 1 Acidity (Subcontracted) 2 1 Alkalinity 3 1 Bicarbonate/ Carbonate	DW	9.65	9.65	
6	1	Hydroxide	DW	14.75	14.75
7	1	Redox Potential	DW	16.05	16.05
8	1	TDS	DW	17.85	17.85
9	1	TSS	DW	17.85	17.85
10	1	TOC	DW	24.25	24.25
11	1	TIC	DW	24.25	24.25
12	1	ICPOES AI, Ba, Be, Cr, Co, Cu, Fe, Li, Mn, Mo, Ni, Sn, Sr, Ti, V, Zn + Hardness ICPMS Sb, As, Cd, Pb, Se, Ag, TI, U CVAAS Hg	DW	93.85	93.85
	1	ICPOES AI, Ba, Be, Cr, Co, Cu, Fe, Li, Mn, Mo, Ni, Sn, Sr, Ti, V, Zn + Hardness ICPMS Sb, As, Cd, Pb, Se, Ag, Tl, U	DW	93.85	93.85
14	1	Fecal Coliforms	DW	16.60	16.60
	1	Н	DW	9.20	9.20
	1	DW	14.75	14.75	
17	. 1			25.00	25.00
do not include shippii	ng unless otherwise state			Subtotal	468.90
	narge of \$1.50 per			HST	60.96

60.96 **Total Cost** 529.86

Kristine Cavanagh

Customer Service Representative

Caduceon Environmental Laboratories

kcavanagh@caduceonlabs.com

Cell: 819-230-9605 Office 613-526-0123



GENERAL CHAIN OF CUSTODY FORM

Page	of	
5		

			Please use our Drink	ing Wa	ater	Cha	ain (of C	usto	dy I	Form	for	regi	ulated	drin	king	wat	er sa	3mpl	es				_		
REPORT	TO:				IN	VOI	CE T	r o: ((if d	iffer	ent	fron	ı Re	port)				PROJECT INFORMATION:							
Client:		Cadu	ceon Environmental L	aboratories	Ctien	nt	Cad	uceo	n Env	ironm	ental	Labor	atorie	s		_			TMC	Quote #	ķ.					
Address:			2378 Holly Lane		Addr	ess:	285	Dalt	on Av	enue									Clien	t P.O. f	#: P:	21031	T	ľΜ		
•			Ottawa ON, K1V 7	P1			King	gston	ON													-				
Contact:	•		Greg Clarkin		7		К7К	6Z1											1	•						
Email: .	gclark	in@caduce	onlabs.com tyapi	ci@caduceonlabs.com	Ema	il:	mn	ncco	ormic	:k@c	adu	ceonla	abs.c	:om												
Phone:	613-526-012	3	Fax: 613-526-	1244	Phor	ne:	613	5442	2001			Fax	:	6135	442770				1							
REPORTIN	IG/ I NVOICI	NG FORMAT	TURN AR	OUND TIME (TAT)*							An	ALYSI	s Re	QUES	STED			۸.		LAB	ORA	TORY	USI	E ONLY	7 (4)	
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QC	DATA REPO	RTED	☐3 Business Day	s	CONTAINERS						ļ	-			Ì	pH (if applicable)	TEMP (if applicable)	Field Filtered	CONTAINERS RECEIVED							
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	MPLE DISP		SPECIFIC DATE:	ements must be made for	ا ا							İ				f ap	🛎	표	2							
	□Dispose			ekend/holiday work	∰ ا	红	·					- [=		S.F	署		Jilli.					
DATE	SAMPLIN		EDESCRIPTION	NUMBER	Acidity		1								FIELD ,	FIELD	METALS (Y/N?)	È					P13#2			
(mm-dd-yy		MATRIX**		Appear On The Report)	z		_		Ш	_			\sqcup				=	ΣΣ	0.4000	TE	MP 🐣	Bti. Ty	ре	Lab II)	
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	in Concentra			⋛ □O.Reg. 558 □PWQO □MISA □CofA □]EE	N [None	е										
COMMEN	TS/FIELD I	NOTES:			뿐 Sewer Use: ∐Sanitary ☐Storm Municipality:																					
					Other:																					
							Relinquished to Testmark By (Signature)							Date			- 17	ime								
Sampled Client	Ву	Date	Tim	e		Shi	ppec	l By					sone or	N ()	ÁU Á		2 (CS)	Shipp	ping	Refere	:nce		dojit.			
Received	Ву	Date						Rec	eive	d at	Test	mark	Ву							Date			Time			



Final Report

C.O.C.: G87491 REPORT No. B21-06618

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 09-Mar-21

DATE REPORTED: 16-Mar-21 SAMPLE MATRIX: Drinking Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test A (WTP)

P.O. NUMBER:

WATERWORKS NO.

			Client I.D.		Test A- Potable WTP	Test A- Potable (Total)	Test A- Raw WTP	Test A- Raw WTP (Total)
			Sample I.D.		B21-06618-1	B21-06618-2	B21-06618-3	B21-06618-4
			Date Collecte	ed	09-Mar-21	09-Mar-21	09-Mar-21	09-Mar-21
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Hardness (as CaCO3)	mg/L	1	SM 3120	10-Mar-21/O	22		22	
Hardness (as CaCO3)	mg/L	1	SM 3120	12-Mar-21/O		22		23
Alkalinity(CaCO3) to pH4.5	mg/L	5	SM 2320B	09-Mar-21/O	17		14	
Bicarbonate(as CaCO3)	mg/L	5	SM 2320B	09-Mar-21/O	17		14	
Carbonate (as CaCO3)	mg/L	5	SM 2320B	09-Mar-21/O	< 5		< 5	
Hydroxide	mg/L	5	EPA 310.2	09-Mar-21/O	< 5		< 5	
Acidity (as CaCO3)	mg/L	5	Subcontract	16-Mar-21	< 5	1	< 5 1	
pH @25°C	pH Units		SM 4500H	09-Mar-21/O	7.46		7.27	
Conductivity @25°C	µmho/cm	1	SM 2510B	09-Mar-21/O	46		49	
TDS(ion sum calc.)	mg/L	1	Calc.	11-Mar-21/O	23		24	
Total Suspended Solids	mg/L	3	SM2540D	11-Mar-21/K	< 3		< 3	
Turbidity	NTU	0.1	SM 2130	11-Mar-21/O	1.1		0.3	
REDOX potential	mV		In-House	11-Mar-21/R	420		689	
Chloride	mg/L	0.5	SM4110C	10-Mar-21/O	1.4		3.4	
Sulphate	mg/L	1	SM4110C	10-Mar-21/O	3		3	
Aluminum	mg/L	0.01	SM 3120	10-Mar-21/O	< 0.01		< 0.01	
Aluminum	mg/L	0.01	SM 3120	12-Mar-21/O		< 0.01		0.01
Antimony	mg/L	0.0001	EPA 200.8	12-Mar-21/O	< 0.0001		< 0.0001	
Antimony	mg/L	0.0001	EPA 200.8	12-Mar-21/O		< 0.0001		< 0.0001
Arsenic	mg/L	0.0001	EPA 200.8	12-Mar-21/O	< 0.0001		< 0.0001	
Arsenic	mg/L	0.0001	EPA 200.8	12-Mar-21/O		< 0.0001		0.0001
Barium	mg/L	0.001	SM 3120	10-Mar-21/O	0.002		0.002	
Barium	mg/L	0.001	SM 3120	12-Mar-21/O		0.003		0.002
Beryllium	mg/L	0.002	SM 3120	10-Mar-21/O	< 0.002		< 0.002	
Beryllium	mg/L	0.002	SM 3120	12-Mar-21/O		< 0.002		< 0.002
Cadmium	mg/L).000015	EPA 200.8	12-Mar-21/O	< 0.000015		< 0.000015	

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Final Report

Test A- Raw

C.O.C.: G87491 REPORT No. B21-06618

Client I.D.

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 09-Mar-21

DATE REPORTED: 16-Mar-21

SAMPLE MATRIX: Drinking Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test A (WTP)

Test A-

< 0.01

< 0.001

< 0.0001

0.017

Test A- Raw

P.O. NUMBER: WATERWORKS NO.

Test A-

					Potable WTP	Potable (Total)	WTP	WTP (Total)	
			Sample I.D.		B21-06618-1	B21-06618-2	B21-06618-3	B21-06618-4	
			Date Collecte	ed	09-Mar-21	09-Mar-21	09-Mar-21	09-Mar-21	
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed					
Cadmium	mg/L	0.000015	EPA 200.8	12-Mar-21/O		< 0.000015		< 0.000015	
Chromium	mg/L	0.002	SM 3120	10-Mar-21/O	< 0.002		< 0.002		
Chromium	mg/L	0.002	SM 3120	12-Mar-21/O		< 0.002		< 0.002	
Cobalt	mg/L	0.005	SM 3120	10-Mar-21/O	< 0.005		< 0.005		
Cobalt	mg/L	0.005	SM 3120	12-Mar-21/O		< 0.005		< 0.005	
Copper	mg/L	0.002	SM 3120	10-Mar-21/O	0.020		0.056		
Copper	mg/L	0.002	SM 3120	12-Mar-21/O		0.025		0.095	
Iron	mg/L	0.005	SM 3120	10-Mar-21/O	0.018		0.012		
Iron	mg/L	0.005	SM 3120	12-Mar-21/O		0.053		0.043	
Lead	mg/L	0.00002	EPA 200.8	12-Mar-21/O	0.00007		0.00008		
Lead	mg/L	0.00002	EPA 200.8	12-Mar-21/O		0.00023		0.00018	
Lithium	mg/L	0.01	SM 3120	10-Mar-21/O	< 0.01		< 0.01		
Lithium	mg/L	0.01	SM 3120	12-Mar-21/O		0.01		< 0.01	
Manganese	mg/L	0.001	SM 3120	10-Mar-21/O	0.009		0.001		
Manganese	mg/L	0.001	SM 3120	12-Mar-21/O		0.018		0.002	
Mercury	mg/L	0.00002	SM 3112 B	11-Mar-21/O	< 0.00002	< 0.00002	< 0.00002	< 0.00002	
Molybdenum	mg/L	0.01	SM 3120	10-Mar-21/O	< 0.01		< 0.01		
Molybdenum	mg/L	0.01	SM 3120	12-Mar-21/O		< 0.01		< 0.01	
Nickel	mg/L	0.01	SM 3120	10-Mar-21/O	< 0.01		< 0.01		

12-Mar-21/O

12-Mar-21/O

12-Mar-21/O

12-Mar-21/O

12-Mar-21/O

10-Mar-21/O

12-Mar-21/O

< 0.001

< 0.0001

0.016

R.L. = Reporting Limit

Nickel

Silver

Silver

Selenium

Selenium

Strontium

Strontium

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

0.01

0.001

0.001

0.0001

0.0001

0.001

0.001

mg/L

mg/L

mg/L

mg/L

mg/L

mg/L

mg/L

SM 3120

EPA 200.8

EPA 200.8

EPA 200.8

EPA 200.8

SM 3120

SM 3120

Greg Clarkin, BSc., C. Chem Lab Manager - Ottawa District

< 0.001

< 0.0001

0.015

< 0.01

< 0.001

< 0.0001

0.016



Final Report

C.O.C.: G87491 REPORT No. B21-06618

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 09-Mar-21

DATE REPORTED: 16-Mar-21

SAMPLE MATRIX: Drinking Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test A (WTP)

P.O. NUMBER:

WATERWORKS NO.

		Client I.D.		Test A- Potable WTP	Test A- Potable (Total)	Test A- Raw WTP	Test A- Raw WTP (Total)	
			Sample I.D.		B21-06618-1	B21-06618-2	B21-06618-3	B21-06618-4
	Date Collected				09-Mar-21	09-Mar-21	09-Mar-21	09-Mar-21
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Thallium	mg/L	0.00005	EPA 200.8	12-Mar-21/O	< 0.00005		< 0.00005	
Thallium	mg/L	0.00005	EPA 200.8	12-Mar-21/O		< 0.00005		< 0.00005
Tin	mg/L	0.05	SM 3120	10-Mar-21/O	< 0.05		< 0.05	
Tin	mg/L	0.05	SM 3120	12-Mar-21/O		< 0.05		< 0.05
Titanium	mg/L	0.005	SM 3120	10-Mar-21/O	< 0.005		< 0.005	
Titanium	mg/L	0.005	SM 3120	12-Mar-21/O		< 0.005		< 0.005
Uranium	mg/L	0.00005	EPA 200.8	12-Mar-21/O	< 0.00005		< 0.00005	
Uranium	mg/L	0.00005	EPA 200.8	12-Mar-21/O		< 0.00005		< 0.00005
Vanadium	mg/L	0.005	SM 3120	10-Mar-21/O	< 0.005		< 0.005	
Vanadium	mg/L	0.005	SM 3120	12-Mar-21/O		< 0.005		< 0.005
Zinc	mg/L	0.005	SM 3120	10-Mar-21/O	< 0.005		0.009	
Zinc	mg/L	0.005	SM 3120	12-Mar-21/O		0.007		0.021
Total Organic Carbon	mg/L	0.2	EPA 415.2	09-Mar-21/O	2.0		1.9	
TIC	mg/L	0.5	EPA 415.1	09-Mar-21/O	4.42		3.78	
Fecal Coliform	cfu/100mL	1	MOE E3371	09-Mar-21/O	0		0	
Anion Sum	meq/L		Calc.	11-Mar-21/O	0.428		0.448	
Cation Sum	meq/L		Calc.	11-Mar-21/O	0.492		0.482	
% Difference	%		Calc.	11-Mar-21/O	6.99		3.58	
Ion Ratio	AS/CS		Calc.	11-Mar-21/O	0.869		0.931	
Sodium Adsorption Ratio	-		Calc.	11-Mar-21/O	0.0842		0.0865	
Conductivity (calc.)	µmho/cm		Calc.	11-Mar-21/O	49		50	_
EC(calc.)/EC(actual)	-		Calc.	11-Mar-21/O	1.05		1.01	
TDS(calc.)/EC(actual)	-		Calc.	11-Mar-21/O	0.502		0.485	
Langelier Index(25°C)	S.I.		Calc.	11-Mar-21/O	-1.80		-2.08	

Subcontracted to Testmark Labs

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

	TESTING REQUIREMENTS REPORT (UMS 27 Lab Use)								Jse)		
CADUCEZIN	O.Reg 153 Table Medium/Fine Coarse MISA Guidelines RPI ICC Agricultural (O.Reg 153) O.Reg 558 Leachate Analysis					0	YIM				
ENVIRONMENTAL LABORATORIES	Yes				Disposal Sit					-	
Client committed. Quality assured.		ter Quality Objectives			Landfill Mon	itoring	K		NE	-25	
Are any complete to be submitted intended for Human Consumption	Sewer Use By-		□ Vaa □ Na		Other:			PI-I			
Are any samples to be submitted intended for Human Consumption Indicate Laboratory Samples are submitted		(If yes, su		Vindsor	Dles on a Dri	nking Water Cha		1.7			
Organization: Address and Invoicing Address		Kingston					_ barrie	Londor	ROUND SERVICE	re .	
city of Igaluit Box 400		ANALYSES REQUESTED (Print Test in Boxes)			T 8		TED (see back p				
Contact: Emmanuel Kayade Igaluit			16				ninate				
	n II m		Quot		3		Suspected Highly Contaminated	Platinum 200% Surcharge Gold 100% Surcharge Silver 50% Surcharge			
Tel: 867-222-4612 Na, XOA	OHO) S			-	
Fax: Quote No.:	Project Name:		Pe				High	Bronze	25% Surcha	arge	
Email: P.O. No.:	Additional Info:		0				ectec	Standard	5-7 days		
Email: Kayalea galuita P.O. No.: 460	Additional line.		*				Susp	☐ Specific D)ate:		
Sample Matrix Legend: www=waste war	The state of the s						ips, F=Filter,		L B W		
No: Sample Identification S.P.L.		Collected Time -mm-dd) Collected			For Each Samplark In The Box		~	Field pH Te	mp. # Bottles/ Sample F	Field Filtered(Y/N)	
	1	06-07 8.50am		Tes	JL				1	,	
Lagoon (Start)	W oc St.	06-07 83-411		1 0) I		-		\mathcal{O}		
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SAMPLE SUBMISSION INFORMATION SHIPPING INFORMATION			REPORTING / INVOICE	CING	SAME	PLE RECEIVING	INFORMATIO	ON (LABORATO	RY USE ONLY)		
Sampled by: Submitted by:	Sampled by: Submitted by: Client's Courier Invoice			Report by Fax Received By (print): Submasking Signature:							
Print: Emmanuel Kayade Emmanuel Kayade	Caduceon's Courie	er 🔲 💮	Report by Email Date Received (yy-mm-dd): 21/6				106/08	56/08 Time Received: 11:05 aw			
Sign: Hafotol Kallon	Drop Off # of Pieces		Invoice by Email	Laboratory Prepared Bottles: Yes No							
-66	Caduceon (Pick-up)			Invoice by Mail							
Date (yy-mm-dd)/Time: Date (yy-mm-dd)/Time:				San	nple Tempera	ture °C: 21	.6	Labeled by:			
			s 1 5					Page	of		
			petoR, M	, NP,	H9, F	Bact		G 8749	34		



Quote #:

YD21 Iqaluit F

Organization:

City of Igaluit

Contact:

Mike Hatfield 867-979-6363

Telephone: Facsimile:

Email:

M.Hatfield@city.lgaluit.nu.ca

Project #: Address:

TEST F - Sewage Lagoon Box 460, Igaluit NU, X0A 0H0

Additional Info:

QUOTE # ('S) MUST BE ON C OF C TO APPLY if not listed, General pricing will be applied.

Additional Info:

Replacing Quote YD19_Iqaluit_F

Date:

27-May-21

Valid Until:

31-Dec-21

ltem #	Quantity	Analysis Request	Matrix	Unit Cost, \$	Amount, \$
1	1	BOD	ww	31.50	31.50
2	1	Total Coliform / Fecal Coliform	ww	32.50	32.50
3	1	Ammonia, NO2/NO3	ww	31.50	31.50
4	1	Total Phosphorus	ww	18.25	18.25
5	1	Orthophosphate	ww	18.25	18.25
6	1	Conductivity	ww	10.00	10.00
7	1	TSS	ww	18.25	18.25
8	1	рН	WW	9.50	9.50
9	1	TOTAL METALS ICPOES AI, Ba, Be, Cr, Co, Cu, Fe, Li, Mn, Mo, Ni, Sn, Sr, Ti, V, Zn ICPMS Sb, As, Cd, Pb, Se, Ag, Tl, U CVAAS Hg	ww	96.00	96.00
10	1	Ottawa Airport Pick Up		25.00	25.00
• •	ng unless otherwise state			Subtotal	290.75
vironmental Surch	narge of \$2 per san	nple set		HST	37.80

Total Cost 328.55

Kristine Cavanagh

Customer Service Representative

Caduceon Environmental Laboratories

kcavanagh@caduceonlabs.com



Final Report

REPORT No. B21-17450 C.O.C.: G87494

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 08-Jun-21

DATE REPORTED: 16-Jun-21

SAMPLE MATRIX: Waste Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1

Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test F

P.O. NUMBER: 460

WATERWORKS NO.

			Client I.D.		Lagoon (Start)		
			Sample I.D.		B21-17450-1		
			Date Collecte	ed	07-Jun-21		
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
BOD(5 day)	mg/L	3	SM 5210B	10-Jun-21/K	117		
Total Suspended Solids	mg/L	3	SM2540D	10-Jun-21/K	28		
Conductivity @25°C	µmho/cm	1	SM 2510B	11-Jun-21/O	605		
pH @25°C	pH Units		SM 4500H	11-Jun-21/O	7.34		
Nitrite (N)	mg/L	0.1	SM4110C	10-Jun-21/O	< 0.1		
Nitrate (N)	mg/L	0.1	SM4110C	10-Jun-21/O	< 0.1		
Ammonia (N)-Total	mg/L	0.01	SM4500- NH3-H	10-Jun-21/K	48.8		
o-Phosphate (P)	mg/L	0.002	PE4500-S	10-Jun-21/K	5.09		
Phosphorus-Total	mg/L	0.01	E3199A.1	10-Jun-21/K	6.40		
Aluminum	mg/L	0.01	SM 3120	10-Jun-21/O	0.09		
Antimony	mg/L	0.0005	EPA 200.8	15-Jun-21/O	< 0.0005		
Arsenic	mg/L	0.0005	EPA 200.8	15-Jun-21/O	< 0.0005		
Barium	mg/L	0.001	SM 3120	10-Jun-21/O	0.006		
Beryllium	mg/L	0.002	SM 3120	10-Jun-21/O	< 0.002		
Cadmium	mg/L	0.000070	EPA 200.8	15-Jun-21/O	< 0.000070		
Chromium	mg/L	0.002	SM 3120	10-Jun-21/O	< 0.002		
Cobalt	mg/L	0.005	SM 3120	10-Jun-21/O	< 0.005		
Copper	mg/L	0.002	SM 3120	10-Jun-21/O	0.074		
Iron	mg/L	0.005	SM 3120	10-Jun-21/O	2.20		
Lead	mg/L	0.0001	EPA 200.8	15-Jun-21/O	0.0006		
Lithium	mg/L	0.01	SM 3120	10-Jun-21/O	< 0.01		
Manganese	mg/L	0.001	SM 3120	10-Jun-21/O	0.182		
Mercury	mg/L	0.00002	SM 3112 B	11-Jun-21/O	< 0.00002		
Molybdenum	mg/L	0.01	SM 3120	10-Jun-21/O	< 0.01		
Nickel	mg/L	0.01	SM 3120	10-Jun-21/O	< 0.01		
Selenium	mg/L	0.005	EPA 200.8	15-Jun-21/O	< 0.005		

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Final Report

C.O.C.: G87494 REPORT No. B21-17450

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 08-Jun-21

DATE REPORTED: 16-Jun-21 SAMPLE MATRIX: Waste Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test F

P.O. NUMBER: 460

WATERWORKS NO.

		Client I.D.		Lagoon (Start)			
			Sample I.D.		B21-17450-1		
			Date Collect	ed	07-Jun-21		
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
Silver	mg/L	0.0001	EPA 200.8	15-Jun-21/O	< 0.0001		
Strontium	mg/L	0.001	SM 3120	10-Jun-21/O	0.057		
Thallium	mg/L	0.0003	EPA 200.8	15-Jun-21/O	< 0.0003		
Tin	mg/L	0.05	SM 3120	10-Jun-21/O	< 0.05		
Titanium	mg/L	0.005	SM 3120	10-Jun-21/O	0.005		
Uranium	mg/L	0.0003	EPA 200.8	15-Jun-21/O	< 0.0003		
Vanadium	mg/L	0.005	SM 3120	10-Jun-21/O	< 0.005		
Zinc	mg/L	0.005	SM 3120	10-Jun-21/O	0.045		
Total Coliform	cfu/100mL	1	MOE E3371	08-Jun-21/O	27000000		
Fecal Coliform	cfu/100mL	1	MOE E3371	08-Jun-21/O	102000		

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

			TESTING REQUIRE				REPOR	T MAMEER (Lab Use)					
CA.DUCEZN"	O.Reg 153		Medium/Fine	=	MISA Guidelines		July	17.61					
	RPI LICC	Agricultural	(O.Reg 153	ji ama	O.Reg 558 Leachate Analysis								
* ENVIRONMENTAL LABORATOR TES Client committed. Quality assured.	Provincial Water Quality	Record of Site Con	dition (O.Reg 153	_	Disposal Site: Landfill Monitoring	-	201	18044					
	Sewer Use By-Law:	Objectives			Other:		141-	12044					
Are any samples to be submitted intended for Human Consumption	under any Drinking Water R	egulations?	Yes No		mit all Drinking Water San	ples on a D	rinking Water Ch	ain of Custody)					
Indicate Laboratory Samples are submitt	ed to: King	ston 💢 O		chmond Hill	☐ Windsor [Barrie	Londo						
Organization: Address and Invoicing Address	(if different)		ANALY	SES REQUE	STED (Print Test in Boxes)		TURN	AROUND SERVICE					
City of Igaluit Box 4	60					1 2	REQUES	STED (see back page)					
Contact.			9			Contaminated							
		4 - 1	9			l lutar	☐ Platinum☐ Gold	200% Surcharge 100% Surcharge					
867-222-4612 Na,	XOAOHO		Duck					50% Surcharge					
Fax: Quote No.:	Project Name:	118	Per			Vienected High	Bronze	25% Surcharge					
			77.54			pato	Standard	5-7 days					
Email: e. Kayode@ Igaluit. a P.O. No.: 460	Additional Info:		AS			gusi	Specific	Deter					
* Sample Matrix Legend: WW=Waste Wat	ter, SW=Surface Water, GW=Gr	oundwater, LS=Ligi	uid Sludge, SS=Solid S	Sludge, S=Soil	Sed=Sediment. PC=Paint C	hips. F=Filter	Oil = Oil	Date:					
Lab	Sample Date Collected	Time		Indicate Test Fi	or Each Sample		Field	# Bottles/ Field					
No: Sample Identification S.P.L.	Matrix * (yy-mm-dd)	Collected	By Usin	ng A Check Mai	k In The Box Provided	V	pri i	emp. Sample Filtered(Y/N					
Lagon (Middle of decant)	WW 21-06-11	1-45pm		Test	F		6.30 2	38 6					
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SAMPLE SUBMISSION INFORMATION	SHIPPING INFORM		REPORTING / INVO	CING	SAMPLE RECEIVING	INFORMAT	ION (LABORATO	PRY USE ONLY)					
Sampled by: Submitted by:	Client's Courier	Invoice R	Report by Fax	Recei	ved By (print):	8h	Signature:	SB					
Print: Emmanuel Kayode Emmanuel Kayode	Caduceon's Courier	□ R	Report by Email	Date I	Received (yy-mm-dd): 14	106/2	/ Time Received						
6 3636	Drop Off		nvoice by Email	A CONTRACTOR OF THE PARTY OF TH	ratory Prepared Bottles:	Y Ye							
7 3	Caduceon (Pick-up)		nvoice by Mail										
Date (yy-mm-dd)/Time: Date (yy-mm-dd)/Time:		L. HER			le Temperature °C: /7	2	Labeled by:	2					
Comments:	IR + IDET + IM + INP + I HO + I back Page of												
) (1-5-5)		G 874	92					

Quote #:

YD21_lqaluit_F

Organization:

City of Iqaluit

Contact:

Mike Hatfield

Telephone:

867-979-6363

Facsimile:

Email:

M.Hatfield@city.lgaluit.nu.ca

Project #: Address:

TEST F - Sewage Lagoon Box 460, Igaluit NU, X0A 0H0

Additional Info:

QUOTE # ('S) MUST BE ON C OF C TO APPLY if not listed, General pricing will be applied.

Additional Info:

Replacing Quote YD19_Iqaluit_F

Date:

27-May-21

Valid Until:

31-Dec-21

Item #	Quantity	Analysis Request	Matrix	Unit Cost, \$	Amount, \$
1	1	BOD	WW	31.50	31.50
2	1	Total Coliform / Fecal Coliform	WW	32.50	32.50
3	1	Ammonia, NO2/NO3	WW	31.50	31.50
4	1	Total Phosphorus	WW	18.25	18.25
5	1	Orthophosphate	WW	18.25	18.25
6	1	Conductivity	WW	10.00	10.00
7	1	TSS	WW	18.25	18.25
8	1	pH	WW	9.50	9.50
9	1	TOTAL METALS ICPOES AI, Ba, Be, Cr, Co, Cu, Fe, Li, Mn, Mo, Ni, Sn, Sr, Ti, V, Zn ICPMS Sb, As, Cd, Pb, Se, Ag, TI, U CVAAS Hg	ww	96.00	96.00
10	1	Ottawa Airport Pick Up		25.00	25.00
o not include shippi	ng unless otherwise state	d.		Subtotal	290.75
anmontal Cural	area of \$2 nor con	anla aat		LICT	27.00

Environmental Surcharge of \$2 per sample set

HST 37.80 Total Cost 328.55

Kristine Cavanagh

Customer Service Representative

Caduceon Environmental Laboratories

kcavanagh@caduceonlabs.com



Final Report

C.O.C.: G87492 REPORT No. B21-18044

Report To:

City of Iqaluit

PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 14-Jun-21

DATE REPORTED: 21-Jun-21

SAMPLE MATRIX: Waste Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test F

P.O. NUMBER:

WATERWORKS NO.

			Client I.D.		Lagoon (Middle of Decant)		
			Sample I.D.		B21-18044-1		
			Date Collecte	ed	11-Jun-21		
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
BOD(5 day)	mg/L	3	SM 5210B	16-Jun-21/K	15		
Total Suspended Solids	mg/L	3	SM2540D	16-Jun-21/K	48		
Conductivity @25°C	µmho/cm	1	SM 2510B	16-Jun-21/O	642		
pH @25°C	pH Units		SM 4500H	16-Jun-21/O	6.83		
Nitrite (N)	mg/L	0.1	SM4110C	17-Jun-21/O	< 0.1		
Nitrate (N)	mg/L	0.1	SM4110C	17-Jun-21/O	< 0.1		
Ammonia (N)-Total	mg/L	0.01	SM4500- NH3-H	15-Jun-21/K	46.4		
o-Phosphate (P)	mg/L	0.002	PE4500-S	15-Jun-21/K	5.42		
Phosphorus-Total	mg/L	0.01	E3199A.1	17-Jun-21/K	7.20		
Aluminum	mg/L	0.01	SM 3120	14-Jun-21/O	0.11		
Antimony	mg/L	0.0005	EPA 200.8	15-Jun-21/O	< 0.0005		
Arsenic	mg/L	0.0005	EPA 200.8	15-Jun-21/O	< 0.0005		
Barium	mg/L	0.001	SM 3120	14-Jun-21/O	0.006		
Beryllium	mg/L	0.002	SM 3120	14-Jun-21/O	< 0.002		
Cadmium	mg/L	0.000070	EPA 200.8	15-Jun-21/O	< 0.000070		
Chromium	mg/L	0.002	SM 3120	14-Jun-21/O	< 0.002		
Cobalt	mg/L	0.005	SM 3120	14-Jun-21/O	< 0.005		
Copper	mg/L	0.002	SM 3120	14-Jun-21/O	0.073		
Iron	mg/L	0.005	SM 3120	14-Jun-21/O	2.33		
Lead	mg/L	0.0001	EPA 200.8	15-Jun-21/O	0.0006		
Lithium	mg/L	0.01	SM 3120	14-Jun-21/O	< 0.01		
Manganese	mg/L	0.001	SM 3120	14-Jun-21/O	0.188		
Mercury	mg/L	0.00002		17-Jun-21/O	< 0.00002		
Molybdenum	mg/L	0.01	SM 3120	14-Jun-21/O	< 0.01		
Nickel	mg/L	0.01	SM 3120	14-Jun-21/O	< 0.01		

NOTE: Total & Fecal Coliforms passed acceptable holding times of 48 hrs upon arrival at Lab.

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Final Report

C.O.C.: G87492 REPORT No. B21-18044

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 14-Jun-21

DATE REPORTED: 21-Jun-21 SAMPLE MATRIX: Waste Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test F

P.O. NUMBER:

WATERWORKS NO.

	Client I.D. Sample I.D.		Lagoon (Middle of Decant) B21-18044-1				
			Date Collecte		11-Jun-21		
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
Selenium	mg/L	0.005	EPA 200.8	15-Jun-21/O	< 0.005		
Silver	mg/L	0.0001	EPA 200.8	15-Jun-21/O	< 0.0001		
Strontium	mg/L	0.001	SM 3120	14-Jun-21/O	0.058		
Thallium	mg/L	0.0003	EPA 200.8	15-Jun-21/O	< 0.0003		
Tin	mg/L	0.05	SM 3120	14-Jun-21/O	< 0.05		
Titanium	mg/L	0.005	SM 3120	14-Jun-21/O	< 0.005		
Uranium	mg/L	0.0003	EPA 200.8	15-Jun-21/O	< 0.0003		
Vanadium	mg/L	0.005	SM 3120	14-Jun-21/O	< 0.005		
Zinc	mg/L	0.005	SM 3120	14-Jun-21/O	0.065		
Total Coliform	cfu/100mL	1	MOE E3371	14-Jun-21/O	2400000		
Fecal Coliform	cfu/100mL	1	MOE E3371	14-Jun-21/O	35000		

NOTE: Total & Fecal Coliforms passed acceptable holding times of 48 hrs upon arrival at Lab.

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

	3 NA C	ENVIRO	NMENTAL L cutory or Depot S Richmond Hill	ABORAT ent committe amples are	ORIES d. Quality a	ssured.	lon		Municipal Large Residenti Seasonal Other:	al		Non-I Small Non-I	ACILI Municip I Reside Round	pal [[ntial [Reg. 1 Reg. 3 Reg. 2 Private	70/03 319/08	king W	ater	Jun B2	4.	PORTHUMB	3(4) Use) 817	5
Organi	city o	F lagly	it	Waterworks			Invoicing Addres	s (if different)		Micr	obiolo	oical		AN	ALYS	SES R	REQUE	ESTEL)	Other			NAROUND SER	
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Email:		1		Quote No.:			P.O. No.:			Total Coliform /	Background	rotrop	En		ride	Trihalomethanes	S	Nitrite, Nitrate as N	Sch. 23 Inorganics	24 Organics		Standard Specific	d 5-7 day	-
	e. Kayode	@ Igalu			= Treated M	lator DW - Die	tribution Water, G	W = Paw Gray	industor C	Tota	Back	Hete	Sodium	Lead	Fluoride	Tih	HAA's	N I	Sch.	Sch.		opecino	Date.	
			Sample mans	Legella. 144	GUDI = (Groundwater ui	nder the influence	of surface war	ter, PR = Plu	umbing	Resid	lential,	PNR =	Plumb	ing No	n-Res	idential			water/Distribution	1)			1
Lab No.	Sample Source and/o	r Sample Identificat	tion	S.P.L.	Sample Matrix *	Consumption (Y/N)	Date Collected (yy-mm-dd)	Time Collected	Adverse Resample				By l	Indi Using A			r Each c In The			1		Chlo Free	orine Total	# Bottles/ Sample
	IQAC	8			DW		21-06-16	9-20.							,	t	+					8.43	Temp 5.8	10
	IQAC				SW		~	9.40						1								7.37	9.4	10
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			oratory Anal																	priately com	plet	ed		
	SAMPLE	SUBMISSION INF	ORMATION				INFORMATION		REPORT	ALTON DE LA CONTRACTOR DE	NVOIC	CING				SA	MPLE	RECE	IVING	INFORMATION	(LABC	RATORY USE	ONLY)	
	Sampled	by:	Submitted	by:		lient account	/	Invoice	Report by		1	. 1	Receiv	red By	(print	t):		70	ch	Signal	ture:	OB		
Print:	Enmanu	el	Emman	uel		aduceon acc	ount)		Report by			7	Date R	eceive	ed (yy-	-mm-c	dd):	18/	56	12/ Time I	Receiv	red: 14.	00	
Sign:	Harri	TIP	Land	25	Drop Off			# of Pieces	Invoice by	Emai	ı		Labora	atory P	repar	ed Bo	ottles:		Ϋ́Υ	es No				
	21 - 0	6 -1 6	21-66 Date (vy-mm-d	-16	Caduceor	(Pick-up)			Invoice by	Mail	-		Sample	e Tem	perati	ure °C	9	2		Labeled by:				
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										2	× 2	2				,					1000000		5904	



Quote #:

YD21 Iqaluit E

Organization:

City of Iqaluit

Contact:

Paul Clow

Telephone:

867-979-6363 Ex233

Facsimile:

Email:

p.clow@city.iqaluit.nu.ca

Project #: Address:

TEST E (Landfill Runoff)

Additional Info:

QUOTE # ('S) MUST BE ON C OF C TO APPLY if not listed, General pricing will be applied.

Additional Info:

Replacing Quote YD18_lqaluit_E

City Of Iqaluit Box 460 Iqaluit, NU

Date:

27-May-21

Valid Until:

31-Dec-21

Item #	Quantity	Analysis Request	Matrix	Unit Cost, \$	Amount, \$
		Detention Pond			
1	1	pH	WW	9.50	9.50
2	1	Turbidity	WW	15.25	15.25
3	1	TSS	WW	18.25	18.25
4	1	BOD5	WW	31.50	31.50
5	1	COD	WW	18.25	18.25
6	1	TOC	WW	25.00	25.00
		Retention Pond			
7	1	pH	WW	9.50	9.50
8	1	Turbidity	WW	15.25	15.25
9	1	TSS	WW	18.25	18.25
10	1	BOD5	WW	31.50	31.50
11	1	COD	WW	18.25	18.25
12	1	TOC	WW	25.00	25.00
13	1	Ammonia Nitrogen	WW	10.00	10.00
14	1	TKN	WW	18.25	18.25
15	1	Total Phosphorus	WW	18.25	18.25
16	1	Full Metals Scan +Hg	WW	73.50	73.50
17	1	Total Coliform/Fecal Coliform	WW	32.50	32.50
18	1	BTEX	WW	76.50	76.50
19	1	PCB's	WW	82.50	82.50
19	1	Ottawa Airport Pick Up		25.00	25.00
ces do not include shippin				Subtotal	572.00
vironmental Surch	arge of \$2 per san	nple set		HST	74.36

Total Cost 646.36

Kristine Cavanagh

Customer Service Representative

Caduceon Environmental Laboratories

kcavanagh@caduceonlabs.com



Final Report

C.O.C.: G105904 REPORT No. B21-18817

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 18-Jun-21

DATE REPORTED: 25-Jun-21
SAMPLE MATRIX: Waste Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123

JOB/PROJECT NO.: Test E

P.O. NUMBER:

Fax: 613-526-1244

WATERWORKS NO.

			Client I.D.		1QA08	1QA08 A	
			Sample I.D.		B21-18817-1	B21-18817-2	
			Date Collecte	ed	16-Jun-21	16-Jun-21	
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
BOD(5 day)	mg/L	3	SM 5210B	19-Jun-21/K	16	< 3	
COD	mg/L	5	SM5220C	22-Jun-21/K	119	30	
Total Organic Carbon	mg/L	0.2	EPA 415.2	18-Jun-21/O	10.5	6.9	
Total Suspended Solids	mg/L	3	SM2540D	22-Jun-21/K	28	121	
Turbidity	NTU	0.1	SM 2130	22-Jun-21/O	35.2	67.6	
pH @25°C	pH Units		SM 4500H	18-Jun-21/O	8.29	7.96	
Ammonia (N)-Total	mg/L	0.01	SM4500- NH3-H	21-Jun-21/K	16.5	0.21	
Total Kjeldahl Nitrogen	mg/L	0.1	E3199A.1	22-Jun-21/K	19.5	0.9	
Phosphorus-Total	mg/L	0.01	E3199A.1	22-Jun-21/K	1.27	0.08	
Aluminum	mg/L	0.01	SM 3120	18-Jun-21/O	0.05	1.39	
Arsenic	mg/L	0.0005	EPA 200.8	21-Jun-21/O	0.0011	0.0007	
Antimony	mg/L	0.0005	EPA 200.8	21-Jun-21/O	0.0017	< 0.0005	
Barium	mg/L	0.001	SM 3120	18-Jun-21/O	0.011	0.025	
Beryllium	mg/L	0.0005	EPA 200.8	21-Jun-21/O	< 0.0005	< 0.0005	
Chromium	mg/L	0.001	EPA 200.8	21-Jun-21/O	0.001	0.003	
Cobalt	mg/L	0.0005	EPA 200.8	21-Jun-21/O	0.0013	0.0016	
Copper	mg/L	0.0005	EPA 200.8	21-Jun-21/O	0.0302	0.0161	
Iron	mg/L	0.005	SM 3120	18-Jun-21/O	3.35	4.50	
Lithium	mg/L	0.01	SM 3120	18-Jun-21/O	0.01	< 0.01	
Manganese	mg/L	0.001	SM 3120	18-Jun-21/O	0.277	0.268	
Mercury	mg/L	0.00002	SM 3112 B	22-Jun-21/O	0.00003	< 0.00002	
Molybdenum	mg/L	0.0005	EPA 200.8	21-Jun-21/O	0.0025	0.0012	
Nickel	mg/L	0.001	EPA 200.8	21-Jun-21/O	0.019	0.006	
Selenium	mg/L	0.005	EPA 200.8	21-Jun-21/O	< 0.005	< 0.005	
Silver	mg/L	0.0001	EPA 200.8	21-Jun-21/O	< 0.0001	< 0.0001	
Strontium	mg/L	0.001	SM 3120	18-Jun-21/O	0.334	0.117	
Tin	mg/L	0.05	SM 3120	18-Jun-21/O	< 0.05	< 0.05	

NOTE: Total & Fecal Coliforms passed acceptable holding times of 48 hrs upon arrival at Lab.

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Final Report

REPORT No. B21-18817 C.O.C.: G105904

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 18-Jun-21

DATE REPORTED: 25-Jun-21 SAMPLE MATRIX: Waste Water

2378 Holly Lane

Caduceon Environmental Laboratories

Ottawa Ontario K1V 7P1

Tel: 613-526-0123 Fax: 613-526-1244

JOB/PROJECT NO.: Test E

P.O. NUMBER:

WATERWORKS NO.

			Client I.D.		1QA08	1QA08 A	
			Sample I.D.		B21-18817-1	B21-18817-2	
			Date Collecte	ed	16-Jun-21	16-Jun-21	
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
Titanium	mg/L	0.005	SM 3120	18-Jun-21/O	< 0.005	0.087	
Uranium	mg/L	0.0003	EPA 200.8	21-Jun-21/O	< 0.0003	0.0004	
Vanadium	mg/L	0.0005	EPA 200.8	21-Jun-21/O	< 0.0005	0.0031	
Zinc	mg/L	0.005	SM 3120	18-Jun-21/O	0.835	0.086	
Total Coliform	cfu/100mL	1	MOE E3371	18-Jun-21/O	< 10	< 2	
Fecal Coliform	cfu/100mL	1	MOE E3371	18-Jun-21/O	< 10	< 2	
Benzene	μg/L	0.5	EPA 8260	22-Jun-21/R	< 0.5	< 0.5	
Toluene	μg/L	0.5	EPA 8260	22-Jun-21/R	< 0.5	< 0.5	
Ethylbenzene	μg/L	0.5	EPA 8260	22-Jun-21/R	< 0.5	< 0.5	
Xylene, m,p-	μg/L	1.0	EPA 8260	22-Jun-21/R	< 1.0	< 1.0	
Xylene, o-	μg/L	0.5	EPA 8260	22-Jun-21/R	< 0.5	< 0.5	
Xylene, m,p,o-	μg/L	1.1	EPA 8260	22-Jun-21/R	< 1.1	< 1.1	
Toluene-d8 (SS)	% rec.		EPA 8260	22-Jun-21/R	102	105	
Poly-Chlorinated Biphenyls (PCB's)	μg/L	0.05	EPA 8082	22-Jun-21/K	< 0.05	< 0.05	

NOTE: Total & Fecal Coliforms passed acceptable holding times of 48 hrs upon arrival at Lab.

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

			TESTING REQUI	REMENTS			REPORT NUM	MBER (Lab Use)
CADUCEZN	O.Reg 153	Table	Medium/Fine	_	MISA Guidelines	(Jure 21	.21
0	RPI LICC	Agricultural Record of Site Con	(O.Reg		O.Reg 558 Leachate An	alysis		
ENVIRONMENTAL LABORATORIES Client committed. Quality assured.	Provincial Water Quality		ndition (O.Reg	133) [Disposal Site: Landfill Monitoring	0	21-19	MIC
	Sewer Use By-Law:				Other:	6	4-19	1110
Are any samples to be submitted intended for Human Consumption	n under any Drinking Water	Regulations? [Yes IN	lo (If yes, s	submit all Drinking Water	Samples on a Dr	inking Water Chain of	Custody)
Indicate Laboratory Samples are submit	ted to:	gston 🔲 O		Richmond H		☐ Barrie	London	
Organization: Address and Invoicing Address	s (if different)		ANA	LYSES REQ	UESTED (Print Test in Bo	es)	TURNAROU	IND SERVICE
Contact: Box 460			9			ted	REQUESTED ((see back page)
Contact: Emmanuel Kayode Igaluit Tel: 867-222-4612 Nu, Xo						Contaminated	☐ Platinum	2000/ Curahana
Tel:	Antha	L	Quet			onta	Gold	200% Surcharge 100% Surcharge
			9			Sept.	Silver	50% Surcharge
Fax: Quote No.:	Project Name:		8			Suspected Highly	Bronze	25% Surcharge
Fmail: PO No:	Additional Info:					ectec	Standard	5-7 days
Email: e. Kayode@lgalutza P.O. No.: 460	Additional line.		E			dsng	Specific Date:	
* Sample Matrix Legend: WW=Waste Wa			uid Sludge, SS=Soli			int Chips, F=Filter,	Oil = Oil	
No: Sample Identification S.P.L.	Sample Date Collected Matrix * (yy-mm-dd)	Time Collected	Pv11		st For Each Sample Mark In The Box Provided		Field	# Bottles/ Field
THE RESERVE TO THE PARTY OF THE		1	T I I	+ 1	IVIAIN III THE BOX PTOVIDED		pH Temp.	Sample Filtered(Y/N)
Lagoon (End of Decant)	21-06-18	10.30am	-	lest	+		6.62 098	6
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6								
42								
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	1/6							
SAMPLE SUBMISSION INFORMATION	SHIPPING INFORM	MATION	REPORTING / INV	OICING	SAMPLE RECEI	VING INFORMATI	ION (LABORATORY U	SE CNLY)
Sampled by: Submitted by:	Client's Courier	Invoice R	Report by Fax	Re		ubhasha		al)
Print: Emmanuel Kayode Pat Wolfe	Caduceon's Courier		Report by Email	1	te Received (yy-mm-dd):			6:00h8
Sign: Rate Put While	Drop Off		nvoice by Email		boratory Prepared Bottle		s No	D.OOM
21-06-18 21-06-18				La	boratory Frepared Bottle	s. Le Ye	, LI NO	
Date (yy-mm-dd)/Time: Date (yy-mm-dd)/Time:	Caduceon (Pick-up)	In	nvoice by Mail	Sa	mple Temperature °C:	7.6	Labeled by:	
Comments:			1 -				- 6	of.
		Pe;	t, R, M,	NP, E	Bact, 149		Page	of
							01433	

Quote #:

YD21_lqaluit F

Organization:

City of Iqaluit

Contact:

Mike Hatfield

Telephone:

867-979-6363

Facsimile:

Email:

M.Hatfield@city.lgaluit.nu.ca

Project #: Address:

TEST F - Sewage Lagoon Box 460, Igaluit NU, X0A 0H0

Additional Info:

QUOTE # ('S) MUST BE ON C OF C TO APPLY if not listed, General pricing will be applied.

Additional Info:

Replacing Quote YD19_lqaluit_F

Date:

27-May-21

Valid Until: 31-Dec-21

Item #	Quantity	Analysis Request	Matrix	Unit Cost, \$	Amount, \$
1	1	BOD	WW	31.50	31.50
2	1	Total Coliform / Fecal Coliform	ww	32.50	32.50
3	1	Ammonia, NO2/NO3	ww	31.50	31.50
4	1	Total Phosphorus	ww	18.25	18.25
5	1	Orthophosphate	WW	18.25	18.25
6	1	Conductivity	ww	10.00	10.00
7	1	TSS	ww	18.25	18.25
8	1	pH	ww	9.50	9.50
9	1	TOTAL METALS ICPOES AI, Ba, Be, Cr, Co, Cu, Fe, Li, Mn, Mo, Ni, Sn, Sr, Ti, V, Zn ICPMS Sb, As, Cd, Pb, Se, Ag, Tl, U CVAAS Hg	ww	96.00	96.00
10	1	Ottawa Airport Pick Up		25.00	25.00
not include shippi	ng unless otherwise state	d.		Subtotal	290.75

Environmental Surcharge of \$2 per sample set

HST 37.80 **Total Cost** 328.55

Kristine Cavanagh

Customer Service Representative Caduceon Environmental Laboratories

kcavanagh@caduceonlabs.com



Final Report

C.O.C.: G87493 REPORT No. B21-19118

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 21-Jun-21

DATE REPORTED: 29-Jun-21

SAMPLE MATRIX: Waste Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1

Tel: 613-526-0123 Fax: 613-526-1244

JOB/PROJECT NO.: Test F

P.O. NUMBER:

WATERWORKS NO.

			Client I.D.		Lagoon (End of Decant)		
			Sample I.D.		B21-19118-1		
			Date Collecte	ed	18-Jun-21		
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
BOD(5 day)	mg/L	3	SM 5210B	23-Jun-21/K	94		
Total Suspended Solids	mg/L	3	SM2540D	24-Jun-21/K	60		
Conductivity @25°C	µmho/cm	1	SM 2510B	22-Jun-21/O	593		
pH @25°C	pH Units		SM 4500H	22-Jun-21/O	7.38		
Nitrite (N)	mg/L	0.1	SM4110C	23-Jun-21/O	< 0.1		
Nitrate (N)	mg/L	0.1	SM4110C	23-Jun-21/O	0.2		
Ammonia (N)-Total	mg/L	0.01	SM4500- NH3-H	23-Jun-21/K	42.9		
o-Phosphate (P)	mg/L	0.002	PE4500-S	23-Jun-21/K	5.16		
Phosphorus-Total	mg/L	0.01	E3199A.1	25-Jun-21/K	7.11		
Aluminum	mg/L	0.01	SM 3120	23-Jun-21/O	0.09		
Antimony	mg/L	0.0005	EPA 200.8	24-Jun-21/O	< 0.0005		
Arsenic	mg/L	0.0005	EPA 200.8	24-Jun-21/O	0.0005		
Barium	mg/L	0.001	SM 3120	23-Jun-21/O	0.006		
Beryllium	mg/L	0.002	SM 3120	23-Jun-21/O	< 0.002		
Cadmium	mg/L	0.000070	EPA 200.8	24-Jun-21/O	< 0.000070		
Chromium	mg/L	0.002	SM 3120	23-Jun-21/O	< 0.002		
Cobalt	mg/L	0.005	SM 3120	23-Jun-21/O	< 0.005		
Copper	mg/L	0.002	SM 3120	23-Jun-21/O	0.058		
Iron	mg/L	0.005	SM 3120	23-Jun-21/O	2.92		
Lead	mg/L	0.0001	EPA 200.8	24-Jun-21/O	0.0006		
Lithium	mg/L	0.01	SM 3120	23-Jun-21/O	< 0.01		
Manganese	mg/L	0.001	SM 3120	23-Jun-21/O	0.215		
Mercury	mg/L	0.00002	SM 3112 B	22-Jun-21/O	< 0.00002		
Molybdenum	mg/L	0.01	SM 3120	23-Jun-21/O	< 0.01		
Nickel	mg/L	0.01	SM 3120	23-Jun-21/O	< 0.01		
Selenium	mg/L	0.005	EPA 200.8	24-Jun-21/O	< 0.005		

NOTE: Total & Fecal Coliforms passed acceptable holding times of 48 hrs upon arrival at Lab.

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Final Report

C.O.C.: G87493 REPORT No. B21-19118

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 21-Jun-21

DATE REPORTED: 29-Jun-21 SAMPLE MATRIX: Waste Water **Caduceon Environmental Laboratories**

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test F

P.O. NUMBER:

WATERWORKS NO.

			Client I.D.		Lagoon (End of Decant)		
			Sample I.D.		B21-19118-1		
			Date Collecte	ed	18-Jun-21		
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
Silver	mg/L	0.0001	EPA 200.8	24-Jun-21/O	< 0.0001		
Strontium	mg/L	0.001	SM 3120	23-Jun-21/O	0.060		
Thallium	mg/L	0.0003	EPA 200.8	24-Jun-21/O	< 0.0003		
Tin	mg/L	0.05	SM 3120	23-Jun-21/O	< 0.05		
Titanium	mg/L	0.005	SM 3120	23-Jun-21/O	< 0.005		
Uranium	mg/L	0.0003	EPA 200.8	24-Jun-21/O	< 0.0003		
Vanadium	mg/L	0.005	SM 3120	23-Jun-21/O	< 0.005		
Zinc	mg/L	0.005	SM 3120	23-Jun-21/O	0.035		
Total Coliform	cfu/100mL	1	MOE E3371	22-Jun-21/O	1000000		
Fecal Coliform	cfu/100mL	1	MOE E3371	22-Jun-21/O	9000		

NOTE: Total & Fecal Coliforms passed acceptable holding times of 48 hrs upon arrival at Lab.

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

	-25	DRINKING V	VATER SU	BMISSI	ON FOR	RM	-5-1		DRIN	IKING	WAT	ER F	ACILIT	Y CLAS	SIFICA	ATION			11/2	MORT	191	(Do se)	
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	☐ Kingsto	n 🔀 Ottawa 🔲 I	Richmond Hill	7		ie Lond		/if different)						ANAI	VCEC	REQUES	TED					ROUND SER	
Organiz	city	of Igali	ît	Waterworks			Invoicing Address	s (ir aimerent):		Micr	obiolog	gical		ANAL	-	mical	HED		Other	Annual Distriction of the Control		ED (see back	
Contact	Emman	of Igalu	ode	NU								Count								☐ Plati	num		Surcharge
Tel:	67-222-461	Fax:		Xo	AOH	0				/ E.co		Plate (es		as N	ics		Gold Silve			Surcharge urcharge
After Ho	ours Tel:	Public Health Unit:		Waterworks	No.:		Project Name/No.	:		oliform	puno	rophic			methan		Nitrate Inorga	Organ		☐ Bron	ize dard		urcharge
Email:	e. Kayode	@ Igaluit.	Ca	Quote No.:			P.O. No.:	-60		Total Coliform / E.coli	Background	Heterotrophic Plate Count	Sodium	Lead	Trihalomethanes	HAA's	Nitrite, Nitrate as N Sch. 23 Inorganics	Sch. 24 Organics			ific Dat		
			* Sample Matrix	x Legend: TW	= Treated W GUDI = 0	ater, DW = Dis Groundwater u	tribution Water, G	W = Raw Grou of surface wat	indwater, S er, PR = Pli	W = Ra	w Surf	face W	ater, UG	W = Untr	eated G	roundwate	r (Drinking	Water/D	Distribution)			100	
Lab No.	Sample Source an	d/or Sample Identification	on	S.P.L.	Sample Matrix*	Human Consumption (Y/N)	Date Collected (vy-mm-dd)	Time Collected	Adverse Resample				By U			or Each S	ample Sox Provid	ed		Free	Chlorine	e Total	# Bottles/ Sample
					pw		21-06-28							-	st	A							
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	SAMP	LE SUBMISSION INFO				SHIPPING	INFORMATION		REPORT	ING / I										ABORATORY	USE ON	NLY)	
	Samp	oled by:	Submitter	d by:		lient accoun	1	Invoice	Report by		_		Receive	ed By (p	rint):	helly			Signatu	ire:SC			
Print:	Emmanue	1 Kayode	Emmanuel	1 Kayade		Caduceon acc	ount)		Report by				Date Re	eceived	(yy-mm	-dd): <u> </u>	-06-	29	Time R	eceived: /O	155		
Sign:	akes	the parties	Kecke	ES	Drop Off			# of Pieces					Labora	tory Pre	pared E	Bottles:		Yes [No				
	2 - 6 Date (yy-n	6 - 28 nm-dd)/Time:	21-06 Date (yy-mm-		Caduceor	n (Pick-up)			Invoice b				ASSESSMENT OF THE PARTY NAMED IN	Tempe	Service and the Annual Printers	A STATE OF THE PARTY OF THE PAR	11.5	La	beled by:	9			
Comm	ents:						(2	Pei,	ZR,	NP	, 21	M,	ZH	19,	Bac	+))	2			Page		of	
														V						DW 1	05	900	



Quote # :

YD21_lqaluit_A

Organization:

City of Iqaluit

Contact: Telephone: Mike Hatfield 867-979-6363

Facsimile:

Email:

M.Hatfield@city.lqaluit.nu.ca

Project #: Address: TEST A - Drinking Water Box 460, Iqaluit NU, X0A 0H0

Additional Info:

QUOTE # ('S) MUST BE ON C OF C TO APPLY if not listed, General pricing will be applied.

Additional Info:

Replacing Quote YD20_lqaluit_A

Date:

27-May-21

Valid Until:

31-Dec-21

Item #	Quantity	Analysis Request	Matrix	Unit Cost, \$	Amount, \$
1	1	Acidity (Subcontracted)	DW	35.15	35.15
2	1	Alkalinity	DW	15.00	15.00
3	1	Bicarbonate/ Carbonate	DW	18.25	18.25
4	1	Chloride/Sulphate	DW	25.00	25.00
5	1	Conductivity	DW	10.00	10.00
6	1	Hydroxide	DW	15.25	15.25
7	1	Redox Potential	DW	16.50	16.50
8	1	TDS	DW	18.25	18.25
9	1	TSS	DW	18.25	18.25
10	1	TOC	DW	25.00	25.00
11	11	TIC	DW	25.00	25.00
12	1	TOTAL METALS ICPOES AI, Ba, Be, Cr, Co, Cu, Fe, Li, Mn, Mo, Ni, Sn, Sr, Ti, V, Zn + Hardness ICPMS Sb, As, Cd, Pb, Se, Ag, Tl, U CVAAS Hg	DW	96.00	96.00
13	1	DISSOLVED METALS ICPOES AI, Ba, Be, Cr, Co, Cu, Fe, Li, Mn, Mo, Ni, Sn, Sr, Ti, V, Zn + Hardness ICPMS Sb, As, Cd, Pb, Se, Ag, Ti, U CVAAS Hg	DW	96.00	96.00
14	1	Fecal Coliforms	DW	17.00	17.00
15	1	pH	DW	9.50	9.50
16	1	Turbidity	DW	15.25	15.25
17	1	Ottawa Airport Pick Up		25.00	25.00
es do not include shippir	ng unless otherwise state			Subtotal	480,40

Prices do not include shipping unless otherwise stated.

Environmental Surcharge of \$2 per sample set

 Subtotal
 480.40

 HST
 62.45

 Total Cost
 542.85

Kristine Cavanagh

Customer Service Representative

Caduceon Environmental Laboratories

kcavanagh@caduceonlabs.com



GENERAL CHAIN OF CUSTODY FORM

Page	of	

Please use our Drinking Water Chain of Custody Form for regulated drinking water samples

REPORT Client:	TO:	Cadu	ceon Environmental L	ahoratories	INV							fron Labor			:)						DJECT I uote #:	NFORMA	TION:	
Address:			2378 Holly Lane		Addres	ss: -	285 E	Dalto	n Av	enue										Client	P.O.#:	210629		
•			Ottawa ON, K1V 7	P1]	1	Kings	ston (ON												Project #:			
Contact:			Greg Clarkin			Ī	K7K 6	6Z1																
Email:	gclarl	cin@caduce	onlabs.com tyapi	ci@caduceonlabs.com	Email:		mm	ccor	rmic	k@c	aduc	ceonl	abs.	com										
Phone:	613-526-012	:3	Fax: 613-526-	1244	Phone	: -	6135	4420	001			Fa	С	613	4427	70								
REPORTI	NG/INVOICI	ING FORMAT	TURN AR	OUND TIME (TAT)*							An	ALYS	ıs R	EQUE	STED				۷.		LABOR	ATORY U	SE ON	LY.
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DATE	SAMPLIN	MATRIX**		E DESCRIPTION Appear On The Report)	NUMBER	Acidity		- 1									FIELD pH (if applicable)	FIELD	METALS (Y/N?)	CONTAINERS	TEMP	Btl. Type	algebory seption	b ID
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Received	Ву			Date	Time	:	5	Rec	eive	d at	Test	tmar	к Ву							Turker Take	Date		Time	1



Final Report

C.O.C.: --- REPORT No. B21-19977

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 29-Jun-21

DATE REPORTED: 05-Jul-21
SAMPLE MATRIX: Drinking Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test A (WTP)

P.O. NUMBER: WATERWORKS NO.

			Client I.D.		Test A- Raw WTP	Test A- Raw (Total)	Test A- Potable WTP	Test A- Potable (Total)
			Sample I.D.		B21-19977-1	B21-19977-2	B21-19977-3	B21-19977-4
			Date Collecte	ed	29-Jun-21	29-Jun-21	29-Jun-21	29-Jun-21
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Hardness (as CaCO3)	mg/L	1	SM 3120	29-Jun-21/O	24		24	
Hardness (as CaCO3)	mg/L	1	SM 3120	30-Jun-21/O		25		25
Alkalinity(CaCO3) to pH4.5	mg/L	5	SM 2320B	29-Jun-21/O	32		27	
Bicarbonate(as CaCO3)	mg/L	5	SM 2320B	29-Jun-21/O	32		27	
Carbonate (as CaCO3)	mg/L	5	SM 2320B	29-Jun-21/O	< 5		< 5	
Hydroxide	mg/L	5	EPA 310.2	29-Jun-21/O	< 5		< 5	
Acidity (as CaCO3)	mg/L	5	Subcontract	02-Jul-21	8 1	1	6 1	
pH @25°C	pH Units		SM 4500H	29-Jun-21/O	6.75		6.61	
Conductivity @25°C	µmho/cm	1	SM 2510B	29-Jun-21/O	51		53	
TDS(ion sum calc.)	mg/L	1	Calc.	02-Jul-21/O	36		35	
Total Suspended Solids	mg/L	3	SM2540D	30-Jun-21/K	3		< 3	
Turbidity	NTU	0.1	SM 2130	29-Jun-21/O	1.6		0.4	
REDOX potential	mV		In-House	30-Jun-21/R	465		612	
Chloride	mg/L	0.5	SM4110C	30-Jun-21/O	3.0		4.5	
Sulphate	mg/L	1	SM4110C	30-Jun-21/O	4		4	
Aluminum	mg/L	0.01	SM 3120	29-Jun-21/O	0.02		< 0.01	
Aluminum	mg/L	0.01	SM 3120	30-Jun-21/O		0.03		< 0.01
Antimony	mg/L	0.0001	EPA 200.8	02-Jul-21/O	< 0.0001		< 0.0001	
Antimony	mg/L	0.0001	EPA 200.8	30-Jun-21/O		0.0003		0.0003
Arsenic	mg/L	0.0001	EPA 200.8	02-Jul-21/O	< 0.0001		< 0.0001	
Arsenic	mg/L	0.0001	EPA 200.8	30-Jun-21/O		< 0.0001		< 0.0001
Barium	mg/L	0.001	SM 3120	29-Jun-21/O	0.003		0.002	
Barium	mg/L	0.001	SM 3120	30-Jun-21/O		0.003		0.002
Beryllium	mg/L	0.002	SM 3120	29-Jun-21/O	< 0.002		< 0.002	
Beryllium	mg/L	0.002	SM 3120	30-Jun-21/O		< 0.002		< 0.002
Cadmium	mg/L).000015	EPA 200.8	02-Jul-21/O	< 0.000015		< 0.000015	

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Final Report

C.O.C.: --- REPORT No. B21-19977

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 29-Jun-21

DATE REPORTED: 05-Jul-21
SAMPLE MATRIX: Drinking Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test A (WTP)

P.O. NUMBER:

WATERWORKS NO.

			Client I.D.		Test A- Raw WTP	Test A- Raw (Total)	Test A- Potable WTP	Test A- Potable (Total)
			Sample I.D.		B21-19977-1	B21-19977-2	B21-19977-3	B21-19977-4
			Date Collecte	ed	29-Jun-21	29-Jun-21	29-Jun-21	29-Jun-21
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Cadmium	mg/L	0.000015	EPA 200.8	30-Jun-21/O		< 0.000015		< 0.000015
Chromium	mg/L	0.002	SM 3120	29-Jun-21/O	< 0.002		< 0.002	
Chromium	mg/L	0.002	SM 3120	30-Jun-21/O		< 0.002		< 0.002
Cobalt	mg/L	0.005	SM 3120	29-Jun-21/O	< 0.005		< 0.005	
Cobalt	mg/L	0.005	SM 3120	30-Jun-21/O		< 0.005		< 0.005
Copper	mg/L	0.002	SM 3120	29-Jun-21/O	0.040		0.096	
Copper	mg/L	0.002	SM 3120	30-Jun-21/O		0.040		0.134
Iron	mg/L	0.005	SM 3120	29-Jun-21/O	0.106		0.012	
Iron	mg/L	0.005	SM 3120	30-Jun-21/O		0.235		0.024
Lead	mg/L	0.00002	EPA 200.8	02-Jul-21/O	0.00263		0.00025	
Lead	mg/L	0.00002	EPA 200.8	30-Jun-21/O		0.00263		0.00037
Lithium	mg/L	0.01	SM 3120	29-Jun-21/O	< 0.01		< 0.01	
Lithium	mg/L	0.01	SM 3120	30-Jun-21/O		< 0.01		< 0.01
Manganese	mg/L	0.001	SM 3120	29-Jun-21/O	0.073		0.001	
Manganese	mg/L	0.001	SM 3120	30-Jun-21/O		0.082		0.001
Mercury	mg/L	0.00002	SM 3112 B	30-Jun-21/O	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Molybdenum	mg/L	0.01	SM 3120	29-Jun-21/O	< 0.01		< 0.01	
Molybdenum	mg/L	0.01	SM 3120	30-Jun-21/O		< 0.01		< 0.01
Nickel	mg/L	0.01	SM 3120	29-Jun-21/O	< 0.01		< 0.01	
Nickel	mg/L	0.01	SM 3120	30-Jun-21/O		< 0.01		< 0.01
Selenium	mg/L	0.001	EPA 200.8	02-Jul-21/O	< 0.001		< 0.001	
Selenium	mg/L	0.001	EPA 200.8	30-Jun-21/O		< 0.001		< 0.001
Silver	mg/L	0.0001	EPA 200.8	02-Jul-21/O	< 0.0001		< 0.0001	
Silver	mg/L	0.0001	EPA 200.8	30-Jun-21/O		< 0.0001		< 0.0001
Strontium	mg/L	0.001	SM 3120	29-Jun-21/O	0.017		0.017	
Strontium	mg/L	0.001	SM 3120	30-Jun-21/O		0.017		0.007

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Final Report

C.O.C.: --- REPORT No. B21-19977

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 29-Jun-21

DATE REPORTED: 05-Jul-21

SAMPLE MATRIX: Drinking Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1

Tel: 613-526-0123 Fax: 613-526-1244

JOB/PROJECT NO.: Test A (WTP)

P.O. NUMBER:

WATERWORKS NO.

			Client I.D.		Test A- Raw WTP	Test A- Raw (Total)	Test A- Potable WTP	Test A- Potable (Total)
			Sample I.D.		B21-19977-1	B21-19977-2	B21-19977-3	B21-19977-4
			Date Collecte	ed	29-Jun-21	29-Jun-21	29-Jun-21	29-Jun-21
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Thallium	mg/L	0.00005	EPA 200.8	02-Jul-21/O	< 0.00005		< 0.00005	
Thallium	mg/L	0.00005	EPA 200.8	30-Jun-21/O		< 0.00005		< 0.00005
Tin	mg/L	0.05	SM 3120	29-Jun-21/O	< 0.05		< 0.05	
Tin	mg/L	0.05	SM 3120	30-Jun-21/O		< 0.05		< 0.05
Titanium	mg/L	0.005	SM 3120	29-Jun-21/O	< 0.005		< 0.005	
Titanium	mg/L	0.005	SM 3120	30-Jun-21/O		< 0.005		< 0.005
Uranium	mg/L	0.00005	EPA 200.8	02-Jul-21/O	< 0.00005		< 0.00005	
Uranium	mg/L	0.00005	EPA 200.8	30-Jun-21/O		< 0.00005		< 0.00005
Vanadium	mg/L	0.005	SM 3120	29-Jun-21/O	< 0.005		< 0.005	
Vanadium	mg/L	0.005	SM 3120	30-Jun-21/O		< 0.005		< 0.005
Zinc	mg/L	0.005	SM 3120	29-Jun-21/O	< 0.005		< 0.005	
Zinc	mg/L	0.005	SM 3120	30-Jun-21/O		0.016		0.034
Total Organic Carbon	mg/L	0.2	EPA 415.2	29-Jun-21/O	1.8		1.8	
TIC	mg/L	0.5	EPA 415.1	29-Jun-21/O	10.24		9.99	
Fecal Coliform	cfu/100mL	. 1	MOE E3371	29-Jun-21/O	0		0	
Anion Sum	meq/L		Calc.	02-Jul-21/O	0.815		0.784	
Cation Sum	meq/L		Calc.	02-Jul-21/O	0.528		0.523	
% Difference	%		Calc.	02-Jul-21/O	21.4		20.0	
Ion Ratio	AS/CS		Calc.	02-Jul-21/O	1.54		1.50	
Sodium Adsorption Ratio	-		Calc.	02-Jul-21/O	0.0914		0.0901	
Conductivity (calc.)	µmho/cm		Calc.	02-Jul-21/O	69		68	
EC(calc.)/EC(actual)	-		Calc.	02-Jul-21/O	1.33		1.27	
TDS(calc.)/EC(actual)	-		Calc.	02-Jul-21/O	0.708		0.661	
Langelier Index(25°C)	S.I.		Calc.	02-Jul-21/O	-2.21		-2.42	

1 Subcontracted to Testmark Labs

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

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		* Sample Mati	ix Legend: TW	= Treated W	ater, DW = Dis	stribution Water, G	W = Raw Grou	indwater, S er. PR = Plu	W = Ra	w Surfa	ace Wa	ter, UGW	= Untre	ated G	roundwat	er (Drink	ng Water/	Distribution)			
Lab				Sample	Human Consumption	Date Collected	Time	Adverse						200000000	or Each S	ample				Chlo	AND REAL PROPERTY AND REAL PRO	# Bottles/
No.	Sample Source and/or Samp		S.P.L.	Matrix *	(Y/N)	(yy-mm-dd)	Collected	Resample				-		eck Mai	rk In The	Box Prov	ided			PA	Temp	Sample
1	WIP PO	bable @ WI	P-70ta	P	TW	21-08-03	9.47 am					/ 1	es t	1	+	12	21	2	1135	36	11-5	10
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		Laboratory An			mence un	til all Notifica		mation i	s rec	eive	d and	d the S		ssior	n form	is app	ropria	ely com	pleted		le	
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	Sampled by:	Submitte			lient accoun		Invoice	Report by				Received	By (pri	int):	8	Spho	sha	Signa	ture:	A)	
Print:	Enmanuel	Kayude Emman	nel Krydd	e i	aduceon acc	ount)		Report by				Date Rec	eived (yy-mm	-dd): §	21/0	8/04	Time I	Received:	13	50ho	9
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	21-08- Date (yy-mm-dd)/Tin	03 21-0 ne: Date (yy-mm	8-03 -dd)/Time:	Caduceon	(Pick-up)			Invoice by	/ Mail			Sample T	empera	ature °	c: /	1.0	L	abeled by:				
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						NP.P			9.	1	Ba	ich									5903	



Quote #:

YD21_lqaluit_A

Organization:

City of Iqaluit

Contact: Telephone: Mike Hatfield 867-979-6363

Facsimile:

Email:

M.Hatfield@city.lgaluit.nu.ca

Project #: Address: TEST A - Drinking Water Box 460, Iqaluit NU, X0A 0H0

Additional Info:

QUOTE # ('S) MUST BE ON C OF C TO APPLY if not listed, General pricing will be applied.

Additional Info:

Replacing Quote YD20_lqaluit_A

Date: 27-May-21

Valid Until: 31-Dec-21

Item #	Quantity	Analysis Request	Matrix	Unit Cost, \$	Amount, \$
1	1	Acidity (Subcontracted)	DW	35.15	35.15
2	1	Alkalinity	DW	15.00	15.00
3	1	Bicarbonate/ Carbonate	DW	18.25	18.25
4	1	Chloride/Sulphate	DW	25.00	25.00
5	1	Conductivity	DW	10.00	10.00
6	1	Hydroxide	DW	15.25	15.25
7	1	Redox Potential	DW	16.50	16.50
8	1	TDS	DW	18.25	18.25
9	1	TSS	DW	18.25	18.25
10	1	TOC	DW	25.00	25.00
11	1	TIC	DW	25.00	25.00
12	1	TOTAL METALS ICPOES AI, Ba, Be, Cr, Co, Cu, Fe, Li, Mn, Mo, Ni, Sn, Sr, Ti, V, Zn + Hardness ICPMS Sb, As, Cd, Pb, Se, Ag, TI, U CVAAS Hg	DW	96.00	96.00
13	1	DISSOLVED METALS ICPOES AI, Ba, Be, Cr, Co, Cu, Fe, Li, Mn, Mo, Ni, Sn, Sr, Ti, V, Zn + Hardness ICPMS Sb, As, Cd, Pb, Se, Ag, TI, U CVAAS Hg	DW	96.00	96.00
14	1	Fecal Coliforms	DW	17.00	17.00
15	1	pH	DW	9.50	9.50
16	1	Turbidity	DW	15.25	15.25
17	1	Ottawa Airport Pick Up		25.00	25.00
es do not include shippir	ng unless otherwise state		-	Subtotal	480.40

Prices do not include shipping unless otherwise stated

Environmental Surcharge of \$2 per sample set

 Subtotal
 480.40

 HST
 62.45

 Total Cost
 542.85

Kristine Cavanagh

Customer Service Representative

Caduceon Environmental Laboratories

kcavanagh@caduceonlabs.com



GENERAL CHAIN OF CUSTODY FORM

Page	c	of
5-		

Please use our Drinking Water Chain of Custody Form for regulated drinking water samples

REPORT Client:	то:	Cadu	ceon Environmental L	aboratories	INV Client:			-	if dif				_)					OJECT IN Quote #:	IFORMA	TION:	
Address:	_		2378 Holly Lane		Addres	ss: -	285 D	alto	n Aver	nue									Client	t P.O. #: P	210805_	_TM	
-			Ottawa ON, K1V 7	'P1]	Ī	Kingst	ton (ON									_	1	t Project#:			
Contact:			Greg Clarkin]	Ī	K7K 6	Z1															
Email:	gclark	cin@caduce	onlabs.com tyapi	ci@caduceonlabs.com	Email:		mmc	cor	rmick	@ca	duce	onla	bs.c	<u>om</u>									
Phone:	613-526-012	3	Fax: 613-526	-1244	Phone	: (61354	1420	001			Fax:		6135	442770)							
REPORTIN	G/INVOICI	NG FORMAT	TURN AR	OUND TIME (TAT)*							Anai	LYSI	s Re	QUES	TED			٧.		LABORA	TORY U	SE ONLY	7
□Fax	☑Email	□Mail	☐1 Business Day	☐2 Business Days	OF CONTAINERS											Ţ	Je)	FILTERED	30	Wo	rk Order	NUMBER:	
_	DATA REPO		☐3 Business Day	s Standard	Ai									İ		able,	applicable)	I.T.E.	RECEIVED				
□Yes		□No	_		8			-								🥞	app .	E a	Rec				
	MPLE DISP		SPECIFIC DATE: * Prior arrang	ements must be made for	8			- 1								l is	<u> </u>	FIELD				1000	
	Dispose		rush/we	ekend/holiday work	- #	<u>≩</u>		- 1								l Ē	TEMP	lsi 🤇	AIN				
DATE	SAMPLIN	MATRIX**		E DESCRIPTION Appear On The Report)	NUMBER	Acidity										FIELD pH (if applicable)	FIELD	METALS (Y/N?)	CONTAINERS	TEMP	Bti. Type	Lab I	n
(mm-dd-yy) 8/03/21	TIME	WW		321-24521-1	+	$\frac{A}{X}$	\dashv	+	+	+	+		Н	\dashv		 E	+ =	2 0	O	ICMP	Du. Type	Laui	
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SW=Surfa	ace Water,	W=Water,	WW=Wastewate	P=Paint, S=Soil, SL=Sludg r, SD=Sediment	je,			REGULATION	<u></u> O.I	[□lnd	lustri	al / C	omn	4 ∐5 ercial]Fine :]8 ∐9 tesiden turface	tial / I	Parkland ☐Subsurf		gricultural	ı
∐Hig	h Concentra	itions Expect	led					3	□ 0.I											R □EE		ne	
COMMEN.	rs/field i	NOTES:					- 1		Sewe ∐Otl		e: 🗆	Sani	tary	□s	torm	Mu	nicipa	ility:					
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Sampled Client				Date	Time	!	22 22 27		ped l	10 - 17 20 - 17 14										Shipping	Reference	æ	
Received	Ву			Date	Time	!	R	lece	eived	at T	estrr	nark	Ву			1				Date		Time	



Final Report

C.O.C.: DW 105903 REPORT No. B21-24521

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 04-Aug-21

DATE REPORTED: 17-Aug-21

SAMPLE MATRIX: Drinking Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test A (WTP)

P.O. NUMBER:

WATERWORKS NO.

			Client I.D.		Test A- Potable WTP	Test A- Potable (Total)	Test A- Raw WTP	Test A- Raw WTP (Total)
			Sample I.D.		B21-24521-1	B21-24521-2	B21-24521-3	B21-24521-4
			Date Collecte	ed	03-Aug-21	03-Aug-21	03-Aug-21	03-Aug-21
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Hardness (as CaCO3)	mg/L	1	SM 3120	06-Aug-21/O	13		13	
Hardness (as CaCO3)	mg/L	1	SM 3120	06-Aug-21/O		14		14
Alkalinity(CaCO3) to pH4.5	mg/L	5	SM 2320B	05-Aug-21/O	9		11	
Bicarbonate(as CaCO3)	mg/L	5	SM 2320B	05-Aug-21/O	9		11	
Carbonate (as CaCO3)	mg/L	5	SM 2320B	05-Aug-21/O	< 5		< 5	
Hydroxide	mg/L	5	EPA 310.2	05-Aug-21/O	< 5		< 5	
Acidity (as CaCO3)	mg/L	5	Subcontract	06-Aug-21	< 5 1		7 1	
pH @25°C	pH Units		SM 4500H	05-Aug-21/O	6.52		6.55	
Conductivity @25°C	µmho/cm	1	SM 2510B	05-Aug-21/O	32		29	
TDS(ion sum calc.)	mg/L	1	Calc.	09-Aug-21/O	14		12	
Total Suspended Solids	mg/L	3	SM2540D	05-Aug-21/K	< 3		4	
Turbidity	NTU	0.1	SM 2130	06-Aug-21/O	0.8		0.6	
REDOX potential	mV		In-House	06-Aug-21/R	630		369	
Chloride	mg/L	0.5	SM4110C	05-Aug-21/O	2.6		< 0.5	
Sulphate	mg/L	1	SM4110C	05-Aug-21/O	< 1		< 1	
Aluminum	mg/L	0.01	SM 3120	06-Aug-21/O	< 0.01		< 0.01	
Aluminum	mg/L	0.01	SM 3120	06-Aug-21/O		< 0.01		0.01
Antimony	mg/L	0.0001	EPA 200.8	06-Aug-21/O	< 0.0001		< 0.0001	
Antimony	mg/L	0.0001	EPA 200.8	05-Aug-21/O		0.0005		0.0004
Arsenic	mg/L	0.0001	EPA 200.8	06-Aug-21/O	< 0.0001		< 0.0001	
Arsenic	mg/L	0.0001	EPA 200.8	05-Aug-21/O		< 0.0001		< 0.0001
Barium	mg/L	0.001	SM 3120	06-Aug-21/O	0.001		0.001	
Barium	mg/L	0.001	SM 3120	06-Aug-21/O		0.001		0.002
Beryllium	mg/L	0.002	SM 3120	06-Aug-21/O	< 0.002		< 0.002	
Beryllium	mg/L	0.002	SM 3120	06-Aug-21/O		< 0.002		< 0.002
Cadmium	mg/L	0.000015	EPA 200.8	06-Aug-21/O	< 0.000015		< 0.000015	

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Final Report

C.O.C.: DW 105903 REPORT No. B21-24521

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 04-Aug-21

DATE REPORTED: 17-Aug-21
SAMPLE MATRIX: Drinking Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123 Fax: 613-526-1244

JOB/PROJECT NO.: Test A (WTP)

P.O. NUMBER: WATERWORKS NO.

			Client I.D.		Test A- Potable WTP	Test A- Potable (Total)	Test A- Raw WTP	Test A- Raw WTP (Total)
			Sample I.D.		B21-24521-1	B21-24521-2	B21-24521-3	B21-24521-4
			Date Collect	ed	03-Aug-21	03-Aug-21	03-Aug-21	03-Aug-21
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Cadmium	mg/L	0.000015	EPA 200.8	05-Aug-21/O		< 0.000015		< 0.000015
Chromium	mg/L	0.002	SM 3120	06-Aug-21/O	< 0.002		< 0.002	
Chromium	mg/L	0.002	SM 3120	06-Aug-21/O		< 0.002		< 0.002
Cobalt	mg/L	0.005	SM 3120	06-Aug-21/O	< 0.005		< 0.005	
Cobalt	mg/L	0.005	SM 3120	06-Aug-21/O		< 0.005		< 0.005
Copper	mg/L	0.002	SM 3120	06-Aug-21/O	0.028		< 0.002	
Copper	mg/L	0.002	SM 3120	06-Aug-21/O		0.028		0.011
Iron	mg/L	0.005	SM 3120	06-Aug-21/O	0.014		0.035	
Iron	mg/L	0.005	SM 3120	06-Aug-21/O		0.023		0.130
Lead	mg/L	0.00002	EPA 200.8	06-Aug-21/O	0.00008		0.00005	
Lead	mg/L	0.00002	EPA 200.8	05-Aug-21/O		0.00010		0.00023
Lithium	mg/L	0.01	SM 3120	06-Aug-21/O	< 0.01		< 0.01	
Lithium	mg/L	0.01	SM 3120	06-Aug-21/O		< 0.01		< 0.01
Manganese	mg/L	0.001	SM 3120	06-Aug-21/O	0.005		0.029	
Manganese	mg/L	0.001	SM 3120	06-Aug-21/O		0.005		0.089
Mercury	mg/L	0.00002	SM 3112 B	10-Aug-21/O	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Molybdenum	mg/L	0.01	SM 3120	06-Aug-21/O	< 0.01		< 0.01	
Molybdenum	mg/L	0.01	SM 3120	06-Aug-21/O		< 0.01		< 0.01
Nickel	mg/L	0.01	SM 3120	06-Aug-21/O	< 0.01		< 0.01	
Nickel	mg/L	0.01	SM 3120	06-Aug-21/O		< 0.01		< 0.01
Selenium	mg/L	0.001	EPA 200.8	06-Aug-21/O	< 0.001		< 0.001	
Selenium	mg/L	0.001	EPA 200.8	05-Aug-21/O		< 0.001		< 0.001
Silver	mg/L	0.0001	EPA 200.8	06-Aug-21/O	< 0.0001		< 0.0001	
Silver	mg/L	0.0001	EPA 200.8	05-Aug-21/O		< 0.0001		< 0.0001
Strontium	mg/L	0.001	SM 3120	06-Aug-21/O	0.010		0.010	
Strontium	mg/L	0.001	SM 3120	06-Aug-21/O		0.010		0.010

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Final Report

C.O.C.: DW 105903 REPORT No. B21-24521

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 04-Aug-21

DATE REPORTED: 17-Aug-21
SAMPLE MATRIX: Drinking Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123 Fax: 613-526-1244

JOB/PROJECT NO.: Test A (WTP)

P.O. NUMBER: WATERWORKS NO.

			Client I.D.		Test A- Potable WTP	Test A- Potable (Total)	Test A- Raw WTP	Test A- Raw WTP (Total)
			Sample I.D.		B21-24521-1	B21-24521-2	B21-24521-3	B21-24521-4
			Date Collecte	ed	03-Aug-21	03-Aug-21	03-Aug-21	03-Aug-21
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Thallium	mg/L	0.00005	EPA 200.8	06-Aug-21/O	< 0.00005		< 0.00005	
Thallium	mg/L	0.00005	EPA 200.8	05-Aug-21/O		0.00005		< 0.00005
Tin	mg/L	0.05	SM 3120	06-Aug-21/O	< 0.05		< 0.05	
Tin	mg/L	0.05	SM 3120	06-Aug-21/O		< 0.05		< 0.05
Titanium	mg/L	0.005	SM 3120	06-Aug-21/O	< 0.005		< 0.005	
Titanium	mg/L	0.005	SM 3120	06-Aug-21/O		< 0.005		< 0.005
Uranium	mg/L	0.00005	EPA 200.8	06-Aug-21/O	< 0.00005		< 0.00005	
Uranium	mg/L	0.00005	EPA 200.8	05-Aug-21/O		< 0.00005		< 0.00005
Vanadium	mg/L	0.005	SM 3120	06-Aug-21/O	< 0.005		< 0.005	
Vanadium	mg/L	0.005	SM 3120	06-Aug-21/O		< 0.005		< 0.005
Zinc	mg/L	0.005	SM 3120	06-Aug-21/O	< 0.005		< 0.005	
Zinc	mg/L	0.005	SM 3120	06-Aug-21/O		0.019		0.018
Total Organic Carbon	mg/L	0.2	EPA 415.2	04-Aug-21/O	1.6		1.7	
TIC	mg/L	0.5	EPA 415.1	04-Aug-21/O	3.69		4.07	
Fecal Coliform	cfu/100mL	1	MOE E3371	04-Aug-21/O	0		0	
Anion Sum	meq/L		Calc.	09-Aug-21/O	0.265		0.228	
Cation Sum	meq/L		Calc.	09-Aug-21/O	0.293		0.294	
% Difference	%		Calc.	09-Aug-21/O	5.13		12.7	
Ion Ratio	AS/CS		Calc.	09-Aug-21/O	0.902		0.774	
Sodium Adsorption Ratio	-		Calc.	09-Aug-21/O	0.0758		0.0745	
Conductivity (calc.)	µmho/cm		Calc.	09-Aug-21/O	29		26	
EC(calc.)/EC(actual)	-		Calc.	09-Aug-21/O	0.910		0.893	
TDS(calc.)/EC(actual)	-		Calc.	09-Aug-21/O	0.424		0.422	
Langelier Index(25°C)	S.I.		Calc.	09-Aug-21/O	-3.50		-3.10	

¹ Subcontracted to Testmark Labs

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

	ENVIRONMENTAL L	ABORATO amples are	ORIES d. Quality as Submitted	isured.	2452		Large Residenti Seasonal Other:				Residenti Round	ial _	Reg Reg Priv	ATION g. 170/03 g. 319/08 g. 243/07 vate Drii in Serv	3 8 7 nking V	Vater		PERO	ME (F)	ER 20 (a)	
Organiz	zation:	Waterworks		ie Lonc	Invoicing Address	s (if different):	4					ANAL	YSES	REQU	JESTE	D			TURN	AROUND SER	VICE
Contact	City of Igaluit	3	x 46	0				Micr	obiolog				Ch	emical	П		Other		REQUES	TED (see bac	k page)
Tel:	Emmanuel Kayude F67-222-4612 Fax:	1	AOH	0, N4				E.coli		Heterotrophic Plate Count			9	?	Z	lics			Platinum Gold Silver	100%	Surcharge Surcharge Surcharge
After Ho	ours Tel: Public Health Unit:	Waterworks	No.: Igal	ut_A	Project Name/No.	:		Coliform /	Background	otrophic P	E	3	Trihalomethanes		Nitrite, Nitrate as N	Sch. 23 Inorganics Sch. 24 Organics			Bronze Standard	25% S 5-7 day	urcharge
Email:	e Kayode@ Igaluit· Ca	Quote No.:	Toale	4-E		60		Total	Backç	Heter	Sodium	Lead			Nitrite	Sch. 2			Specific I	Date:	
	* Sample Matrix	Legend: TW	= Treated W GUDI = 0	Groundwater u	tribution Water, G	W = Raw Grou of surface wat	indwater, S er, PR = Pl	SW = Ra umbing	w Surf Reside	ace W ential,	ater, UGV PNR = Pl	V = Unti	reated	Groundv tesidenti	vater (Dr ial	rinking Wate	r/Distribution))			
Lab No.	Sample Source and/or Sample Identification	S.P.L.	Sample Matrix *	Human Consumption (Y/N)	Date Collected (yy-mm-dd)	Time Collected	Adverse Resample				Ry Hel			For Each					Chlor	rine Terral	# Bottles/ Sample
+		-70fa		TW	21-08-03		Market Market					es i		4	2	221	21	125	36	11-5	10
2	WIP Raw (4) Par	1			1	9-18-in					7	es l		A	3	261		2	58	9.9	10
3	pertention Pond			SW	_	2.15pm						Te	st	TE							10
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	Laboratory Ana SAMPLE SUBMISSION INFORMATION	iyələ Will i	lot comi		INFORMATION	tion infor	REPORT				u me c	Jubin					ORMATION (ORXIDSE	ONLY)	
	Sampled by: Submitted	by:	Courier (C	lient account) 💢	Invoice	Report by	Fax	[Received	і Ву (р	rint):	8	Soupl	nasho	Signat	ure:	A	5	
Print:	Enmanuel Kayude Emmanu	el Kayad	Courier (C	aduceon acc	ount)		Report by	Email)	\	Date Rec	eived	(yy-mı			0810		Received:	13	50ho	9
Sign:	Ball Lafet	20	Drop Off			# of Pieces	Invoice by	y Emai	i [\neg	Laborato	ry Pre	pared	Bottles	: [Yes	☐ No				
	21-08-03 21-08 Date (vv-mm-dd)/Time: Date (vv-mm-d	-03	Caduceon	(Pick-up)			Invoice by	y Mail	[\neg	Sample 1	Гетре	rature	°C:	11.	20	Labeled by:				
Comm		et, 21	3, 2N	1,219	, NP, Ba	ct DI	41 Hg	() 1	LA	mbes						19,200			of	
	② 2D	ot 2R	2M	1, 9149	NP.P	act (4) H.H	9.		t Bo	act								10!	5903	16 -



Quote #:

YD21_lqaluit_E

Organization:

City of Iqaluit **Paul Clow**

Contact: Telephone:

867-979-6363 Ex233

Facsimile:

Email:

p.clow@city.iqaluit.nu.ca **TEST E (Landfill Runoff)**

Project #: Address:

City Of Iqaluit Box 460 Iqaluit, NU

Additional Info:

QUOTE # ('S) MUST BE ON C OF C TO APPLY if not listed, General pricing will be applied.

Additional Info:

Replacing Quote YD18_lqaluit_E

Date:

27-May-21

Valid Until:

31-Dec-21

Item #	Quantity	Analysis Request	Matrix	Unit Cost, \$	Amount, \$
		Detention Pond			
1	1	рН	WW	9.50	9.50
2	1	Turbidity	WW	15.25	15.25
3	1	TSS	WW	18.25	18.25
4	1	BOD5	WW	31.50	31.50
5	1	COD	WW	18.25	18.25
6	1	TOC	ww	25.00	25.00
		Retention Pond			
7	1	рН	WW	9.50	9.50
88	1	Turbidity	WW	15.25	15.25
9	1	TSS	WW	18.25	18.25
10	1	BOD5	WW	31.50	31.50
11	1	COD	WW	18.25	18.25
12	1	TOC	WW	25.00	25.00
13	1	Ammonia Nitrogen	ww	10.00	10.00
14	1	TKN	ww	18.25	18.25
15	1	Total Phosphorus	WW	18.25	18.25
16	1	Full Metals Scan +Hg	WW	73.50	73.50
17	1	Total Coliform/Fecal Coliform	ww	32.50	32.50
18	1	BTEX	WW	76.50	76.50
19	1	PCB's	WW	82.50	82.50
19	1	Ottawa Airport Pick Up		25.00	25.00
	ng unless otherwise state			Subtotal	572.00
onmental Surch	narge of \$2 per san	nple set		HST	74.36

Total Cost 646.36

Kristine Cavanagh

Customer Service Representative

Caduceon Environmental Laboratories

kcavanagh@caduceonlabs.com



Final Report

C.O.C.: --- REPORT No. B21-24525

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 04-Aug-21

DATE REPORTED: 12-Aug-21

SAMPLE MATRIX: Waste Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1

Tel: 613-526-0123 Fax: 613-526-1244

JOB/PROJECT NO.: Test E

P.O. NUMBER:

WATERWORKS NO.

			Client I.D.		Detention		
					Pond		
			Sample I.D.		B21-24525-1		
			Date Collect	ed	03-Aug-21		
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
BOD(5 day)	mg/L	3	SM 5210B	06-Aug-21/K	14		
COD	mg/L	5	SM5220C	10-Aug-21/K	141		
Total Organic Carbon	mg/L	0.2	EPA 415.2	04-Aug-21/O	34.9		
Total Suspended Solids	mg/L	3	SM2540D	05-Aug-21/K	33		
Turbidity	NTU	0.1	SM 2130	06-Aug-21/O	20.4		
pH @25°C	pH Units		SM 4500H	05-Aug-21/O	9.61		
Ammonia (N)-Total	mg/L	0.01	SM4500- NH3-H	06-Aug-21/K	1.32		
Total Kjeldahl Nitrogen	mg/L	0.1	E3199A.1	09-Aug-21/K	8.0		
Phosphorus-Total	mg/L	0.01	E3199A.1	09-Aug-21/K	1.10		
Aluminum	mg/L	0.01	SM 3120	09-Aug-21/O	0.03		
Arsenic	mg/L	0.0005	EPA 200.8	05-Aug-21/O	0.0014		
Antimony	mg/L	0.0005	EPA 200.8	05-Aug-21/O	0.0005		
Barium	mg/L	0.001	SM 3120	09-Aug-21/O	0.007		
Beryllium	mg/L	0.0005	EPA 200.8	05-Aug-21/O	< 0.0005		
Chromium	mg/L	0.001	EPA 200.8	05-Aug-21/O	< 0.001		
Cobalt	mg/L	0.0005	EPA 200.8	05-Aug-21/O	< 0.0005		
Copper	mg/L	0.0005	EPA 200.8	05-Aug-21/O	< 0.0005		
Iron	mg/L	0.005	SM 3120	09-Aug-21/O	0.131		
Lithium	mg/L	0.01	SM 3120	09-Aug-21/O	< 0.01		
Manganese	mg/L	0.001	SM 3120	09-Aug-21/O	0.072		
Mercury	mg/L	0.00002	SM 3112 B	10-Aug-21/O	< 0.00002		
Molybdenum	mg/L	0.0005	EPA 200.8	05-Aug-21/O	0.0007		
Nickel	mg/L	0.001	EPA 200.8	05-Aug-21/O	0.006		
Selenium	mg/L	0.005	EPA 200.8	05-Aug-21/O	< 0.005		
Silver	mg/L	0.0001	EPA 200.8	05-Aug-21/O	< 0.0001		
Strontium	mg/L	0.001	SM 3120	09-Aug-21/O	0.294		

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Final Report

C.O.C.: --- REPORT No. B21-24525

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 04-Aug-21

DATE REPORTED: 12-Aug-21

SAMPLE MATRIX: Waste Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test E

P.O. NUMBER:

WATERWORKS NO.

			Client I.D.		Detention Pond		
			Sample I.D.		B21-24525-1		
			Date Collect	ed	03-Aug-21		
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
Tin	mg/L	0.05	SM 3120	09-Aug-21/O	< 0.05		
Titanium	mg/L	0.005	SM 3120	09-Aug-21/O	< 0.005		
Uranium	mg/L	0.0003	EPA 200.8	05-Aug-21/O	< 0.0003		
Vanadium	mg/L	0.0005	EPA 200.8	05-Aug-21/O	0.0008		
Zinc	mg/L	0.005	SM 3120	09-Aug-21/O	0.026		
Total Coliform	cfu/100mL	1	MOE E3371	04-Aug-21/O	0		
Fecal Coliform	cfu/100mL	1	MOE E3371	04-Aug-21/O	0		
Benzene	μg/L	0.5	EPA 8260	09-Aug-21/R	< 0.5		
Toluene	μg/L	0.5	EPA 8260	09-Aug-21/R	< 0.5		
Ethylbenzene	μg/L	0.5	EPA 8260	09-Aug-21/R	< 0.5		
Xylene, m,p-	μg/L	1.0	EPA 8260	09-Aug-21/R	< 1.0		
Xylene, o-	μg/L	0.5	EPA 8260	09-Aug-21/R	< 0.5		
Xylene, m,p,o-	μg/L	1.1	EPA 8260	09-Aug-21/R	< 1.1		
Toluene-d8 (SS)	% rec.		EPA 8260	09-Aug-21/R	101		
Poly-Chlorinated Biphenyls (PCB's)	μg/L	0.05	EPA 8082	11-Aug-21/K	< 0.05		

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

			WATER SU			/			DRIN	KING	WAT	ERF	ACILITY	CLAS	SIFIC	ATION			Con	Par Comp	(Vab Use)	
100		CAE) U C	EZ	37	N"			Municipal Large			Small			Reg.	170/03 319/08			39	-28		
		ENVIRO	L LATHAMNC	ABORATO		sured.			Residentia Seasonal	al			Resident Round	ial 🔲		243/07 te Drin	king Wa	ter	201	00	700	2
	Kingston		ratory or Depot S Richmond Hill				on		Other:							n Servi			1921	- 20	12	2
Organiz		-	luit	Waterworks /	Address:		Invoicing Addres	ss (if different):		MIT: 4-	- bilataa	-11		ANAL	-		ESTED			TURN	AROUND SER	VICE
Contact	Emmany		und 0	3	ox 4	-60				MICE	obiolog				Che	mical			Other		STED (see back	
Tel: Q	57 222 461	Fax:	yare	N	galui Yo	160 1 1AU HO				E.coli		ate Co					z	S		☐ Platinum☐ Gold	100%	Surcharge Surcharge
After Ho	ours Tel:	Public Health U	Jnit:	Waterworks I			Project Name/No		TO	iform /	pur	phic Pl			ethane		trate as	23 Inorganic	all all all all all all all all all all	Silver Bronze	25% S	urcharge urcharge
Email:	Pillenad	06 160	iluit: Cq	Quoto No.:	Tan	10= 1	P.O. No.:	ALW	14)	Total Coliform / E.coli	Background	Heterotrophic Plate Count	Sodium	Lead	Trihalomethanes	HAA's	Nitrite, Nitrate as N	Sch. 23 Inorganics		Standard Specific		S
	c kay se	Elle 19	* Sample Matrix	Legend: TW	= Treated Wa	ater, DW = Dis	tribution Water, Onder the influence	GW = Raw Grou	indwater, St	W = Ra	w Surf	ace W	ater, UGV	V = Untre	eated G	roundw	ater (Drin	king Wa	ater/Distribution)			
Lab					Sample	Human Consumption	Date Collected	Time	Adverse	imbing	Reside	ciiuai,		Indicate	e Test F	or Each	Sample			Chlo	and with the last transport of the last transport and the last transport and the last transport and the last transport and the last transport and the last transport and the last transport and the last transport and the last transport and the last transport and the last transport and the last transport and the last transport and transpor	# Bottles/
No.	Sample Source and	The second secon	0 1	RW	Matrix *	DW (VIN)	Sept. 7	7.50am	Resample					es t	T	A	e Box Pr	ovided		7-05	10-6	Sample / O
3)	WTP		Comment of the commen	Total	-	66 DW		7.55am	10.8					1		,	\top	+		6.58	10.8	70
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		Has	Lab Service No	otification	(LSN) F	orm heen	completed 8	Suhmitte	d to the	MEC	:P/PI	HII2		Yes			No		Not Appl	icable		
	CAMPI		aboratory Anal			mence unt			mation is	s rec	eive	d an			ssio		n is ap		nately comple	ted		
	Sample		Submitted	Char	Courier (C	lient account)		Invoice	REPORTI Report by		AVOIC		Received	d Bu (pr	SWARE STATE		bha	1	FORMATION (LAB	ORATOREUSE	enty)	
Print:	Em manu e	1.			Courier (C	aduceon acc	ount)		Report by	Email			Date Rec				100		Signature:	ived: 1A	:40ai	n
Sign:	(K. 18	er Ci	6 616		Drop Off			# of Pieces	Invoice by	Email			Laborato					Yes			10010)
	21-09	- 67	21-09		Caduceon	(Pick-up)			Invoice by	Mail			Sample 1				10.1		Labeled by:	R		
Comme	ents:	годрание;	Date (yy-mm-d	uptine:			S.	27 5	D n	M	.1.							1	Laboled by.	Page	of	
							21	æt, 21	77	ryl,	N	"	2170	1)'	Da	Cr	۸.	4		DW 1 0	5905	



Quote # :

YD21_lgaluit_A

Organization:

City of Iqaluit

Contact:

Mike Hatfield

Telephone:

867-979-6363

Facsimile:

Email:

M.Hatfield@city.lgaluit.nu.ca

Project #: Address: TEST A - Drinking Water Box 460, Igaluit NU, X0A 0H0

Address: Additional Info:

QUOTE # ('S) MUST BE ON C OF C TO APPLY if not listed, General pricing will be applied.

Additional Info:

Replacing Quote YD20_lqaluit_A

Date:

27-May-21

Valid Until:

31-Dec-21

Item #	Quantity	Analysis Request	Matrix	Unit Cost, \$	Amount, \$
1	1	Acidity (Subcontracted)	DW	35.15	35.15
2	1	Alkalinity	DW	15.00	15.00
3	1	Bicarbonate/ Carbonate	DW	18.25	18.25
4	1	Chloride/Sulphate	DW	25.00	25.00
5	1	Conductivity	DW	10.00	10.00
6	1	Hydroxide	DW	15.25	15.25
7	1	Redox Potential	DW	16.50	16.50
8	1	TDS	DW	18.25	18.25
9	1	TSS	DW	18.25	18.25
10	1	TOC	DW	25.00	25.00
11	1	TIC	DW	25.00	25.00
12	1	TOTAL METALS ICPOES AI, Ba, Be, Cr, Co, Cu, Fe, Li, Mn, Mo, Ni, Sn, Sr, Ti, V, Zn + Hardness ICPMS Sb, As, Cd, Pb, Se, Ag, Tl, U CVAAS Hg	DW	96.00	96.00
13	1	DISSOLVED METALS ICPOES AI, Ba, Be, Cr, Co, Cu, Fe, Li, Mn, Mo, Ni, Sn, Sr, Ti, V, Zn + Hardness ICPMS Sb, As, Cd, Pb, Se, Ag, Tl, U CVAAS Hg	DW	96.00	96.00
14	1	Fecal Coliforms	DW	17.00	17.00
15	11	pH	DW	9.50	9.50
16	11	Turbidity	DW	15.25	15.25
17	1	Ottawa Airport Pick Up		25.00	25.00
• •	ing unless otherwise stated	i.		Subtotal	480.40

Environmental Surcharge of \$2 per sample set

 Subtotal
 480.40

 HST
 62.45

 Total Cost
 542.85

Kristine Cavanagh

Customer Service Representative

Caduceon Environmental Laboratories

kcavanagh@caduceonlabs.com



Sampled By

Client Received By

GENERAL CHAIN OF CUSTODY FORM

Page	of	
9-	 •••	

Shipping Reference

Please use our Drinking Water Chain of Custody Form for regulated drinking water samples REPORT TO: **INVOICE TO: (if different from Report)** PROJECT INFORMATION: Client: TM Quote #: Client: Caduceon Environmental Laboratories Caduceon Environmental Laboratories Client P.O. #: **P210909_TM** 2378 Holly Lane Address: 285 Dalton Avenue Address: Ottawa ON, K1V 7P1 Kingston ON Client Project #: K7K 6Z1 Contact: Greg Clarkin qclarkin@caduceonlabs.com tyapici@caduceonlabs.com Email: mmccormick@caduceonlabs.com Email: 613-526-0123 Fax: 613-526-1244 Phone: 6135442001 Fax: 6135442770 Phone: REPORTING/INVOICING FORMAT TURN AROUND TIME (TAT)* LABORATORY USE ONLY **ANALYSIS REQUESTED** CONTAINERS ☐2 Business Days ☐1 Business Day FIELD FILTERED WORK ORDER NUMBER: □Fax □Email ∏Mail FIELD TEMP (if applicable) FIELD pH (if applicable) **OC DATA REPORTED** ☐3 Business Days √Standard □No □Yes SAMPLE DISPOSAL SPECIFIC DATE: Ь * Prior arrangements must be made for ☐Hold ☐Dispose ☐Return Acidity NUMBER METALS rush/weekend/holiday work **SAMPLING** SAMPLE DESCRIPTION (This Will Appear On The Report) Btl. Type MATRIX** TEMP Lab ID: TIME (mm-dd-yy) X 8/03/21 ww B21-28733-1 8/03/21 WW B21-28733-3 iorr. 2000 (1200) □O.Reg. 153: (1 □2 □3 □4 □5 □6 □7 □8 □9 □) **Matrix: B=Biota, GW=Ground Water, O=Oil, P=Paint, S=Soil, SL=Sludge, SW=Surface Water, W=Water, WW=Wastewater, SD=Sediment □Industrial / Commercial Residential / Parkland □ Agricultural ☐Surface ☐Coarse Soil ☐Fine Soil ☐ Subsurface High Concentrations Expected O.Reg. 558 PWQO MISA CofA MMER EEM None Sewer Use: □Sanitary □Storm Municipality: COMMENTS/FIELD NOTES: ☐Other: Relinquished to Testmark By (Signature) Date Time

Shipped By

Received at Testmark By

Time

Time

Date

Date



Final Report

C.O.C.: DW 105905 REPORT No. B21-28733

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 08-Sep-21

DATE REPORTED: 16-Sep-21
SAMPLE MATRIX: Drinking Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test A (WTP)

P.O. NUMBER: WATERWORKS NO.

			Client I.D.		Test A- Raw WTP	Test A- Raw WTP (Total)	Test A- Potable	Test A- Potable (Total)
			Sample I.D.		B21-28733-1	B21-28733-2	B21-28733-3	B21-28733-4
			Date Collect	ed	07-Sep-21	07-Sep-21	07-Sep-21	07-Sep-21
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Hardness (as CaCO3)	mg/L	1	SM 3120	08-Sep-21/O	13		13	
Hardness (as CaCO3)	mg/L	1	SM 3120	13-Sep-21/O		14		15
Alkalinity(CaCO3) to pH4.5	mg/L	5	SM 2320B	08-Sep-21/O	12		9	
Bicarbonate(as CaCO3)	mg/L	5	SM 2320B	08-Sep-21/O	12		9	
Carbonate (as CaCO3)	mg/L	5	SM 2320B	08-Sep-21/O	< 5		< 5	
Hydroxide	mg/L	5	EPA 310.2	08-Sep-21/O	< 5		< 5	
Acidity (as CaCO3)	mg/L	5	Subcontract	14-Sep-21	10 1		9 1	
pH @25°C	pH Units		SM 4500H	08-Sep-21/O	6.92		6.81	
Conductivity @25°C	µmho/cm	1	SM 2510B	08-Sep-21/O	32		33	
TDS(ion sum calc.)	mg/L	1	Calc.	10-Sep-21/O	15		16	
Total Suspended Solids	mg/L	3	SM2540D	09-Sep-21/K	3		< 3	
Turbidity	NTU	0.1	SM 2130	09-Sep-21/O	0.5		0.4	
REDOX potential	mV		In-House	10-Sep-21/R	448		695	
Chloride	mg/L	0.5	SM4110C	09-Sep-21/O	0.7		2.8	
Sulphate	mg/L	1	SM4110C	09-Sep-21/O	2		2	
Aluminum	mg/L	0.01	SM 3120	08-Sep-21/O	< 0.01		< 0.01	
Aluminum	mg/L	0.01	SM 3120	13-Sep-21/O		0.02		0.01
Antimony	mg/L	0.0001	EPA 200.8	15-Sep-21/O	< 0.0001		< 0.0001	
Antimony	mg/L	0.0001	EPA 200.8	14-Sep-21/O		0.0003		< 0.0001
Arsenic	mg/L	0.0001	EPA 200.8	15-Sep-21/O	< 0.0001		< 0.0001	
Arsenic	mg/L	0.0001	EPA 200.8	14-Sep-21/O		< 0.0001		0.0001
Barium	mg/L	0.001	SM 3120	08-Sep-21/O	< 0.001		< 0.001	
Barium	mg/L	0.001	SM 3120	13-Sep-21/O		0.002		0.002
Beryllium	mg/L	0.002	SM 3120	08-Sep-21/O	< 0.002		< 0.002	
Beryllium	mg/L	0.002	SM 3120	13-Sep-21/O		< 0.002		< 0.002
Cadmium	mg/L).000015	EPA 200.8	15-Sep-21/O	< 0.000015		< 0.000015	

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Final Report

C.O.C.: DW 105905 REPORT No. B21-28733

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

<u>Attention:</u> Emmanuel Kayode

DATE RECEIVED: 08-Sep-21

DATE REPORTED: 16-Sep-21
SAMPLE MATRIX: Drinking Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test A (WTP)

P.O. NUMBER: WATERWORKS NO.

			Client I.D.		Test A- Raw WTP	Test A- Raw WTP (Total)	Test A- Potable	Test A- Potable (Total)
			Sample I.D.		B21-28733-1	B21-28733-2	B21-28733-3	B21-28733-4
			Date Collected		07-Sep-21	07-Sep-21	07-Sep-21	07-Sep-21
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Cadmium	mg/L).000015	EPA 200.8	14-Sep-21/O		< 0.000015		< 0.000015
Chromium	mg/L	0.002	SM 3120	08-Sep-21/O	< 0.002		< 0.002	
Chromium	mg/L	0.002	SM 3120	13-Sep-21/O		< 0.002		< 0.002
Cobalt	mg/L	0.005	SM 3120	08-Sep-21/O	< 0.005		< 0.005	
Cobalt	mg/L	0.005	SM 3120	13-Sep-21/O		< 0.005		< 0.005
Copper	mg/L	0.002	SM 3120	08-Sep-21/O	0.004		0.037	
Copper	mg/L	0.002	SM 3120	13-Sep-21/O		0.006		0.041
Iron	mg/L	0.005	SM 3120	08-Sep-21/O	0.026		0.011	
Iron	mg/L	0.005	SM 3120	13-Sep-21/O		0.081		0.033
Lead	mg/L	0.00002	EPA 200.8	15-Sep-21/O	0.00004		0.00007	
Lead	mg/L	0.00002	EPA 200.8	14-Sep-21/O		0.00007		0.00008
Lithium	mg/L	0.01	SM 3120	08-Sep-21/O	< 0.01		< 0.01	
Lithium	mg/L	0.01	SM 3120	13-Sep-21/O		< 0.01		< 0.01
Manganese	mg/L	0.001	SM 3120	08-Sep-21/O	0.021		0.002	
Manganese	mg/L	0.001	SM 3120	13-Sep-21/O		0.026		0.005
Mercury	mg/L	0.00002	SM 3112 B	09-Sep-21/O	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Molybdenum	mg/L	0.01	SM 3120	08-Sep-21/O	< 0.01		< 0.01	
Molybdenum	mg/L	0.01	SM 3120	13-Sep-21/O		< 0.01		< 0.01
Nickel	mg/L	0.01	SM 3120	08-Sep-21/O	< 0.01		< 0.01	
Nickel	mg/L	0.01	SM 3120	13-Sep-21/O		< 0.01		< 0.01
Selenium	mg/L	0.001	EPA 200.8	15-Sep-21/O	< 0.001		< 0.001	
Selenium	mg/L	0.001	EPA 200.8	14-Sep-21/O		< 0.001		< 0.001
Silver	mg/L	0.0001	EPA 200.8	15-Sep-21/O	< 0.0001		< 0.0001	
Silver	mg/L	0.0001	EPA 200.8	14-Sep-21/O		< 0.0001		< 0.0001
Strontium	mg/L	0.001	SM 3120	08-Sep-21/O	0.010		0.010	
Strontium	mg/L	0.001	SM 3120	13-Sep-21/O		0.010		0.010

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Final Report

C.O.C.: DW 105905 REPORT No. B21-28733

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 08-Sep-21

DATE REPORTED: 16-Sep-21
SAMPLE MATRIX: Drinking Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123 Fax: 613-526-1244

JOB/PROJECT NO.: Test A (WTP)

P.O. NUMBER: WATERWORKS NO.

			Client I.D.		Test A- Raw WTP	Test A- Raw WTP (Total)	Test A- Potable	Test A- Potable (Total)
			Sample I.D.		B21-28733-1	B21-28733-2	B21-28733-3	B21-28733-4
			Date Collecte	ed	07-Sep-21	07-Sep-21	07-Sep-21	07-Sep-21
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Thallium	mg/L	0.00005	EPA 200.8	15-Sep-21/O	< 0.00005		< 0.00005	
Thallium	mg/L	0.00005	EPA 200.8	14-Sep-21/O		< 0.00005		< 0.00005
Tin	mg/L	0.05	SM 3120	08-Sep-21/O	< 0.05		< 0.05	
Tin	mg/L	0.05	SM 3120	13-Sep-21/O		< 0.05		< 0.05
Titanium	mg/L	0.005	SM 3120	08-Sep-21/O	< 0.005		< 0.005	
Titanium	mg/L	0.005	SM 3120	13-Sep-21/O		< 0.005		< 0.005
Uranium	mg/L	0.00005	EPA 200.8	15-Sep-21/O	< 0.00005		< 0.00005	
Uranium	mg/L	0.00005	EPA 200.8	14-Sep-21/O		< 0.00005		< 0.00005
Vanadium	mg/L	0.005	SM 3120	08-Sep-21/O	< 0.005		< 0.005	
Vanadium	mg/L	0.005	SM 3120	13-Sep-21/O		< 0.005		< 0.005
Zinc	mg/L	0.005	SM 3120	08-Sep-21/O	< 0.005		< 0.005	
Zinc	mg/L	0.005	SM 3120	13-Sep-21/O		< 0.005		0.052
Total Organic Carbon	mg/L	0.2	EPA 415.2	08-Sep-21/O	1.7		1.6	
TIC	mg/L	0.5	EPA 415.1	08-Sep-21/O	3.7		2.9	
Fecal Coliform	cfu/100mL	1	MOE E3371	08-Sep-21/O	0		0	
Anion Sum	meq/L		Calc.	10-Sep-21/O	0.302		0.297	
Cation Sum	meq/L		Calc.	10-Sep-21/O	0.298		0.296	
% Difference	%		Calc.	10-Sep-21/O	0.654		0.225	
Ion Ratio	AS/CS		Calc.	10-Sep-21/O	1.01		1.00	
Sodium Adsorption Ratio	-		Calc.	10-Sep-21/O	0.0771		0.0767	
Conductivity (calc.)	µmho/cm		Calc.	10-Sep-21/O	31		33	
EC(calc.)/EC(actual)	-		Calc.	10-Sep-21/O	0.983		0.993	
TDS(calc.)/EC(actual)	-		Calc.	10-Sep-21/O	0.483		0.469	
Langelier Index(25°C)	S.I.		Calc.	10-Sep-21/O	-2.70		-2.94	
1 Subcontracted to Test			Caic.	10-Sep-21/O	-2.70		-2.94	

Subcontracted to Testmark Labs

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

	GENERAL SAMPLE SUBMISSION FORM SAMPLES SUBMITTE		D TO:			TESTING F	REQU	IREMENT	rs				S	REF	PORTNUM	BER (Lab Us	e)											
2.5	CADUCE		Kingston Ottawa Richmond Hill Barrie			O'Reg 153/04 O'Reg 406/19 RPI		Tabl			Agricultu	ile (1 - 9.1) ral			۲۰.	10.												
	ENVIRONMENTAL LABORATORIES Client committed, Quality assured, Proudly Canadian.		London Windsor			MISA Other:		PWC	lium/Fine QO		O'Reg 558 Landfill M		F	35	21-	20	106	8										
	Are any samples to be submitted intended f	or Human Co	nsumption under any	Drinking	Water Regulation	s?	Yes No (If yes, submit all Drinking Water Samples						nples on a D	a Drinking Water Chain of Custody)														
Organiz	city of Igaluit	Address:	Sox 460 Igaluit Nu, XOAOHO		Address (if different):			ANAL	YSES I	REQUEST	TED .					OUND SERVIC D (see back pa											
Contact	Emmanuel Kayode 67-22-4612 Fax:	19			Nu, XOAOHO		Nu, XOAOHO		Nu, XOAOHO		Igaluit		galuit				Quote							minate		*Must be arranged in advance Platinum* 200% Surcharge		
Tel: 8	67-22-4612 Fax:	N										5								y Contamin		Gold* 100% Surcharge Silver 50% Surcharge						
Email:	e. Kayode@ Igaluit. G	Quote #:		Project N	lame/#:		2							spected Highly		Bronze Standard	25% S 5-7 day	Surcharge vs										
Addition	nal Info (email, cell, etc):	P.O.#: 4	60	Addition	al Info:	-131	₹	-			200			Suspect		Specific Da												
Lab	* Sample Mai	trix Legend: WW	=Waste Water, SW=Surface	e Water, GV Sample	V=Groundwater, LS= Date Collected	Liquid Sludge, SS	Solid Sludge	, S=Sc			PC=Paint C		Iter, Oil =	Oil	Fi	eld	# Bottles/	Field Filtered										
	Sample Source and/or Sample Identification		S.P.L.	Matrix *	(yy-mm-dd)	Collected		By Us	sing A Chec		The Box P			X	pH	Тепр.	Sample	Y/N										
	WWIP Effluent (IRAC	4)		WW	Sept . 9,21	8.40am			Test	t	于				7.16	363	6											
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						[
	SAMPLE SUBMISSION INFORMATION		SHIPPING IN	FORMATIC)N	REPORTING	INVOICING	3			SAMPL	E RECEIV	ING INF	ORMA	TION (LABO	RATORY 9	BE ONLY)											
	Sampled by: Submitted by:	Courie	r (Client account)	X	Invoice	Report by Fax			Received	By (prin	it):	3hbi	hasi	2	Signature:		6											
Print:	Emmanuel Kayode Ennanver Ka	your	r (Caduceon account)			Report by Email			Date Rece			21	09/	10	Time Recei	ved:	11:00	am										
Sign:	21-05-05 21-06-0	Drop C		H	# of Pieces	Invoice by Email			Laborator	y Prepa	red Bottle	s:	Yes		No													
	Date (yy-mm-dd)/Time: Date (yy-mm-dd)/Tim		eon (Pick-up)			Invoice by Mail			Sample Te	emperat	ure °C:	6.	7	Labe	led by:													
Comme	ents:						100	+	R, N	1.1	ID L	10 1	200	1		Page	of	1										
							1,6	-1)	7,10	()/	tol	19,1	Ju'C	ı		G ()	9562	21										

Quote #:

YD20_lqaluit_F

Organization:

City of Iqaluit Mike Hatfield

Contact: Telephone:

867-979-6363

Facsimile:

Email:

Date:

M.Hatfield@city.lgaluit.nu.ca TEST F - Sewage Lagoon

Project #: Address:

Box 460, Iqaluit NU, X0A 0H0

Additional Info:

QUOTE # ('S) MUST BE ON C OF C TO APPLY if not listed, General pricing will be applied. Replacing Quote YD19_Iqaluit_F

Additional Info:

1-Jan-20

Valid Until:

31-Dec-20

Item #	Quantity	Analysis Request	Matrix	Unit Cost, \$	Amount, \$
1	1	BOD	WW	30.60	
2	1	Total Coliform / Fecal Coliform	WW		30.60
3	1	Ammonia, NO2/NO3	WW	31.65	31.65
4	1	Total Phosphorus		30.60	30.60
5	1	Orthophosphate	WW	17.75	17.75
6	1	Conductivity	WW	17.75	17.75
7	 	TSS	WW	9.65	9.65
8	1 1	*	WW	17.75	17.75
		TOTAL METALS	ww	9.20	9.20
9	1	ICPOES AI, Ba, Be, Cr, Co, Cu, Fe, Li, Mn, Mo, Ni, Sn, Sr, Ti, V, Zn ICPMS Sb, As, Cd, Pb, Se, Ag, Ti, U CVAAS Hg	ww	93.85	93.85
10	<u> </u>	Ottawa Airport Pick Up		25.00	25.00
o do not include shippin ronmental Surch	ig unless otherwise state arge of \$1.50 per s	d.		Subtotal	283.80
· ····································	anda oi å i on bet a	sample set		HST	36.89
				Total Cost	320.69

lotal Cost

Kristine Cavanagh

Customer Service Representative

Caduceon Environmental Laboratories

kcavanagh@caduceonlabs.com



Final Report

REPORT No. B21-29068 C.O.C.: G095621

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 10-Sep-21

DATE REPORTED: 21-Sep-21

SAMPLE MATRIX: Waste Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test F

P.O. NUMBER:

WATERWORKS NO.

			Client I.D.		WWTP Effluent (IQA04)		
			Sample I.D.		B21-29068-1		
			Date Collect	ed	09-Sep-21		
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
BOD(5 day)	mg/L	3	SM 5210B	13-Sep-21/K	191		
Total Suspended Solids	mg/L	3	SM2540D	14-Sep-21/K	295		
Conductivity @25°C	µmho/cm	1	SM 2510B	10-Sep-21/O	554		
pH @25°C	pH Units		SM 4500H	10-Sep-21/O	7.73		
Nitrite (N)	mg/L	0.1	SM4110C	10-Sep-21/O	< 0.1		
Nitrate (N)	mg/L	0.1	SM4110C	10-Sep-21/O	0.2		
Ammonia (N)-Total	mg/L	0.01	SM4500- NH3-H	15-Sep-21/K	46.4		
o-Phosphate (P)	mg/L	0.002	PE4500-S	15-Sep-21/K	2.91		
Phosphorus-Total	mg/L	0.01	E3199A.1	15-Sep-21/K	7.69		
Aluminum	mg/L	0.01	SM 3120	13-Sep-21/O	0.28		
Antimony	mg/L	0.0005	EPA 200.8	16-Sep-21/O	0.0005		
Arsenic	mg/L	0.0005	EPA 200.8	16-Sep-21/O	0.0006		
Barium	mg/L	0.001	SM 3120	13-Sep-21/O	0.011		
Beryllium	mg/L	0.002	SM 3120	13-Sep-21/O	< 0.002		
Cadmium	mg/L).000070	EPA 200.8	16-Sep-21/O	0.000520		
Chromium	mg/L	0.002	SM 3120	13-Sep-21/O	< 0.002		
Cobalt	mg/L	0.005	SM 3120	13-Sep-21/O	< 0.005		
Copper	mg/L	0.002	SM 3120	13-Sep-21/O	0.338		
Iron	mg/L	0.005	SM 3120	13-Sep-21/O	0.873		
Lead	mg/L	0.0001	EPA 200.8	16-Sep-21/O	0.0027		
Lithium	mg/L	0.01	SM 3120	13-Sep-21/O	< 0.01		
Manganese	mg/L	0.001	SM 3120	13-Sep-21/O	0.192		
Mercury	mg/L	0.00002	SM 3112 B	14-Sep-21/O	0.00003		
Molybdenum	mg/L	0.01	SM 3120	13-Sep-21/O	< 0.01		
Nickel	mg/L	0.01	SM 3120	13-Sep-21/O	< 0.01		

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Final Report

C.O.C.: G095621 REPORT No. B21-29068

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 10-Sep-21

DATE REPORTED: 21-Sep-21

SAMPLE MATRIX: Waste Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test F

P.O. NUMBER:

WATERWORKS NO.

			Client I.D.		WWTP Effluent (IQA04)		
			Sample I.D.		B21-29068-1		
			Date Collect	ed	09-Sep-21	İ	İ
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
Selenium	mg/L	0.005	EPA 200.8	16-Sep-21/O	< 0.005		
Silver	mg/L	0.0001	EPA 200.8	16-Sep-21/O	0.0002		
Strontium	mg/L	0.001	SM 3120	13-Sep-21/O	0.051		
Thallium	mg/L	0.0003	EPA 200.8	16-Sep-21/O	< 0.0003		
Tin	mg/L	0.05	SM 3120	13-Sep-21/O	< 0.05		
Titanium	mg/L	0.005	SM 3120	13-Sep-21/O	0.005		
Uranium	mg/L	0.0003	EPA 200.8	16-Sep-21/O	0.0006		
Vanadium	mg/L	0.005	SM 3120	13-Sep-21/O	< 0.005		
Zinc	mg/L	0.005	SM 3120	13-Sep-21/O	0.198		
Total Coliform	cfu/100mL	1	MOE E3371	10-Sep-21/O	75000000		
Fecal Coliform	cfu/100mL	1	MOE E3371	10-Sep-21/O	420000		

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

	GENERAL SAMPLE SUBMISSION FORM SAMPLES SUBMITTED TO:			TESTING REQUIREMENTS					RIPORT NIMER (Lab) se									
,	(No.		Kingston Ottawa			O'Reg 153/04 O'Reg 406/19			(1 - 9) (1 - 9.1)	_	Record of	f Site ole (1 - 9.1	١		Y		0	
	CADUCE		Richmond Hill	X.		RPI		ICC	(1-5.1)		Agricultui		,					
	ENVIRONMENTAL LABORATORIES		Barrie			Coarse		-	um/Fine	_	O'Reg 558			12	21	0	120	=
1	Client committed. Quality assured. Proudly Canadian.		London Windsor			MISA Other:		PWQ	0	!	Landfill M	lonitoring		L	4-	30	03	5
	Are any samples to be submitted intended for I-	luman Cons	umption under an	ny Drinking	Water Regulations	s?	Yes		No	(If ye	es, subm	nit all Dri					er Chain of Cu	
Organiz	ation: City of Igaluit Ada	dress:	0x 460	Invoicing	Address (if different)				ANALYS	SES RE	EQUEST	TED					OUND SERVICED (see back p	
Contact	Emnanuel Kayode		valuit				3	TT						inated			ranged in adva	
Tel:	67-222-4612 Fax:	N	u, XOAOH	0			Rude							Contan		Gold* Silver	100%	Surcharge Surcharge
Email:		ote #:		Project N	lame/#:	Hor	Per C							d Highly		Bronze	25% 3	Surcharge
	nal Info (email, cell, etc):	1.#:	- 0	Addition	al Info:		J X							Suspected Highly Contaminate		Standard Specific Da	5-7 da ate:	ys
	* Sample Matrix L		Vaste Water, SW=Surf	ace Water, GV			Solid Sludge	e, S=Soi					Filter, Oil					November 2000
Lab No.	Sample Source and/or Sample Identification		S.P.L.	Sample Matrix *	Date Collected (yy-mm-dd)	Time Collected		By Usi	Indicate Test ng A Check M					X	pH	ield Temp)	# Bottles/ Sample	Field Filtered Y/N
	10 A 08 A			SW	Sept17,21	9.25am			Tes	t	E				7.63	A.65	10	
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	SAMPLE SUBMISSION INFORMATION		SHIPPING	INFORMATIO	ON	REPORTING	INVOICIN					E RECEI	IVING IN	FORMA	TION (LABO	RATORY US		
	Sampled by: Submitted by:		Client account)	X	Invoice	Report by Fax			Received By	y (print)		SW	ohas	h	Signature:		1	
Print:	Emmanuel Kayode Emmanuel Kayo	de Courier (Caduceon account)			Report by Email	X		Date Receive	ed (yy-	mm-dd):	21	109	120	Time Rece	ved:	9:35	am
Sign:	Kales Con	Drop Off			# of Pieces	Invoice by Email]	Laboratory F	Prepare	ed Bottle	es:	Ye	s	No			
	21-09-17 21-09-17 Date (yy-mm-dd)/Time: Date (yy-mm-dd)/Time:	Caduceo	n (Pick-up)			Invoice by Mail			Sample Tem	peratu	re °C:	8	.8	Labe	eled by:		13	
Comme						6.00						11.	0	1		Page	of	1
					1 L Ambe	s, 2 he	, M,	21	11, 2	100	()/	79,	150	CT		G []	9562	22

Quote #:

YD21_Igaluit_E

Organization:

City of Iqaluit

Contact:

Paul Clow

Telephone:

867-979-6363 Ex233

Facsimile:

Email:

p.clow@city.iqaluit.nu.ca

Project #: Address:

TEST E (Landfill Runoff) City Of Iqaluit Box 460 Iqaluit, NU

Additional Info:

QUOTE # ('S) MUST BE ON C OF C TO APPLY if not listed, General pricing will be applied.

Additional Info:

Replacing Quote YD18_lqaluit_E

Date:

27-May-21

Valid Until:

31-Dec-21

ltem #	Quantity	Analysis Request	Matrix	Unit Cost, \$	Amount,
		Detention Pond			
1	1	pH	WW	9.50	9.50
2	1	Turbidity	WW	15.25	15.25
3	1	TSS	WW	18.25	18.25
4	1	BOD5	WW	31.50	31.50
5	1	COD	ww	18.25	18.25
6	1	TOC	WW	25.00	25.00
		Retention Pond			
7	1	pH	WW	9.50	9.50
8	1	Turbidity	ww	15.25	15.25
9	1	TSS	WW	18.25	18.25
10	1	BOD5	ww	31.50	31.50
11	1	COD	WW	18.25	18.25
12	1	TOC	ww	25.00	25.00
13	1	Ammonia Nitrogen	ww	10.00	10.00
14	1	TKN	WW	18.25	18.25
15	1	Total Phosphorus	ww	18.25	18.25
16	1	Full Metals Scan +Hg	ww	73.50	73.50
17	1	Total Coliform/Fecal Coliform	ww	32.50	32.50
18	1	BTEX	WW	76.50	76.50
19	1	PCB's	ww	82.50	82.50
19	11	Ottawa Airport Pick Up		25.00	25.00
do not include shippir	ng unless otherwise state	ed.		Subtotal	572.00
ronmental Surch	arge of \$2 per sar	mple set		HST	74.36
		:		Total Cost	646.36

Total Cost 646.36

Kristine Cavanagh

Customer Service Representative

Caduceon Environmental Laboratories

kcavanagh@caduceonlabs.com



Final Report

C.O.C.: --- REPORT No. B21-30035

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 20-Sep-21

DATE REPORTED: 27-Sep-21

SAMPLE MATRIX: Waste Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1

Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test E

P.O. NUMBER: 460

WATERWORKS NO.

			Client I.D.		1QA08A		
			Sample I.D.		B21-30035-1		
			Date Collect	ed	17-Sep-21		
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
BOD(5 day)	mg/L	3	SM 5210B	20-Sep-21/K	< 3		
COD	mg/L	5	SM5220C	21-Sep-21/K	131		
Total Organic Carbon	mg/L	0.2	EPA 415.2	20-Sep-21/O	12.4		
Total Suspended Solids	mg/L	3	SM2540D	22-Sep-21/K	10		
Turbidity	NTU	0.1	SM 2130	22-Sep-21/O	35.4		
pH @25°C	pH Units		SM 4500H	20-Sep-21/O	8.05		
Ammonia (N)-Total	mg/L	0.01	SM4500- NH3-H	22-Sep-21/K	34.0		
Total Kjeldahl Nitrogen	mg/L	0.1	E3199A.1	22-Sep-21/K	41.3		
Phosphorus-Total	mg/L	0.01	E3199A.1	22-Sep-21/K	0.12		
Aluminum	mg/L	0.01	SM 3120	21-Sep-21/O	0.04		
Arsenic	mg/L	0.0005	EPA 200.8	21-Sep-21/O	0.0013		
Antimony	mg/L	0.0005	EPA 200.8	21-Sep-21/O	0.0011		
Barium	mg/L	0.001	SM 3120	21-Sep-21/O	0.017		
Beryllium	mg/L	0.0005	EPA 200.8	21-Sep-21/O	< 0.0005		
Chromium	mg/L	0.001	EPA 200.8	21-Sep-21/O	< 0.001		
Cobalt	mg/L	0.0005	EPA 200.8	21-Sep-21/O	0.0011		
Copper	mg/L	0.0005	EPA 200.8	21-Sep-21/O	0.0015		
Iron	mg/L	0.005	SM 3120	21-Sep-21/O	3.25		
Lithium	mg/L	0.01	SM 3120	21-Sep-21/O	< 0.01		
Manganese	mg/L	0.001	SM 3120	21-Sep-21/O	0.502		
Mercury	mg/L	0.00002	SM 3112 B	21-Sep-21/O	< 0.00002		
Molybdenum	mg/L	0.0005	EPA 200.8	21-Sep-21/O	0.0032		
Nickel	mg/L	0.001	EPA 200.8	21-Sep-21/O	0.019		
Selenium	mg/L	0.005	EPA 200.8	21-Sep-21/O	< 0.005		
Silver	mg/L	0.0001	EPA 200.8	21-Sep-21/O	< 0.0001		
Strontium	mg/L	0.001	SM 3120	21-Sep-21/O	0.602		

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Final Report

C.O.C.: --- REPORT No. B21-30035

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 20-Sep-21

DATE REPORTED: 27-Sep-21

SAMPLE MATRIX: Waste Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test E

P.O. NUMBER: 460

WATERWORKS NO.

			Client I.D.		1QA08A		
			Sample I.D.		B21-30035-1		
			Date Collecte	ed	17-Sep-21		
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
Tin	mg/L	0.05	SM 3120	21-Sep-21/O	< 0.05		
Titanium	mg/L	0.005	SM 3120	21-Sep-21/O	< 0.005		
Uranium	mg/L	0.0003	EPA 200.8	21-Sep-21/O	< 0.0003		
Vanadium	mg/L	0.0005	EPA 200.8	21-Sep-21/O	< 0.0005		
Zinc	mg/L	0.005	SM 3120	21-Sep-21/O	0.370		
Total Coliform	cfu/100mL	1	MOE E3371	20-Sep-21/O	4		
Fecal Coliform	cfu/100mL	1	MOE E3371	20-Sep-21/O	0		
Benzene	μg/L	0.5	EPA 8260	21-Sep-21/R	< 0.5		
Toluene	μg/L	0.5	EPA 8260	21-Sep-21/R	< 0.5		
Ethylbenzene	μg/L	0.5	EPA 8260	21-Sep-21/R	< 0.5		
Xylene, m,p-	μg/L	1.0	EPA 8260	21-Sep-21/R	< 1.0		
Xylene, o-	μg/L	0.5	EPA 8260	21-Sep-21/R	< 0.5		
Xylene, m,p,o-	μg/L	1.1	EPA 8260	21-Sep-21/R	< 1.1		
Toluene-d8 (SS)	% rec.		EPA 8260	21-Sep-21/R	106		
Poly-Chlorinated Biphenyls (PCB's)	μg/L	0.05	EPA 8082	24-Sep-21/K	< 0.05		

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

GENERAL SAMPLE SUBMISSION FORM	TED TO:		7	CHEBUR	R (Lab Us	e)					
C A D U C E N' ENVIRONMENTAL LABORATORIES Client committed. Quality assured. Proudly Canadian.	Kingston Ottawa Richmond Hill Barrie London Windsor		72	O'Reg 153/04 O'Reg 408/19 RPI Coarse MISA Other:		Table (1 - 9) Table (1 - 9.1) ICC Medium/Fine PWQO	Record of Site SPLP Table (1 - 9.1) Agricultural O'Reg 558 TCLP Landfill Monitoring				
Are any samples to be submitted intended for Huma			5.0		Yes	No (If	yes, sul mit i Drin	Wat r ar	mples on a rin age ta	r pain of u	tod
Organization: City of Igaluit Address:	BOX 460	Invoicing	Address (if different	:		ANALYSES F	REQUESTED	1011		OUND SERVICE O (see back pa	qe)
contact: Emmanuel Kayode	Igaluit				t e	文		minate	*Must be arr	anged in adva	nce Surcharge
Organization: City of Igaluit Contact: Emmanuel Kayode Tel: 8672224612 Fax: Shane, Turner,					Quet	18TEX		/ Contai	Gold*		Surcharge urcharge
Email: e. Kayo de @ 19 alut. cg Quote #:		Project Na	ame/#:		Per		. /	d Highly	Bronze Standard		urcharge
Additional Info (email, cell, etc): P.O. #:	460	Additiona	I Info:		As	HC		Suspected Highly	Specific Da		
* Sample Matrix Legen	d: WW=Waste Water, SW=Surfa		MINISTER SERVICE SERVI	EMPERIOR STATE OF THE PROPERTY	Solid Sludge, S	CANDIDATE OF THE PARTY OF THE P	A CONTRACTOR OF THE PARTY OF TH		Project 1	# P - #1 /	ELIZED CA
No. Sample Source and/or Sample Identification	S.P.L.	Sample Matrix *	Date Collected (yy-mm-dd)	Time Collected	В	Indicate Test For E By Using A Check Mark/In		X	Field PH Temp.	# Bottles/ Sample	Field Filtered Y/N
1 Raw Sample	77 4	SW	Oct, 421	11.34	m	Terre	M		6-36	1	
2 AV 629			~	9.45am			/		6.17	1	
3 Building 222			V	10-22am			7		6-10	1	
	75	1.3	/	11-36am					6.17	I	
4 AV 507 5 Airport Federal			/	11.05 gm		<u></u>			6.00)	
6 Building A WG		at	/	10.42gm			/ .		6.08	1	
O WWTP Influent		ww	Oct, 4,21	14.00pm		Te	CH I		7.04 7.6	6	
000011 (77)	7.7	VV 00	00,11/21	1					7-7/10		
									200		
					++	4	B21	- 2	2545		
			17		-		Cha	nday			
							(),4		4)	12/4	
SAMPLE SUBMISSION INFORMATION	chibbino	INFORMATIO		REPORTING	(INIVOICING		CAMPI E DECENA	NO INFORMA	TION (LABORATORY US	DOM W	
	Courier (Client account)	X	Invoice	Report by Fax	INVOICING	Received By (prin	. 01	195/2	Signature:	EGNILTI	
Sampled by: Submitted by:	Courier (Caduceon account)		1	Report by Email		Date Received (yy		0/06	Time Received:	12:00/	2
Sign:	Drop Off		# of Pieces	Invoice by Email		Laboratory Prepa	red Bottles:	Yes	No		
Date (v. mar da) (in mar da)	Caduceon (Pick-up)			Invoice by Mail		Sample Temperat	ure °C:	9 Labe	eled by:		
Date (yy-mm-dd)/Time: Date (yy-mm-dd)/Time: Comments:	-6 - 10	et =	Transt	cerved-t	o PH	CY VOC	vials.	1	Page	of	
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GENERAL TERMS, CONDITIONS AND SAMPLING INFORMATION GUIDE

Sample Acceptanc

Caduceon Enterprises is a commercial testing laboratory specializing in environmental analyses of samples including, but not limited to the following:
Drinking Water, Groundwater, Surface Water, Wastewater and/or Industrial Process Water/Effluents, Liquid and Solid Sludge, Soil and Sediment, Oil (limited types)

Caduceon does not accept samples including but not limited to the following matrices unless otherwise prearranged with an authorized Caduceon representative;

Human or Animal Tissue, Unprocessed Human or Animal Waste, Food or Beverage (other than Drinking Water), Unknown solids and liquids, Vegetation, Hazardous Waste, Highly contaminated samples (which cause process and instrument complications).

Samples submitted to Caduceon without proper designation are subject to supplementary charges, but not limited to the following: Sample Disposal Fees, Process and Handling Fees, Instrument Maintenance and Refurbishment Fees (parts and labour).

Chain of Custody Forms must be completed with all required information. Analyses of samples will not commence until all required information is received. Receipt of samples will only occur at this time.

Samples must be submitted in Caduceon sampling containers and/or acceptable alternatives with appropriate preservatives (if required),

Samples must be received at the laboratory within required sample holding times. If samples require RUSH analyses based on sample holding times, surcharges may apply. See Turnaround Time Terms and Conditions.

Turnaround Time

Platinum Service – 200% Surcharge (minimum)** Fastest possible Turnaround Time available and/or achievable, same day service or does not meet one of the other listed categories. Subject to additional fees for weekend and/or after hours service. Arrangments must be made in advance with your local laboratory prior to submission of samples.

Gold Service – 100% Surcharge Samples received prior to 2 p.m. will be reported by 5 p.m. on the next business day from the day of receipt. Samples received after 2 p.m. will be reported by 12 p.m. on the second business day from the day of receipt. Arrangments must be made in advance with your local laboratory prior to submission of samples.

Silver Service - 50% Surcharge Samples received prior to 2 p.m. will be reported by 5 p.m. on the second business day from the day of receipt. Samples received after 2 p.m. will be reported by 12 p.m. on the third business day from the day of receipt.

Bronze Service - 25% Surcharge Samples received prior to 2 p.m. will be reported by 5 p.m. on the third business day from the day of receipt. Samples received after 2 p.m. will be reported by 12 p.m. on the fourth business day from the day of receipt.

Standard Service - No Surcharge 5-7 business days from the time of receipt. Note: Samples received after 2 p.m. are considered received the next business day.

Note: If the specific level of Turnaround Time requested is not met the next level of service achieved will be surcharged accordingly. This is at the sole discretion of the laboratory.

Payment

By submission of samples and signing of the chain of custody you agree to Caduceon's Payment Terns and Conditions. (See Caduceon website for details www.caduceonlabs.com)



Client committed. Quality assured. Proudly Canadian.

www.caduceonlabs.com

Laboratory & Depot Locations/Shipping Addresses

Kingston Lab - 285 Dalton Ave., Kingston, ON K7K 6Z1, Tel: (613) 544-2001 Fax: (613) 544-2770 Email: supplieskingston@caduceonlabs.com
Ottawa Lab - 2378 Holly Lane, Ottawa, ON K1V 7P1, Tel: (613) 526-0123 Fax: (613) 526-1244 Email: suppliesottawa@caduceonlabs.com
Richmond Hill Lab - #14-110 West Beaver Creek Rd., ON L4B 1J9, Tel: (289) 475-5442 Fax: (866) 562-1963 Email: suppliesgta@caduceonlabs.com
Windsor Lab - #5-3201 Marentette Ave., Windsor, ON N8X 4G3, Tel: (519) 966-9541 Fax: (519) 966-9567 Email: supplieswindsor@caduceonlabs.com
Barrie Lab - 112 Commerce Park Drive, Unit L, Barrie, ON L4N 8W8, Tel: (705) 252-5743 Fax: (705) 252-5746 Email: suppliesgta@caduceonlabs.com
London Depot - #1-600 Newbold St., London, ON N6E 2T7, Tel: (519) 601-1833 Fax: (519) 601-1833 Email: supplieslondon@caduceonlabs.com



Quote #:

YD21_lqaluit_F

Organization: Contact:

City of Iqaluit Mike Hatfield

Telephone:

867-979-6363

Facsimile:

Email:

M.Hatfield@city.lgaluit.nu.ca

Project #: Address:

TEST F - Sewage Lagoon Box 460, Iqaluit NU, X0A 0H0

Additional Info:

QUOTE # ('S) MUST BE ON C OF C TO APPLY if not listed, General pricing will be applied.

Additional Info:

Replacing Quote YD19_lqaluit_F

Date:

27-May-21

Valid Until:

31-Dec-21

Item #	Quantity	Analysis Request	Matrix	Unit Cost, \$	Amount, \$
1	1	BOD	ww	31.50	31.50
2	1	Total Coliform / Fecal Coliform	ww	32.50	32.50
3	1	Ammonia, NO2/NO3	WW	31.50	31.50
4	1	Total Phosphorus	ww	18.25	18.25
5	1	Orthophosphate	ww	18.25	18.25
6	1	Conductivity	ww	10.00	10.00
7	1	TSS	ww	18.25	18.25
8	1	pH	ww	9.50	9.50
9	1	TOTAL METALS ICPOES AI, Ba, Be, Cr, Co, Cu, Fe, Li, Mn, Mo, Ni, Sn, Sr, Ti, V, Zn ICPMS Sb, As, Cd, Pb, Se, Ag, Tl, U CVAAS Hg	ww	96.00	96.00
10	1	Ottawa Airport Pick Up		25.00	25.00
do not include shippi	ng unless otherwise state	ed.		Subtotal	290.75
onmontal Surch	arge of \$2 per ear	nnla eat		Пет	27.90

Environmental Surcharge of \$2 per sample set

25.00	25.00
Subtotal	290.75
HST	37.80
Total Cost	328 55

Kristine Cavanagh

Customer Service Representative

Caduceon Environmental Laboratories

kcavanagh@caduceonlabs.com



Final Report

C.O.C.: G095624 REPORT No. B21-32514

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 06-Oct-21

DATE REPORTED: 14-Oct-21
SAMPLE MATRIX: Waste Water

DATE RECEIVED: 06-Oct-2

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test F

P.O. NUMBER:

WATERWORKS NO.

			Client I.D.		WWTP Influent		
			Sample I.D.		B21-32514-1		
			Date Collecte	ed	04-Oct-21		
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
BOD(5 day)	mg/L	3	SM 5210B	08-Oct-21/K	172		
Total Suspended Solids	mg/L	3	SM2540D	08-Oct-21/K	268		
Conductivity @25°C	µmho/cm	1	SM 2510B	06-Oct-21/O	439		
pH @25°C	pH Units		SM 4500H	06-Oct-21/O	7.10		
Nitrite (N)	mg/L	0.1	SM4110C	07-Oct-21/O	< 0.1		
Nitrate (N)	mg/L	0.1	SM4110C	07-Oct-21/O	< 0.1		
Ammonia (N)-Total	mg/L	0.01	SM4500- NH3-H	08-Oct-21/K	27.2		
o-Phosphate (P)	mg/L	0.002	PE4500-S	08-Oct-21/K	1.94		
Phosphorus-Total	mg/L	0.01	E3199A.1	13-Oct-21/K	3.66		
Aluminum	mg/L	0.01	SM 3120	07-Oct-21/O	0.34		
Antimony	mg/L	0.0005	EPA 200.8	12-Oct-21/O	0.0007		
Arsenic	mg/L	0.0005	EPA 200.8	12-Oct-21/O	0.0006		
Barium	mg/L	0.001	SM 3120	07-Oct-21/O	0.018		
Beryllium	mg/L	0.002	SM 3120	07-Oct-21/O	< 0.002		
Cadmium	mg/L	0.000070	EPA 200.8	12-Oct-21/O	0.000239		
Chromium	mg/L	0.002	SM 3120	07-Oct-21/O	0.003		
Cobalt	mg/L	0.005	SM 3120	07-Oct-21/O	< 0.005		
Copper	mg/L	0.002	SM 3120	07-Oct-21/O	0.284		
Iron	mg/L	0.005	SM 3120	07-Oct-21/O	1.51		
Lead	mg/L	0.0001	EPA 200.8	12-Oct-21/O	0.0059		
Lithium	mg/L	0.01	SM 3120	07-Oct-21/O	< 0.01		
Manganese	mg/L	0.001	SM 3120	07-Oct-21/O	0.143		
Mercury	mg/L	0.00002	SM 3112 B	08-Oct-21/O	0.00005		
Molybdenum	mg/L	0.01	SM 3120	07-Oct-21/O	< 0.01		
Nickel	mg/L	0.01	SM 3120	07-Oct-21/O	< 0.01		
Selenium	mg/L	0.005	EPA 200.8	12-Oct-21/O	< 0.005		

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Final Report

C.O.C.: G095624 REPORT No. B21-32514

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 06-Oct-21

DATE REPORTED: 14-Oct-21
SAMPLE MATRIX: Waste Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test F

P.O. NUMBER:

WATERWORKS NO.

			Client I.D.		WWTP Influent		
			Sample I.D.		B21-32514-1		
			Date Collecte	ed	04-Oct-21		
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
Silver	mg/L	0.0001	EPA 200.8	12-Oct-21/O	0.0001		
Strontium	mg/L	0.001	SM 3120	07-Oct-21/O	0.043		
Thallium	mg/L	0.0003	EPA 200.8	12-Oct-21/O	< 0.0003		
Tin	mg/L	0.05	SM 3120	07-Oct-21/O	< 0.05		
Titanium	mg/L	0.005	SM 3120	07-Oct-21/O	0.007		
Uranium	mg/L	0.0003	EPA 200.8	12-Oct-21/O	< 0.0003		
Vanadium	mg/L	0.005	SM 3120	07-Oct-21/O	< 0.005		
Zinc	mg/L	0.005	SM 3120	07-Oct-21/O	0.205		
Total Coliform	cfu/100mL	1	MOE E3371	06-Oct-21/O	99000000		
Fecal Coliform	cfu/100mL	1	MOE E3371	06-Oct-21/O	5600000		

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

CADUCE ENVIRONMENTAL LABORATORIES Client committed. Quality assured. Proudly Canadian.	Kingstern Ottawa Richmond Hill Barrie London Windsor		34/	O'R estat O'Reg 406/19 RPI Coarse MISA Other:	STING	Table (1 - Table (1 - ICC Medium// PWQO	9.1)	Record of SPLP Tab Agricultur O'Reg 558 Landfill Mo	le (1 - 9.1) al TCLP	_	00	FINE	Hall b Ise	a)
Are any samples to be submitted intended for Hu					Yes	No) (I	f yes, subm	it all Drinkir	ng Water S	amples on a D		r Chain of Cus	• /
Organization: City of Igaluit Addr	Box 460	Invoicing	g Address (if different):			ANALYSES	REQUEST	ED				OUND SERVICE O (see back pag	
Contact: Emmonuel Kayode					9		TT			T day		*Must be arra	anged in advar	nce
el: 86 7-222-46 12 Fax:	Nu XOAOHO	٥			not					Contamina		Platinum* Gold* Silver	100% \$	Surcharge Surcharge urcharge
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* Sample Matrix Leg	gend: WW=Waste Water, SW=Sur	face Water, GV	V=Groundwater, LS=	Liquid Sludge, SS=	Solid Sludge	e, S=Soil, S	Sed=Sediment,	PC=Paint Cl	hips, F=Filte	r, Qil = Qil	20	10	OF	20
Lab No. Sample Source and/or Sample Identification	S.P.L.	Sample Matrix *	Date Collected	Time			icate Test For		San San San	1,			#Bo les	
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Quote #:

YD21_lqaluit_A

Organization:

City of Iqaluit

Contact: Telephone: Mike Hatfield 867-979-6363

Facsimile:

Email:

M.Hatfield@city.lqaluit.nu.ca

Project #: Address:

TEST A - Drinking Water Box 460, Iqaluit NU, X0A 0H0

Additional Info:

QUOTE # ('S) MUST BE ON C OF C TO APPLY if not listed, General pricing will be applied.

Additional Info:

Replacing Quote YD20_lqaluit_A

Date:

Valid Until: 31-Dec-21 27-May-21

Item #	Quantity	Analysis Request	Matrix	Unit Cost, \$	Amount, \$
1	1	Acidity (Subcontracted)	DW	35.15	35.15
2	1	Alkalinity	DW	15.00	15.00
3	1	Bicarbonate/ Carbonate	DW	18.25	18.25
4	1	Chloride/Sulphate	DW	25.00	25.00
5	1	Conductivity	DW	10.00	10.00
6	1	Hydroxide	DW	15.25	15.25
7	1	Redox Potential	DW	16.50	16.50
8	1	TDS	DW	18.25	18.25
9	1	TSS	DW	18.25	18.25
10	1	TOC	DW	25.00	25.00
11	1	TIC	DW	25.00	25.00
12	1	TOTAL METALS ICPOES AI, Ba, Be, Cr, Co, Cu, Fe, Li, Mn, Mo, Ni, Sn, Sr, Ti, V, Zn + Hardness ICPMS Sb, As, Cd, Pb, Se, Ag, Tl, U CVAAS Hg	DW	96.00	96.00
13	1	DISSOLVED METALS ICPOES AI, Ba, Be, Cr, Co, Cu, Fe, Li, Mn, Mo, Ni, Sn, Sr, Ti, V, Zn + Hardness ICPMS Sb, As, Cd, Pb, Se, Ag, Tl, U CVAAS Hg	DW	96.00	96.00
14	1	Fecal Coliforms	DW	17.00	17.00
15	1	pH	DW	9.50	9.50
16	1	Turbidity	DW	15.25	15.25
17	1	Ottawa Airport Pick Up		25.00	25.00
rices do not include shippir	na unless otherwise state			Subtotal	480.40

Environmental Surcharge of \$2 per sample set

HST 62.45 **Total Cost** 542.85

Kristine Cavanagh

Customer Service Representative

Caduceon Environmental Laboratories

kcavanagh@caduceonlabs.com



GENERAL CHAIN OF CUSTODY FORM

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Email:	gclarl	kin@caduce	onlabs.com tyapi	ci@c	aduceonlabs.com	Emai	il:	mr	ncco	orm	ick@	cad	uceo	nlal	os.co	<u>m</u>												_
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Final Report

C.O.C.: G095626 REPORT No. B21-32539

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 06-Oct-21

DATE REPORTED: 19-Oct-21
SAMPLE MATRIX: Drinking Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123 Fax: 613-526-1244

JOB/PROJECT NO.: Test A (WTP)

P.O. NUMBER: WATERWORKS NO.

			Client I.D.		Test A- Raw WTP	Test A- Raw WTP (Total)	Test A- Potable WTP	Test A- Potable (Total)
			Sample I.D.		B21-32539-1	B21-32539-2	B21-32539-3	B21-32539-4
			Date Collecte	ed	01-Oct-21	01-Oct-21	01-Oct-21	01-Oct-21
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Hardness (as CaCO3)	mg/L	1	SM 3120	12-Oct-21/O	16		16	
Hardness (as CaCO3)	mg/L	1	SM 3120	13-Oct-21/O		16		16
Alkalinity(CaCO3) to pH4.5	mg/L	5	SM 2320B	07-Oct-21/O	14		11	
Bicarbonate(as CaCO3)	mg/L	5	SM 2320B	07-Oct-21/O	14		11	
Carbonate (as CaCO3)	mg/L	5	SM 2320B	07-Oct-21/O	< 5		< 5	
Hydroxide	mg/L	5	EPA 310.2	07-Oct-21/O	< 5		< 5	
Acidity (as CaCO3)	mg/L	5	Subcontract	13-Oct-21	< 5 ¹	1	< 5 1	
pH @25°C	pH Units		SM 4500H	07-Oct-21/O	7.74		6.33	
Conductivity @25°C	µmho/cm	1	SM 2510B	07-Oct-21/O	33		35	
TDS(ion sum calc.)	mg/L	1	Calc.	13-Oct-21/O	19		19	
Total Suspended Solids	mg/L	3	SM2540D	08-Oct-21/K	3		< 3	
Turbidity	NTU	0.1	SM 2130	08-Oct-21/O	0.5		0.3	
REDOX potential	mV		In-House	12-Oct-21/R	346		687	
Chloride	mg/L	0.5	SM4110C	07-Oct-21/O	1.7		3.1	
Sulphate	mg/L	1	SM4110C	07-Oct-21/O	2		2	
Aluminum	mg/L	0.01	SM 3120	12-Oct-21/O	0.02		0.01	
Aluminum	mg/L	0.01	SM 3120	13-Oct-21/O		0.02		0.02
Antimony	mg/L	0.0001	EPA 200.8	12-Oct-21/O	0.0002		< 0.0001	
Antimony	mg/L	0.0001	EPA 200.8	08-Oct-21/O		0.0004		0.0003
Arsenic	mg/L	0.0001	EPA 200.8	12-Oct-21/O	< 0.0001		< 0.0001	
Arsenic	mg/L	0.0001	EPA 200.8	08-Oct-21/O		< 0.0001		< 0.0001
Barium	mg/L	0.001	SM 3120	12-Oct-21/O	0.002		0.001	
Barium	mg/L	0.001	SM 3120	13-Oct-21/O		0.002		0.002
Beryllium	mg/L	0.002	SM 3120	12-Oct-21/O	< 0.002		< 0.002	
Beryllium	mg/L	0.002	SM 3120	13-Oct-21/O		< 0.002		< 0.002
Cadmium	mg/L).000015	EPA 200.8	12-Oct-21/O	< 0.000015		< 0.000015	

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Final Report

C.O.C.: G095626 **REPORT No. B21-32539**

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 06-Oct-21

DATE REPORTED: 19-Oct-21 SAMPLE MATRIX: Drinking Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test A (WTP)

P.O. NUMBER:

WATERWORKS NO.

			Client I.D.		Test A- Raw WTP	Test A- Raw WTP (Total)	Test A- Potable WTP	Test A- Potable (Total)
			Sample I.D.		B21-32539-1	B21-32539-2	B21-32539-3	B21-32539-4
			Date Collecte	ed	01-Oct-21	01-Oct-21	01-Oct-21	01-Oct-21
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Cadmium	mg/L	0.000015	EPA 200.8	08-Oct-21/O		< 0.000015		< 0.000015
Chromium	mg/L	0.002	SM 3120	12-Oct-21/O	< 0.002		< 0.002	
Chromium	mg/L	0.002	SM 3120	13-Oct-21/O		< 0.002		< 0.002
Cobalt	mg/L	0.005	SM 3120	12-Oct-21/O	< 0.005		< 0.005	
Cobalt	mg/L	0.005	SM 3120	13-Oct-21/O		< 0.005		< 0.005
Copper	mg/L	0.002	SM 3120	12-Oct-21/O	0.008		0.012	
Copper	mg/L	0.002	SM 3120	13-Oct-21/O		0.003		0.009
Iron	mg/L	0.005	SM 3120	12-Oct-21/O	0.076		0.023	
Iron	mg/L	0.005	SM 3120	13-Oct-21/O		0.094		0.034
Lead	mg/L	0.00002	EPA 200.8	12-Oct-21/O	0.00019		0.00004	
Lead	mg/L	0.00002	EPA 200.8	08-Oct-21/O		0.00019		0.00004
Lithium	mg/L	0.01	SM 3120	12-Oct-21/O	< 0.01		< 0.01	
Lithium	mg/L	0.01	SM 3120	13-Oct-21/O		< 0.01		< 0.01
Manganese	mg/L	0.001	SM 3120	12-Oct-21/O	0.053		0.004	
Manganese	mg/L	0.001	SM 3120	13-Oct-21/O		0.053		0.004
Mercury	mg/L	0.00002	SM 3112 B	13-Oct-21/O	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Molybdenum	mg/L	0.01	SM 3120	12-Oct-21/O	< 0.01		< 0.01	
Molybdenum	mg/L	0.01	SM 3120	13-Oct-21/O		< 0.01		< 0.01
Nickel	mg/L	0.01	SM 3120	12-Oct-21/O	< 0.01		< 0.01	
Nickel	mg/L	0.01	SM 3120	13-Oct-21/O		< 0.01		< 0.01
Selenium	mg/L	0.001	EPA 200.8	12-Oct-21/O	< 0.001		< 0.001	
Selenium	mg/L	0.001	EPA 200.8	08-Oct-21/O		< 0.001		< 0.001
Silver	mg/L	0.0001	EPA 200.8	12-Oct-21/O	< 0.0001		< 0.0001	
Silver	mg/L	0.0001	EPA 200.8	08-Oct-21/O		< 0.0001		< 0.0001
Strontium	mg/L	0.001	SM 3120	12-Oct-21/O	0.011		0.011	
Strontium	mg/L	0.001	SM 3120	13-Oct-21/O		0.011		0.011

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Final Report

C.O.C.: G095626 REPORT No. B21-32539

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 06-Oct-21

DATE REPORTED: 19-Oct-21
SAMPLE MATRIX: Drinking Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test A (WTP)

P.O. NUMBER:

WATERWORKS NO.

			Client I.D.		Test A- Raw WTP	Test A- Raw WTP (Total)	Test A- Potable WTP	Test A- Potable (Total)
			Sample I.D.		B21-32539-1	B21-32539-2	B21-32539-3	B21-32539-4
			Date Collecte	ed	01-Oct-21	01-Oct-21	01-Oct-21	01-Oct-21
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Thallium	mg/L	0.00005	EPA 200.8	12-Oct-21/O	< 0.00005		< 0.00005	
Thallium	mg/L	0.00005	EPA 200.8	08-Oct-21/O		< 0.00005		< 0.00005
Tin	mg/L	0.05	SM 3120	12-Oct-21/O	< 0.05		< 0.05	
Tin	mg/L	0.05	SM 3120	13-Oct-21/O		< 0.05		< 0.05
Titanium	mg/L	0.005	SM 3120	12-Oct-21/O	< 0.005		< 0.005	
Titanium	mg/L	0.005	SM 3120	13-Oct-21/O		< 0.005		< 0.005
Uranium	mg/L	0.00005	EPA 200.8	12-Oct-21/O	< 0.00005		< 0.00005	
Uranium	mg/L	0.00005	EPA 200.8	08-Oct-21/O		< 0.00005		< 0.00005
Vanadium	mg/L	0.005	SM 3120	12-Oct-21/O	< 0.005		< 0.005	
Vanadium	mg/L	0.005	SM 3120	13-Oct-21/O		< 0.005		< 0.005
Zinc	mg/L	0.005	SM 3120	12-Oct-21/O	0.006		< 0.005	
Zinc	mg/L	0.005	SM 3120	13-Oct-21/O		0.006		0.033
Total Organic Carbon	mg/L	0.2	EPA 415.2	07-Oct-21/O	1.9		2.0	
TIC	mg/L	0.5	EPA 415.1	07-Oct-21/O	3.5		5.6	
Fecal Coliform	cfu/100mL	. 1	MOE E3371	06-Oct-21/O	0		0	
Anion Sum	meq/L		Calc.	13-Oct-21/O	0.369		0.356	
Cation Sum	meq/L		Calc.	13-Oct-21/O	0.354		0.353	
% Difference	%		Calc.	13-Oct-21/O	2.03		0.439	
Ion Ratio	AS/CS		Calc.	13-Oct-21/O	1.04		1.01	
Sodium Adsorption Ratio	-		Calc.	13-Oct-21/O	0.0788		0.0774	
Conductivity (calc.)	µmho/cm		Calc.	13-Oct-21/O	38		39	
EC(calc.)/EC(actual)	-		Calc.	13-Oct-21/O	1.15		1.13	
TDS(calc.)/EC(actual)	-		Calc.	13-Oct-21/O	0.569		0.538	
Langelier Index(25°C)	S.I.		Calc.	13-Oct-21/O	-1.75		-3.24	

1 Subcontracted to Testmark Labs

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

GENERAL SAMPLE SUBMISSION FORM	SAMPLES SUBMITTE	D TO:		TEST	ING REC	UIREME	NTS				1	N	ORT N	BERT b	se)
CADUCE N' ENVIRONMENTAL LABORATORIES Client committed. Quality assured. Proudly Canadian.	Kingston Ottawa Richmond Hill Barrie London Windsor			1	Ta IC Me	able (1 - 9) able (1 - 9.1 C edium/Fine		Record of SPLP Tabl Agricultur O'Reg 558 Landfill Mo	le (1 - 9.1) al TCLP			,C			
Are any samples to be submitted intended for Hu					Yes	No	(If	yes, submi	it all Drinl	king Wate	er Sample	es on a Dr		r Chain of Cu	
Organization: City of Igaluit Addre	Box 460	Invoicing Addres	ss (if different):			AN	ALYSES	REQUEST	ED			1		OUND SERVIO O (see back p	
Contact: Emmanuel Kayode	1ga luit			9			1				Contaminated		Must be arr Platinum*	anged in adv	ance Surcharge
Fax: Fax:	NU XGAOHO			Tuck									Gold* Silver		Surcharge Surcharge
e. Kayode@ Kaluit·G Yt Additional Info (email, cell, etc): Quote Yt P.O. #	20_ Facult A	Project Name/#:	-Igaluit	T Aspera							Suspected Highly	X	Bronze Standard Specific Da	25% 5-7 da	Surcharge
* Sample Matrix Leg	end: WW=Waste Water, SW=Surface		ndwater, LS=Liquid	Sludge, SS=Solid	Sludge, S=			PC=Paint Cl		ter, Oil =	OII	0	2	A L	20
No. Sample Source and/or Sample Identification	S.P.L.	Odnipic		Collected	Ву			The Box P			X	pH	Teally.	oample	ZIN
1 WTP Raw @ Paw 7	otal	SW Oct	15,21	7-43gm			1250	A	()		7	7.04	3.5	10	
3 WTP Potable @ Potal	de total.		7.	50 am			-		5		(6.76	43	10	
3 WWTP Effluent		WW .	/			1	est	T.				6-94	483	6	
													700		7 7
	7.7											15			
						+		47	120	21		2	15	12	
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SAMPLE SUBMISSION INFORMATION	SHIPPING IN	FORMATION	F	REPORTING / INV	OICING			1	RECEIV	ING INFO			RATORYUS	E ONLY)	
Sampled by: Submitted by:	Courier (Client account)	X	invoice	t by Fax			ed By (prir		Subj	nsk	h 1	gnature:		K)	
Print: Emmanuel Kayode Emmanuel Kayode	Courier (Caduceon account) Drop Off			t by Email	X			y-mm-dd): red Bottles	21/1	0/(16"	ne Receiv	ed:	2:05	nos
21-10-05 21-10-05	Caduceon (Pick-up)	# (e by Email			e Tempera		4.	Yes	Labeled	No hv:		1	
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	3 - pet	2t, 2R	, 2M,	2Hg, 1	UP,	Bac	CF .							9562	26
	3 - pet	R,M,	NP, H	9, Bac	+			100	100			Coff	C. May 2020 F		_0



Quote #: YD21_lqaluit_F

Organization:

City of Iqaluit

Contact: Telephone: Mike Hatfield 867-979-6363

Facsimile:

Email: M.Hatfield@city.lgaluit.nu.ca Proiect #: **TEST F - Sewage Lagoon** Address: Box 460, Igaluit NU, X0A 0H0

Additional Info:

QUOTE # ('S) MUST BE ON C OF C TO APPLY if not listed, General pricing will be applied.

Additional Info: Replacing Quote YD19_lqaluit_F

27-May-21 Valid Until: 31-Dec-21 Date:

ltem #	Quantity	Analysis Request	Matrix	Unit Cost, \$	Amount,
1	1	BOD	ww_	31.50	31.50
2	1	Total Coliform / Fecal Coliform	ww	32.50	32.50
3	1	Ammonia, NO2/NO3	ww	31.50	31.50
4	1	Total Phosphorus	ww	18.25	18.25
5	1	Orthophosphate	WW	18.25	18.25
6	1	Conductivity	ww	10.00	10.00
7	1	TSS	ww	18.25	18.25
8	1	pH	ww	9.50	9.50
9	1	TOTAL METALS ICPOES AI, Ba, Be, Cr, Co, Cu, Fe, Li, Mn, Mo, Ni, Sn, Sr, Ti, V, Zn ICPMS Sb, As, Cd, Pb, Se, Ag, TI, U CVAAS Ha	ww	96.00	96.00
10	1	Ottawa Airport Pick Up	· · · · · ·	25.00	25.00
not include shippi	ng unless otherwise state	d.		Subtotal	290.75
nmental Surch	narge of \$2 per sar	nple set		HST	37.80
	= •			T-4-104	200 55

Total Cost 328.55

Kristine Cavanagh

Customer Service Representative

Caduceon Environmental Laboratories

kcavanagh@caduceonlabs.com



Final Report

C.O.C.: G095626 **REPORT No. B21-32543**

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 06-Oct-21

DATE REPORTED: 14-Oct-21

SAMPLE MATRIX: Waste Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test F

P.O. NUMBER:

WATERWORKS NO.

			Client I.D.		WWTP Effluent		
			Sample I.D.		B21-32543-1		
			Date Collecte	ed	05-Oct-21		
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
BOD(5 day)	mg/L	3	SM 5210B	08-Oct-21/K	71		
Total Suspended Solids	mg/L	3	SM2540D	08-Oct-21/K	106		
Conductivity @25°C	µmho/cm	1	SM 2510B	07-Oct-21/O	478		
pH @25°C	pH Units		SM 4500H	07-Oct-21/O	7.54		
Nitrite (N)	mg/L	0.1	SM4110C	12-Oct-21/O	< 0.1		
Nitrate (N)	mg/L	0.1	SM4110C	12-Oct-21/O	< 0.1		
Ammonia (N)-Total	mg/L	0.01	SM4500- NH3-H	08-Oct-21/K	34.3		
o-Phosphate (P)	mg/L	0.002	PE4500-S	08-Oct-21/K	2.56		
Phosphorus-Total	mg/L	0.01	E3199A.1	13-Oct-21/K	4.77		
Aluminum	mg/L	0.01	SM 3120	13-Oct-21/O	0.15		
Antimony	mg/L	0.0005	EPA 200.8	12-Oct-21/O	0.0005		
Arsenic	mg/L	0.0005	EPA 200.8	12-Oct-21/O	< 0.0005		
Barium	mg/L	0.001	SM 3120	13-Oct-21/O	0.010		
Beryllium	mg/L	0.002	SM 3120	13-Oct-21/O	< 0.002		
Cadmium	mg/L	0.000070	EPA 200.8	12-Oct-21/O	0.000098		
Chromium	mg/L	0.002	SM 3120	13-Oct-21/O	< 0.002		
Cobalt	mg/L	0.005	SM 3120	13-Oct-21/O	< 0.005		
Copper	mg/L	0.002	SM 3120	13-Oct-21/O	0.162		
Iron	mg/L	0.005	SM 3120	13-Oct-21/O	0.452		
Lead	mg/L	0.0001	EPA 200.8	12-Oct-21/O	0.0010		
Lithium	mg/L	0.01	SM 3120	13-Oct-21/O	< 0.01		
Manganese	mg/L	0.001	SM 3120	13-Oct-21/O	0.124		
Mercury	mg/L	0.00002	SM 3112 B	08-Oct-21/O	0.00005		
Molybdenum	mg/L	0.01	SM 3120	13-Oct-21/O	< 0.01		
Nickel	mg/L	0.01	SM 3120	13-Oct-21/O	< 0.01		
Selenium	mg/L	0.005	EPA 200.8	12-Oct-21/O	< 0.005		

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Final Report

C.O.C.: G095626 REPORT No. B21-32543

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 06-Oct-21 DATE REPORTED: 14-Oct-21

SAMPLE MATRIX: Waste Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test F

P.O. NUMBER:

WATERWORKS NO.

			Client I.D.		WWTP Effluent		
			Sample I.D.		B21-32543-1		
			Date Collect	ed	05-Oct-21		
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
Silver	mg/L	0.0001	EPA 200.8	12-Oct-21/O	0.0001		
Strontium	mg/L	0.001	SM 3120	13-Oct-21/O	0.042		
Thallium	mg/L	0.0003	EPA 200.8	12-Oct-21/O	< 0.0003		
Tin	mg/L	0.05	SM 3120	13-Oct-21/O	< 0.05		
Titanium	mg/L	0.005	SM 3120	13-Oct-21/O	< 0.005		
Uranium	mg/L	0.0003	EPA 200.8	12-Oct-21/O	< 0.0003		
Vanadium	mg/L	0.005	SM 3120	13-Oct-21/O	< 0.005		
Zinc	mg/L	0.005	SM 3120	13-Oct-21/O	0.103		
Total Coliform	cfu/100mL	1	MOE E3371	06-Oct-21/O	36000000		
Fecal Coliform	cfu/100mL	1	MOE E3371	06-Oct-21/O	2600000		

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

GENERAL SAMPLE SUBMISSION FO	RM SAMPLES SUBN	NITTED TO:			TESTING R	EQUIRE	MENTS			0	RE	29	EP Js	e)
C A D U C E ENVIRONMENTAL LABORATORIES Client committed. Quality assured. Proudly Canadian.	Kingst Ottav Richmond F Barr Lond Winds	wa Hill rie on		O'Reg 153/04 O'Reg 406/19 RPI Coarse MISA Other:		Table (1 - Table (1 - ICC Medium/F PWQO	9.1)	Record of SPLP Table Agricultura O'Reg 558 Landfill Mo	Site (1 - 9.1) I ICLP nitoring	Ba	21-	35	5620	0
Are any samples to be submitted intende	ed for Human Consumption unde	r any Drinking	Water Regulation	is?	Yes	No		(If yes, submi	all Drinking V	Vater Sam	ples on a D	rinking Wate	r Chain of Cus	stody)
Organization: City of Igaluit	Address: Box 460	Invoicing	g Address (if different):		1	ANALYS	ES REQUEST	ED				OUND SERVICE O (see back pa	
Contact: Emmanuel Kanade	Igaluit				angle		T			ninated			anged in adva	
City of Igaluit Contact: Emmanuel Kayode Tel: Fax: Fax:	Nu, XOAOH									Contar		Gold* Silver	100%	Surcharge urcharge
Email: e. Kayode@lgaluit. ca	Quote #:	Project N	lame/#:		25					d Highly		Bronze	25% S	urcharge
Additional Info (email, cell, etc):	P.O.#: 460	Addition	al Info:	40	史					Suspected Highly Contaminate		Standard Specific Da	5-7 day te:	/s
* Sample	Matrix Legend: WW=Waste Water, SW=	1974 C	V=Groundwater, LS=	Liquid Sludge, SS	=Solid Sludge,			ent, PC=Paint Ch	ps, F=Filter, C		FI	eld	# Bottles/	Field Filtered
No. Sample Source and/or Sample Identification	S.P.L.	Sample Matrix *	(yy-mm-dd)	Collected				ark In The Box Pr	ovided	Х	pH	Temp.	Sample	Y/N
10A02 Lagson Efflu	ent	WW	21-10-28			Te.	st	下					6	
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SAMPLE SUBMISSION INFORMATION	SHIPPI	NG INFORMATIO	DN	REPORTING	3 / INVOICING			SAMPLE	RECEIVING II	NFORMAT	ION (LABO	RATORY US	E ONLY)	
Sampled by: Submitted b	Courier (Client account)	\geq	Invoice	Report by Fax			eived By		20	a	Signature:		73	
Print: Emmanuel Emmanuel	<u> </u>	t)		Report by Email	\geq			d (yy-mm-dd):	29/1	UZI	Time Recei	ved:	10:4	0
Sign:	Drop Off		# of Pieces	Invoice by Email		Labo	oratory P	repared Bottles	7 4	'es	No		1	
2/-/0-25 2/-/0- Date (yy-mm-dd)/Time: Date (yy-mm-dd)	Caduceon (Pick-up)			Invoice by Mail		100		perature °C:	10,2	Label			41	
Comments:					IRtIF	EH	1001	PEIMT	149+	160	ct	Page	of	
												G ()	9563	30



Quote #:

YD21_lqaluit_F

Organization:

City of Iqaluit Mike Hatfield

Contact: Telephone:

867-979-6363

Facsimile:

Email:

M.Hatfield@city.lgaluit.nu.ca TEST F - Sewage Lagoon

Project #: Address:

Box 460, Igaluit NU, X0A 0H0

Additional Info:

QUOTE # ('S) MUST BE ON C OF C TO APPLY if not listed, General pricing will be applied.

Additional Info:

Replacing Quote YD19_Iqaluit_F

Date:

27-May-21

Valid Until:

31-Dec-21

Item #	Quantity	Analysis Request	Matrix	Unit Cost, \$	Amount, \$
1	1	BOD	WW	31.50	31.50
2	1	Total Coliform / Fecal Coliform	WW	32.50	32.50
3	1	Ammonia, NO2/NO3	WW	31.50	31.50
4	1	Total Phosphorus	WW	18.25	18.25
5	1	Orthophosphate	WW	18.25	18.25
6	1	Conductivity	WW	10.00	10.00
7	1	TSS	WW	18.25	18.25
8	1	pH .	WW	9.50	9.50
9	1	TOTAL METALS ICPOES AI, Ba, Be, Cr, Co, Cu, Fe, Li, Mn, Mo, Ni, Sn, Sr, Ti, V, Zn ICPMS Sb, As, Cd, Pb, Se, Ag, Tl, U CVAAS Ha	ww	96.00	96.00
10	1	Ottawa Airport Pick Up		25.00	25.00
not include shippir	ng unless otherwise state			Subtotal	290.75
nmental Surch	parge of \$2 per san	nnle set		HST	37.80

25.00	25.00
Subtotal	290.75
HST	37.80
Total Cost	328.55

Kristine Cavanagh

Customer Service Representative

Caduceon Environmental Laboratories

kcavanagh@caduceonlabs.com



Final Report

C.O.C.: G065630 **REPORT No. B21-35620**

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 29-Oct-21

DATE REPORTED: 19-Nov-21

SAMPLE MATRIX: Waste Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1

Tel: 613-526-0123 Fax: 613-526-1244

JOB/PROJECT NO.: Test F

P.O. NUMBER:

WATERWORKS NO.

			Client I.D.		1QA02 Lagoon Effluent		
			Sample I.D.		B21-35620-1		
			Date Collecte	ed	28-Oct-21		
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
BOD(5 day)	mg/L	3	SM 5210B	30-Oct-21/K	18		
Total Suspended Solids	mg/L	3	SM2540D	02-Nov-21/K	118		
Conductivity @25°C	µmho/cm	1	SM 2510B	15-Nov-21/O	565		
pH @25°C	pH Units		SM 4500H	15-Nov-21/O	7.51		
Nitrite (N)	mg/L	0.1	SM4110C	08-Nov-21/O	< 0.1		
Nitrate (N)	mg/L	0.1	SM4110C	08-Nov-21/O	< 0.1		
Ammonia (N)-Total	mg/L	0.01	SM4500- NH3-H	03-Nov-21/K	16.0		
o-Phosphate (P)	mg/L	0.002	PE4500-S	03-Nov-21/K	2.18		
Phosphorus-Total	mg/L	0.01	E3199A.1	04-Nov-21/K	5.42		
Aluminum	mg/L	0.01	SM 3120	05-Nov-21/O	0.10		
Antimony	mg/L	0.0005	EPA 200.8	02-Nov-21/O	< 0.0005		
Arsenic	mg/L	0.0005	EPA 200.8	02-Nov-21/O	0.0007		
Barium	mg/L	0.001	SM 3120	05-Nov-21/O	0.009		
Beryllium	mg/L	0.002	SM 3120	05-Nov-21/O	< 0.002		
Cadmium	mg/L	0.000070	EPA 200.8	02-Nov-21/O	< 0.000070		
Chromium	mg/L	0.002	SM 3120	05-Nov-21/O	< 0.002		
Cobalt	mg/L	0.005	SM 3120	05-Nov-21/O	< 0.005		
Copper	mg/L	0.002	SM 3120	05-Nov-21/O	0.036		
Iron	mg/L	0.005	SM 3120	05-Nov-21/O	3.64		
Lead	mg/L	0.0001	EPA 200.8	02-Nov-21/O	0.0005		
Lithium	mg/L	0.01	SM 3120	05-Nov-21/O	0.01		
Manganese	mg/L	0.001	SM 3120	05-Nov-21/O	0.280		
Mercury	mg/L	0.00002	SM 3112 B	01-Nov-21/O	< 0.00002		
Molybdenum	mg/L	0.01	SM 3120	05-Nov-21/O	< 0.01		
Nickel	mg/L	0.01	SM 3120	05-Nov-21/O	< 0.01		

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Caduceon Environmental Laboratories

Final Report

C.O.C.: G065630 REPORT No. B21-35620

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 29-Oct-21

DATE REPORTED: 19-Nov-21 SAMPLE MATRIX: Waste Water

) anuel Kavode

JOB/PROJECT NO.: Test F

Ottawa Ontario K1V 7P1

P.O. NUMBER:

2378 Holly Lane

Tel: 613-526-0123

Fax: 613-526-1244

WATERWORKS NO.

			Client I.D. Sample I.D.		1QA02 Lagoon Effluent B21-35620-1		
			Date Collect	ed	28-Oct-21		
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
Selenium	mg/L	0.005	EPA 200.8	02-Nov-21/O	< 0.005		
Silver	mg/L	0.0001	EPA 200.8	02-Nov-21/O	< 0.0001		
Strontium	mg/L	0.001	SM 3120	05-Nov-21/O	0.100		
Thallium	mg/L	0.0003	EPA 200.8	02-Nov-21/O	< 0.0003		
Tin	mg/L	0.05	SM 3120	05-Nov-21/O	< 0.05		
Titanium	mg/L	0.005	SM 3120	05-Nov-21/O	< 0.005		
Uranium	mg/L	0.0003	EPA 200.8	02-Nov-21/O	< 0.0003		
Vanadium	mg/L	0.005	SM 3120	05-Nov-21/O	< 0.005		
Zinc	mg/L	0.005	SM 3120	05-Nov-21/O	0.035		
Total Coliform	cfu/100mL	1	MOE E3371	29-Oct-21/O	2000000		
Fecal Coliform	cfu/100mL	1	MOE E3371	29-Oct-21/O	60000		

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

	GENERAL SAMPLE SUBMISSION FOR	VI SAMPLES	SUBMITTED TO:			TESTING REC	QUIREMENTS		N.	八重	PORTNUM	BER (Kab Us	e)
1	CADUCE #FALL		Kingston Ottawa		O'Reg 153/04 O'Reg 406/19		able (1 - 9) able (1 - 9.1)	Record of Site SPLP Table (1 - 9.1)				
	CADUCE	Richr	mond Hill Barrie		RPI Coarse		CC	Agricultural O'Reg 558 TCLP				_0	A house
	Client committed. Quality assured. Proudly Canadian.		London		MISA		WQO	Landfill Monitoring	12	21	3	598	55
			Windsor		Other:					-			
Organiza	Are any samples to be submitted intended to	Address:	Invoicing	Water Regulation Address (if different		Yes		(If yes, submit all Dri	nking Water Sa	mples on a D		er Chain of Cus	
Contact	City of Igaluit	Box 4	60	,			ANALYSE	S REQUESTED	1 13			D (see back pa anged in adva	
)	Emmanuel Kayode	Igalust	1900			quore			taminat		Platinum*	200%	Surcharge
	672224612	XOA OHO							hly Con		Gold* Silver	50% S	Surcharge urcharge
Email:	e-kayode@lgalut. a	Quote #:	Project N	lame/#:	t F	3			ted Higl	X	Bronze Standard	25% S 5-7 day	urcharge /s
Addition	nal Info (email, cell, etc):	P.O.#:	Addition			Z			Suspected Highly Contaminate		Specific Da	te:	
Lab	* Sample Ma	trix Legend: WW=Waste Wate		V=Groundwater, LS= Date Collected	Liquid Sludge, SS	=Solid Sludge, S=	Soil, Sed=Sedimen			F	eld	# Bottles/	Field Filtered
VICTOR VICTOR	Sample Source and/or Sample Identification		P.L. Sample Matrix *	(yy-mm-dd)	Collected	Ву		k In The Box Provided	Х	рН	Temp.	Sample	Y/N
	WWTP Influent	iant	WW	21-11-0			Test	F	7	7:19		6	
,	WWTP Influent		~	~						6.78		6	
	WWTP Effluent		_	~	1.40 pm					6.30		6	
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			1										
			. 1										į,
	445												1
				171									
	SAMPLE SUBMISSION INFORMATION		SHIPPING INFORMATIO	DN I		3 / INVOICING		SAMPLE RECEI				E ONLY)	
	Sampled by: Submitted by:	Courier (Client acco	ount)	Invoice	Report by Fax		Received By (p	101	111	Signature:		4:-3	100
Print:	Emminuel Emminuel	Courier (Caduceon	account)		Report by Email		Date Received	01	4-02	Time Rece	ved: 9	1:53	
Sign:	REST.	Drop Off		# of Pieces	Invoice by Email		Laboratory Pre	pared Bottles:	Yes	No	0		
	Date (yy-mm-dd)/Time: Date (yy-mm-dd)/Time	Caduceon (Pick-up)			Invoice by Mail	لظر	Sample Tempe		. /	eled by:	20		
Comme	ents:				3x 1	PELR	R. NP. M	Hy , Bac +	()		Page	of	
					311		,	J Jack			G ()	9563	32



Quote #:

YD21_lqaluit_F

Organization:

City of Iqaluit Mike Hatfield

Contact: Telephone:

867-979-6363

Facsimile:

Email: M.Hatfield@city.lgaluit.nu.ca

Project #: Address:

TEST F - Sewage Lagoon Box 460, Igaluit NU, X0A 0H0

Additional Info:

QUOTE # ('S) MUST BE ON C OF C TO APPLY if not listed, General pricing will be applied.

Additional Info:

Replacing Quote YD19_lqaluit_F

Date:

27-May-21

Valid Until:

31-Dec-21

Item #	Quantity	Analysis Request	Matrix	Unit Cost, \$	Amount, \$
1	1	BOD	WW	31.50	31.50
2	1	Total Coliform / Fecal Coliform	WW	32.50	32.50
3	1	Ammonia, NO2/NO3	WW	31.50	31.50
4	1	Total Phosphorus	WW	18.25	18.25
5	1	Orthophosphate	WW	18.25	18.25
6	1	Conductivity	WW	10.00	10.00
7	1	TSS	WW	18.25	18.25
8	1	pH	WW	9.50	9.50
9	1	TOTAL METALS ICPOES AI, Ba, Be, Cr, Co, Cu, Fe, Li, Mn, Mo, Ni, Sn, Sr, Ti, V, Zn ICPMS Sb, As, Cd, Pb, Se, Ag, Tl, U CVAAS Hg	ww	96.00	96.00
10	1	Ottawa Airport Pick Up		25.00	25.00
do not include shipping	ng unless otherwise state	d.		Subtotal	290.75

Environmental Surcharge of \$2 per sample set

HST 37.80 **Total Cost** 328.55

Kristine Cavanagh

Customer Service Representative

Caduceon Environmental Laboratories

kcavanagh@caduceonlabs.com



Final Report

C.O.C.: G095632 REPORT No. B21-35985

Report To:

City of Iqaluit

PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 02-Nov-21

DATE REPORTED: 25-Nov-21

SAMPLE MATRIX: Waste Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1

Tel: 613-526-0123 Fax: 613-526-1244

JOB/PROJECT NO.: Test F

P.O. NUMBER:

WATERWORKS NO.

			Client I.D.		IQA02 Middle of Decant	WWTP Influent	WWTP Effluent	
			Sample I.D.		B21-35985-1	B21-35985-2	B21-35985-3	
			Date Collecte	ed	01-Nov-21	01-Nov-21	01-Nov-21	
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
BOD(5 day)	mg/L	3	SM 5210B	04-Nov-21/K	18	268	415	
Total Suspended Solids	mg/L	3	SM2540D	03-Nov-21/K	76	215	38	
Conductivity @25°C	µmho/cm	1	SM 2510B	17-Nov-21/O	469	503	913	
pH @25°C	pH Units		SM 4500H	17-Nov-21/O	7.62	6.78	6.98	
Nitrite (N)	mg/L	0.1	SM4110C	10-Nov-21/O	< 0.1	< 0.1	< 0.1	
Nitrate (N)	mg/L	0.1	SM4110C	10-Nov-21/O	< 0.1	< 0.1	< 0.1	
Ammonia (N)-Total	mg/L	0.01	SM4500- NH3-H	05-Nov-21/K	17.2	4.02	2.66	
o-Phosphate (P)	mg/L	0.002	PE4500-S	05-Nov-21/K	2.00	0.456	20.3	
Phosphorus-Total	mg/L	0.01	E3199A.1	05-Nov-21/K	3.68	6.01	23.4	
Aluminum	mg/L	0.01	SM 3120	05-Nov-21/O	0.06	0.32	0.07	
Antimony	mg/L	0.0005	EPA 200.8	12-Nov-21/O	< 0.0005	0.0005	< 0.0005	
Arsenic	mg/L	0.0005	EPA 200.8	12-Nov-21/O	0.0008	0.0006	0.0012	
Barium	mg/L	0.001	SM 3120	05-Nov-21/O	0.004	0.016	0.014	
Beryllium	mg/L	0.002	SM 3120	05-Nov-21/O	< 0.002	< 0.002	< 0.002	
Cadmium	mg/L).000070	EPA 200.8	12-Nov-21/O	< 0.000070	0.000099	< 0.000070	
Chromium	mg/L	0.002	SM 3120	05-Nov-21/O	< 0.002	0.002	< 0.002	
Cobalt	mg/L	0.005	SM 3120	05-Nov-21/O	< 0.005	< 0.005	< 0.005	
Copper	mg/L	0.002	SM 3120	05-Nov-21/O	0.069	0.312	0.091	
Iron	mg/L	0.005	SM 3120	05-Nov-21/O	1.30	1.23	1.99	
Lead	mg/L	0.0001	EPA 200.8	12-Nov-21/O	8000.0	0.0029	0.0007	
Lithium	mg/L	0.01	SM 3120	05-Nov-21/O	0.01	< 0.01	< 0.01	
Manganese	mg/L	0.001	SM 3120	05-Nov-21/O	0.204	0.105	0.195	
Mercury	mg/L	0.00002	SM 3112 B	05-Nov-21/O	< 0.00002	0.00008	< 0.00002	
Molybdenum	mg/L	0.01	SM 3120	05-Nov-21/O	< 0.01	< 0.01	< 0.01	
Nickel	mg/L	0.01	SM 3120	05-Nov-21/O	< 0.01	< 0.01	< 0.01	

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Final Report

C.O.C.: G095632 REPORT No. B21-35985

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 02-Nov-21

DATE REPORTED: 25-Nov-21

SAMPLE MATRIX: Waste Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test F

P.O. NUMBER:

WATERWORKS NO.

			Client I.D.		IQA02 Middle of Decant	WWTP Influent	WWTP Effluent	l
			Sample I.D.		B21-35985-1	B21-35985-2	B21-35985-3	1
			Date Collect	ed	01-Nov-21	01-Nov-21	01-Nov-21	1
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Selenium	mg/L	0.005	EPA 200.8	12-Nov-21/O	< 0.005	< 0.005	< 0.005	
Silver	mg/L	0.0001	EPA 200.8	12-Nov-21/O	< 0.0001	0.0002	< 0.0001	
Strontium	mg/L	0.001	SM 3120	05-Nov-21/O	0.081	0.038	0.061	
Thallium	mg/L	0.0003	EPA 200.8	12-Nov-21/O	< 0.0003	< 0.0003	< 0.0003	
Tin	mg/L	0.05	SM 3120	05-Nov-21/O	< 0.05	< 0.05	< 0.05	
Titanium	mg/L	0.005	SM 3120	05-Nov-21/O	< 0.005	0.006	< 0.005	
Uranium	mg/L	0.0003	EPA 200.8	15-Nov-21/O	< 0.0003	< 0.0003	< 0.0003	
Vanadium	mg/L	0.005	SM 3120	05-Nov-21/O	< 0.005	< 0.005	< 0.005	
Zinc	mg/L	0.005	SM 3120	05-Nov-21/O	0.034	0.190	0.027	
Total Coliform	cfu/100mL	1	MOE E3371	02-Nov-21/O	920000	87000000	540000	-
Fecal Coliform	cfu/100mL	1	MOE E3371	02-Nov-21/O	830000	16000000	39000	

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

GENERAL SAMPLE SUBMISSION FORM SAMPLES SUBMITTED TO: TESTING REQUIREMENTS Record of Site Table (1 - 9) Table (1 - 9) Table (1 - 9.1) Table (1 - 9.1) Table (1 - 9.1) Table (1 - 9.1) Agricultural Richmond Hill RPI ICC Gorse Gorder committed. Quality assured. Proudly Canadian. Are any samples to be submitted intended for Human Consumption under any Drinking Water Regulations? Organization: City of Igaluit Address: Box 460 Igaluit Nul, XOAOHO Read 48619 Record of Site Table (1 - 9.1) Table (1 - 9.1) Table (1 - 9.1) Table (1 - 9.1) Agricultural Agricultural Agricultural Record of Site Table (1 - 9.1) Table (1 - 9.1) Table (1 - 9.1) Table (1 - 9.1) Table (1 - 9.1) Table (1 - 9.1) Agricultural Agricultural Richmond Hill RPI ICC Corase Medium/Fine PWQO Landfill Monitoring TURNAROUND SERVICE REQUESTED REQUESTED (see back page) TURNAROUND SERVICE REQUESTED (see back page) Following Address (if different): Tel: 867-222-461 Fax: Nul, XOAOHO Quote #: Project Name/#: Project Name/#: Silver 50% Surcharge Siandard 5-7 days Specific Date: Speci
Are any samples to be submitted intended for Human Consumption under any Drinking Water Regulations? Organization: City of Igaluit Contact: Co
Contact: Emmanuel Kayode Tel: 867-222-461 Fax: Email: e Kayode@ Igaluit 'Ca Additional Info (email, cell, etc): ANALYSES REQUESTED REQUESTED (see back page) *Must be arranged in advance Platinum* 200% Surcharge Gold* 100% Surcharge Silver 50% Surcharge Standard 5-7 days Specific Date:
Contact: tmmanuel Kayode Igalust Must be arranged in advance Platinum* 200% Surcharge Gold* 100% Surcharge Gold* 100% Surcharge Silver 50% Surcharge Silver 50% Surcharge Silver 50% Surcharge Silver 50% Surcharge Standard 5-7 days Specific Date: Specific
Email: Capable Capabl
Email: C Kayode ligaluit Ca Additional Info (email, cell, etc): Project Name/#: Project Name/#: Standard 5-7 days Specific Date: Specific Date:
* Sample Matrix Legend: WW=Waste Water, SW=Surface Water, GW=Groundwater, LS=Liquid Sludge, SS=Solid Sludge, S=Soil, Sed=Sediment, PC=Paint Chips, F=Filter, Oil = Oil
Lab Sample Date Collected Time Indicate Test For Each Sample X Field #Bottles/ Field Filt Fild Filt F
(3) WTP Raw (2) - Raw Total 21-11-02 3.25pm Test A 5.78 7.2 10 (3) WTP Potable (4) - WTP-Total. DW 21-11-02 5.70 8.1 10
(3) WTP Potable (4) - WTP-Total. DW 21-11-02 5.70 8.1 10
27-17-02
SAMPLE SUBMISSION INFORMATION SHIPPING INFORMATION REPORTING / INVOICING SAMPLE RECEIVING INFORMATION (LABORATORY USE ONLY)
Courier (Client account) Report by Fax Received By (print): 7
Sampled by: Submitted by: Print: Emmanuel Emmanuel Courier (Caduceon account) Report by Email Date Received (yy-mm-dd): 21-11-63 Time Received: 1129
Sign: Hotalic Laboratory Prepared Bottles: Yes No
21-11-02 Caduceon (Pick-up) Invoice by Mail Sample Temperature °C: Labeled by:
Date (yy-mm-dd)/Time: Date (yy-mm-dd)/Time:
Comments: 2x (ZPE+, ZR, ZM, NP, ZHg, Bact) Page of G 095633



Quote #:

YD21_Iqaluit A

Organization:

City of Iqaluit Mike Hatfield

Contact: Telephone:

867-979-6363

Facsimile:

Email:

M.Hatfield@city.lqaluit.nu.ca **TEST A - Drinking Water**

Project #: Address:

Box 460, Igaluit NU, X0A 0H0

Additional Info:

QUOTE # ('S) MUST BE ON C OF C TO APPLY if not listed, General pricing will be applied.

Additional Info:

Replacing Quote YD20 Igaluit A

Date:

27-May-21

Valid Until:

31-Dec-21

Item #	Quantity	Analysis Request	Matrix	Unit Cost, \$	Amount, \$
1	1	Acidity (Subcontracted)	DW	35.15	35.15
2	1	Alkalinity	DW	15.00	15.00
3	1	Bicarbonate/ Carbonate	DW	18.25	18.25
4	1	Chloride/Sulphate	DW	25.00	25.00
5	1	Conductivity	DW	10.00	10.00
6	1	Hydroxide	DW	15.25	15.25
7	1	Redox Potential	DW	16.50	16.50
8	1	TDS	DW	18.25	18.25
9	1	TSS	DW	18.25	18.25
10	1	TOC	DW	25.00	25.00
11	1	TIC	DW	25.00	25.00
12	1	TOTAL METALS ICPOES AI, Ba, Be, Cr, Co, Cu, Fe, Li, Mn, Mo, Ni, Sn, Sr, Ti, V, Zn + Hardness ICPMS Sb, As, Cd, Pb, Se, Ag, TI, U CVAAS Hg	DW	96.00	96.00
13	1	DISSOLVED METALS ICPOES AI, Ba, Be, Cr, Co, Cu, Fe, Li, Mn, Mo, Ni, Sn, Sr, Ti, V, Zn + Hardness ICPMS Sb, As, Cd, Pb, Se, Ag, TI, U CVAAS Hg	DW	96.00	96.00
14	1	Fecal Coliforms	DW	17.00	17.00
15	1	pH	DW	9.50	9.50
16	1	Turbidity	DW	15.25	15.25
17	1	Ottawa Airport Pick Up		25.00	25.00
es do not include shippir	ng unless otherwise state			Subtotal	480.40

Environmental Surcharge of \$2 per sample set

HST 62.45 **Total Cost** 542.85

Kristine Cavanagh

Customer Service Representative

Caduceon Environmental Laboratories

kcavanagh@caduceonlabs.com



GENERAL CHAIN OF CUSTODY FORM

Page	of
raye	UI .

Please use our Drinking Water Chain of Custody Fe	Form for regulated drinking water samples
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REPORT	то:	Cadu	ceon Environmental L	aboratorios	INV Client:		E TO							ort)	1					OJECT IN Quote #:	IFORMAT	TION:
Address:		Cauu	2378 Holly Lane		Addre	ss:	285 D	alto	n Ave	nue									Clie	nt P.O. #: P	211103	тм
			Ottawa ON, K1V 7	7P1	1		Kingst	ton (ON										7	nt Project #:		
Contact:			Greg Clarkin		1	-	K7K 6	Z1														
Email:	gclarl	cin@caduce	onlabs.com tyapi	ci@caduceonlabs.com	Email:	_	mmc	ccor	mick	(@ca	duce	onla	bs.co	<u>m</u>					1			
Phone: 6	513-526-012	3	Fax: 613-526	-1244	Phone	e: -	61354	1420	001			Fax:	6	1354	42770				1			
REPORTIN	G/INVOICE	NG FORMAT	TURN AR	OUND TIME (TAT)*							ANAL	YSIS	REQ	UES	TED			۷.		LABORA	TORY US	SE ONLY
\$1. max	☑Email	□Mail	☐1 Business Day	√ □2 Business Days	CONTAINERS											Ţ	ole)	J. G.	n.	Wo	rk Order	NUMBER:
-	DATA REPO		☐3 Business Day	s Standard	TAIN											able)	applicable)	FILTERED	RECEIVED			
□Yes		□No			NOU			-								plic	арр	巨口	REC			
	MPLE DISP		SPECIFIC DATE: * Prior arrange	ements must be made for	OF (if ag	P (if	FIELD	ERS			
	Dispose		rush/we	eekend/holiday work		it) Hd	TEMP	LS F	AINE			
DATE	TIME	MATRIX**		E DESCRIPTION Appear On The Report)	NUMBER	Acidity				1						FIELD pH (if applicable)	FIELD	METALS (Y/N?)	CONTAINERS	ТЕМР	Btl. Type	Lab ID
(mm-dd-yy) 11/02/21	TINE	DW		321-36316-1	-	X	-	+	+	+				\dashv		E	<u> </u>	2		I EMP	Du. Type	Labib
11/03/21		DW		321-36316-3		X	-	+	+	+	1			+	-	+	-					
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		tions Expect					1	ATIC			□Coa	irse	Soil		Fine S			urface		Subsurf	ace	g. 10 a.c.a.
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Final Report

C.O.C.: G09633 REPORT No. B21-36316

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 03-Nov-21

DATE REPORTED: 02-Dec-21
SAMPLE MATRIX: Drinking Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123 Fax: 613-526-1244

JOB/PROJECT NO.: Test A (WTP)

P.O. NUMBER: WATERWORKS NO.

			Client I.D.		Test A- Raw WTP	Test A- Raw WTP (Total)	Test A- Potable WTP	Test A- Potable (Total)
	Sample I.D.				B21-36316-1	B21-36316-2	B21-36316-3	B21-36316-4
			Date Collecte	ed	02-Nov-21	02-Nov-21	02-Nov-21	02-Nov-21
Parameter	Units	R.L.	Reference Date/Site Method Analyzed					
Hardness (as CaCO3)	mg/L	1	SM 3120	05-Nov-21/O	16		16	
Hardness (as CaCO3)	mg/L	1	SM 3120	09-Nov-21/O		16		16
Alkalinity(CaCO3) to pH4.5	mg/L	5	SM 2320B	19-Nov-21/O	14		12	
Bicarbonate(as CaCO3)	mg/L	5	SM 2320B	19-Nov-21/O	14		12	
Carbonate (as CaCO3)	mg/L	5	SM 2320B	19-Nov-21/O	< 5		< 5	
Hydroxide	mg/L	5	EPA 310.2	19-Nov-21/O	< 5		< 5	
Acidity (as CaCO3)	mg/L	5	Subcontract	04-Nov-21	< 5 1		< 5 1	
pH @25°C	pH Units		SM 4500H	19-Nov-21/O	6.22		5.99	
Conductivity @25°C	µmho/cm	1	SM 2510B	19-Nov-21/O	34		36	
TDS(ion sum calc.)	mg/L	1	Calc.	21-Nov-21/O	19		19	
Total Suspended Solids	mg/L	3	SM2540D	05-Nov-21/K	< 3		< 3	
Turbidity	NTU	0.1	SM 2130	04-Nov-21/O	0.4		0.3	
REDOX potential	mV		In-House	05-Nov-21/R	390		693	
Chloride	mg/L	0.5	SM4110C	05-Nov-21/O	1.4		3.0	
Sulphate	mg/L	1	SM4110C	05-Nov-21/O	2		2	
Aluminum	mg/L	0.01	SM 3120	05-Nov-21/O	< 0.01		< 0.01	
Aluminum	mg/L	0.01	SM 3120	09-Nov-21/O		< 0.01		< 0.01
Antimony	mg/L	0.0001	EPA 200.8	11-Nov-21/O	< 0.0001		< 0.0001	
Antimony	mg/L	0.0001	EPA 200.8	19-Nov-21/O		< 0.0001		< 0.0001
Arsenic	mg/L	0.0001	EPA 200.8	11-Nov-21/O	< 0.0001		< 0.0001	
Arsenic	mg/L	0.0001	EPA 200.8	19-Nov-21/O		< 0.0001		< 0.0001
Barium	mg/L	0.001	SM 3120	05-Nov-21/O	0.001		0.001	
Barium	mg/L	0.001	SM 3120	09-Nov-21/O		0.002		0.001
Beryllium	mg/L	0.002	SM 3120	05-Nov-21/O	< 0.002		< 0.002	
Beryllium	mg/L	0.002	SM 3120	09-Nov-21/O		< 0.002		< 0.002
Cadmium	mg/L).000015	EPA 200.8	11-Nov-21/O	< 0.000015		< 0.000015	

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Final Report

C.O.C.: G09633 REPORT No. B21-36316

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

<u>Attention:</u> Emmanuel Kayode

DATE RECEIVED: 03-Nov-21

DATE REPORTED: 02-Dec-21
SAMPLE MATRIX: Drinking Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123 Fax: 613-526-1244

JOB/PROJECT NO.: Test A (WTP)

P.O. NUMBER: WATERWORKS NO.

			Client I.D.		Test A- Raw WTP	Test A- Raw WTP (Total)	Test A- Potable WTP	Test A- Potable (Total)
			Sample I.D.		B21-36316-1	B21-36316-2	B21-36316-3	B21-36316-4
			Date Collect	ed	02-Nov-21	02-Nov-21	02-Nov-21	02-Nov-21
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Cadmium	mg/L).000015	EPA 200.8	19-Nov-21/O		< 0.000015		< 0.000015
Chromium	mg/L	0.002	SM 3120	05-Nov-21/O	< 0.002		< 0.002	
Chromium	mg/L	0.002	SM 3120	09-Nov-21/O		< 0.002		< 0.002
Cobalt	mg/L	0.005	SM 3120	05-Nov-21/O	< 0.005		< 0.005	
Cobalt	mg/L	0.005	SM 3120	09-Nov-21/O		< 0.005		< 0.005
Copper	mg/L	0.002	SM 3120	05-Nov-21/O	0.006		0.018	
Copper	mg/L	0.002	SM 3120	09-Nov-21/O		0.006		0.018
Iron	mg/L	0.005	SM 3120	05-Nov-21/O	0.021		0.020	
Iron	mg/L	0.005	SM 3120	09-Nov-21/O		0.030		0.026
Lead	mg/L	0.00002	EPA 200.8	11-Nov-21/O	< 0.00002		0.00006	
Lead	mg/L	0.00002	EPA 200.8	19-Nov-21/O		0.00004		0.00007
Lithium	mg/L	0.01	SM 3120	05-Nov-21/O	< 0.01		< 0.01	
Lithium	mg/L	0.01	SM 3120	09-Nov-21/O		< 0.01		< 0.01
Manganese	mg/L	0.001	SM 3120	05-Nov-21/O	0.006		0.004	
Manganese	mg/L	0.001	SM 3120	09-Nov-21/O		0.006		0.004
Mercury	mg/L	0.00002	SM 3112 B	09-Nov-21/O	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Molybdenum	mg/L	0.01	SM 3120	05-Nov-21/O	< 0.01		< 0.01	
Molybdenum	mg/L	0.01	SM 3120	09-Nov-21/O		< 0.01		< 0.01
Nickel	mg/L	0.01	SM 3120	05-Nov-21/O	< 0.01		< 0.01	
Nickel	mg/L	0.01	SM 3120	09-Nov-21/O		< 0.01		< 0.01
Selenium	mg/L	0.001	EPA 200.8	11-Nov-21/O	< 0.001		< 0.001	
Selenium	mg/L	0.001	EPA 200.8	19-Nov-21/O		< 0.001		< 0.001
Silver	mg/L	0.0001	EPA 200.8	11-Nov-21/O	< 0.0001		< 0.0001	
Silver	mg/L	0.0001	EPA 200.8	19-Nov-21/O		< 0.0001		< 0.0001
Strontium	mg/L	0.001	SM 3120	05-Nov-21/O	0.013		0.012	
Strontium	mg/L	0.001	SM 3120	09-Nov-21/O		0.013		0.012

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Final Report

C.O.C.: G09633 REPORT No. B21-36316

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 03-Nov-21

DATE REPORTED: 02-Dec-21

SAMPLE MATRIX: Drinking Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1

Tel: 613-526-0123 Fax: 613-526-1244

1 dx: 010-020-1244

JOB/PROJECT NO.: Test A (WTP)

P.O. NUMBER:

WATERWORKS NO.

			Client I.D.		Test A- Raw WTP	Test A- Raw WTP (Total)	Test A- Potable WTP	Test A- Potable (Total)
			Sample I.D.		B21-36316-1	B21-36316-2	B21-36316-3	B21-36316-4
			Date Collecte	ed	02-Nov-21	02-Nov-21	02-Nov-21	02-Nov-21
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Thallium	mg/L	0.00005	EPA 200.8	11-Nov-21/O	< 0.00005		< 0.00005	
Thallium	mg/L	0.00005	EPA 200.8	19-Nov-21/O		< 0.00005		< 0.00005
Tin	mg/L	0.05	SM 3120	05-Nov-21/O	< 0.05		< 0.05	
Tin	mg/L	0.05	SM 3120	09-Nov-21/O		< 0.05		< 0.05
Titanium	mg/L	0.005	SM 3120	05-Nov-21/O	< 0.005		< 0.005	
Titanium	mg/L	0.005	SM 3120	09-Nov-21/O		< 0.005		< 0.005
Uranium	mg/L	0.00005	EPA 200.8	11-Nov-21/O	< 0.00005		< 0.00005	
Uranium	mg/L	0.00005	EPA 200.8	19-Nov-21/O		< 0.00005		< 0.00005
Vanadium	mg/L	0.005	SM 3120	05-Nov-21/O	< 0.005		< 0.005	
Vanadium	mg/L	0.005	SM 3120	09-Nov-21/O		< 0.005		< 0.005
Zinc	mg/L	0.005	SM 3120	05-Nov-21/O	< 0.005		< 0.005	
Zinc	mg/L	0.005	SM 3120	09-Nov-21/O		0.006		0.008
Total Organic Carbon	mg/L	0.2	EPA 415.2	25-Nov-21/O	1.9		2.0	
TIC	mg/L	0.5	EPA 415.1	25-Nov-21/O	8.1		9.4	
Fecal Coliform	cfu/100mL	1	MOE E3371	03-Nov-21/O	< 2		< 2	
Anion Sum	meq/L		Calc.	21-Nov-21/O	0.365		0.373	
Cation Sum	meq/L		Calc.	21-Nov-21/O	0.366		0.353	
% Difference	%		Calc.	21-Nov-21/O	0.187		2.73	
Ion Ratio	AS/CS		Calc.	21-Nov-21/O	0.996		1.06	
Sodium Adsorption Ratio	-		Calc.	21-Nov-21/O	0.0852		0.0849	
Conductivity (calc.)	µmho/cm		Calc.	21-Nov-21/O	39		39	
EC(calc.)/EC(actual)	-		Calc.	21-Nov-21/O	1.12		1.07	
TDS(calc.)/EC(actual)	-		Calc.	21-Nov-21/O	0.547		0.520	
Langelier Index(25°C)	S.I.		Calc.	21-Nov-21/O	-3.24		-3.58	

¹ Subcontracted to Testmark Labs

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

GENERAL SAMPLE SUBMISSION FORM	SAMPLES SUBMITT		EQUIREMENTS				FERSIER NUMBER (Lab Use)						
A	Kingston Ottawa			O'Reg 153/04		Table (1 - 9)	Record	of Site able (1 - 9.1)					
CADUCEZIN	Richmond Hill	7		O'Reg 406/19 RPI		Table (1 - 9.1)	Agricult						
ENVIRONMENTAL LABORATORIES	Barrie			Coarse		Medium/Fine		58 TCLP	1	101	2	68	74
Client committed. Quality assured. Proudly Canadian.	London Windsor	\vdash		MISA Other:		PWQO	Landfill	Monitoring		141	-	60.	TI
Are any samples to be submitted intended for Hum		v Drinking	Water Regulations	100000000000000000000000000000000000000	Yes	No	(If yes, sub	mit all Drink	ing Water Sar	mples on a D	rinking Wat	er Chain of Cu	stody)
			Address (if different)				ES REQUE					OUND SERVICE	
Contact:	139X 460				-	I I I	LONEQUE		ltee ltee		STATE OF THE PARTY	D (see back p	And Account Account the second
Organization: City of legituit Contact: Tel: 8672224612 Fax: Email: e- Kayode & Igaluit. Cq Quote#: Additional lofo (email cell etc): P.O.#:	ignituat Na				Cest				Contaminate		Platinum* Gold*		Surcharge Surcharge
8672224612 Fax.	XOA OHO								hly Co		Silver	50% \$	Surcharge
Email: e. Kayode @ Igaluit. Cq Quote #		Project N	lame/#:		Total				ted Hig		Bronze Standard	25% \$ 5-7 da	Surcharge ys
Additional Info (email, cell, etc): P.O. #:	460	Addition	al Info:		\mathbb{K}				Suspected Highly		Specific D	ate:	
	d: WW=Waste Water, SW=Surf	ace Water, GV	PROBABILITIES AND ADDRESS AND		Solid Sludge,		MATERIAL PROPERTY AND REPORT AND ADDRESS OF THE PARTY AND ADDRESS OF TH	CONTRACTOR CONTRACTOR				1	1
No. Sample Source and/or Sample Identification	S.P.L.	Sample Matrix *	Date Collected (yy-mm-dd)	Time Collected		Indicate Test By Using A Check M			X	pH	ield Temp.	# Bottles/ Sample	Field Filtered Y/N
10A02 End of Decant		WW	21-11-06	7 (300		Ta	st A					6	
167132 646				7.30/1									
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Jacob paragraphic	3											- 1	
	A												
	0												2
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SAMPLE SUBMISSION INFORMATION	SHIPPING	INFORMATIO	N	REPORTING	INVOICING	i	SAME	LE RECEIV	NG INFORMA	TION (LABO	RATORY	EONLY)	
Sampled by: Submitted by:	Courier (Client account)	X	Invoice	Report by Fax		Received By	(print):	Dubl	193hr	Signature:		6	
Print: Emmanyel Emmane	Courier (Caduceon account)		= 1	Report by Email	X	Date Receive	ed (yy-mm-do	1: 21/1	1109	Time Rece	ived:	10:55	oan
Sign: Hattle	Drop Off		# of Pieces	Invoice by Email		Laboratory F	repared Bott	les: 2	Yes	No		AN	
21-11 - 06 21-11 - 08 Date (vy-mm-dd)/Time: Date (vy-mm-dd)/Time:	Caduceon (Pick-up)			Invoice by Mail		Sample Tem	perature °C:	9.1	Labe	eled by:		MF	
Date (yy-mm-dd)/Time: Date (yy-mm-dd)/Time: Comments:				h.	1 0		. 1		(Page	of	
				per	かんり	NP, M	, He	, Bac	ct		G ()	9563	4



QUOTATION FOR ANALYTICAL SERVICES

Quote #:

YD21_lqaluit_F

Organization:

City of Iqaluit

Contact: Telephone:

Mike Hatfield 867-979-6363

Facsimile:

Email:

M.Hatfield@city.lgaluit.nu.ca

Project #:

TEST F - Sewage Lagoon Box 460, Iqaluit NU, X0A 0H0

Address: Additional Info:

QUOTE # ('S) MUST BE ON C OF C TO APPLY if not listed, General pricing will be applied.

Additional Info:

Replacing Quote YD19_lqaluit_F

Date:

27-May-21

Valid Until:

31-Dec-21

Item #	Quantity	Analysis Request	Matrix	Unit Cost, \$	Amount, \$
1	1	BOD	WW	31.50	31.50
2	1	Total Coliform / Fecal Coliform	ŴW	32.50	32.50
3	1	Ammonia, NO2/NO3	WW	31.50	31.50
4	1	Total Phosphorus	WW	18.25	18.25
5	1	Orthophosphate	WW	18.25	18.25
6	1	Conductivity	ŴW	10.00	10.00
7	1	TSS	WW	18.25	18.25
8	1	pH	WW	9.50	9.50
9	1	TOTAL METALS ICPOES AI, Ba, Be, Cr, Co, Cu, Fe, Li, Mn, Mo, Ni, Sn, Sr, Ti, V, Zn ICPMS Sb, As, Cd, Pb, Se, Ag, Tl, U CVAAS Hg	ww	96.00	96.00
10	1	Ottawa Airport Pick Up		25.00	25.00
es do not include shippi	ing unless otherwise stat	ed.		Subtotal	290.75

Environmental Surcharge of \$2 per sample set

25.00	25.00
Subtotal	290.75
HST	37.80
Total Cost	328.55

Kristine Cavanagh

Customer Service Representative

Caduceon Environmental Laboratories

kcavanagh@caduceonlabs.com

Cell: 819-230-9605 Office 613-526-0123



Final Report

C.O.C.: G095634 REPORT No. B21-36871

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

<u>Attention:</u> Emmanuel Kayode

DATE RECEIVED: 09-Nov-21

DATE REPORTED: 23-Nov-21

SAMPLE MATRIX: Waste Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test F

P.O. NUMBER:

WATERWORKS NO.

	Client I.D.		IQA02 End of Decant				
			Sample I.D.		B21-36871-1		
			Date Collect	ed	06-Nov-21		
			Reference	Date/Site		1	
Parameter	Units	R.L.	Method	Analyzed			
BOD(5 day)	mg/L	3	SM 5210B	10-Nov-21/K	37		
Total Suspended Solids	mg/L	3	SM2540D	10-Nov-21/K	232		
Conductivity @25°C	µmho/cm	1	SM 2510B	22-Nov-21/O	516		
pH @25°C	pH Units		SM 4500H	22-Nov-21/O	7.39		
Nitrite (N)	mg/L	0.1	SM4110C	16-Nov-21/O	< 0.1		
Nitrate (N)	mg/L	0.1	SM4110C	16-Nov-21/O	< 0.1		
Ammonia (N)-Total	mg/L	0.01	SM4500- NH3-H	12-Nov-21/K	2.53		
o-Phosphate (P)	mg/L	0.002	PE4500-S	12-Nov-21/K	0.247		
Phosphorus-Total	mg/L	0.01	E3199A.1	12-Nov-21/K	5.01		
Aluminum	mg/L	0.01	SM 3120	12-Nov-21/O	1.24		
Antimony	mg/L	0.0005	EPA 200.8	12-Nov-21/O	< 0.0005		
Arsenic	mg/L	0.0005	EPA 200.8	12-Nov-21/O	0.0009		
Barium	mg/L	0.001	SM 3120	12-Nov-21/O	0.020		
Beryllium	mg/L	0.002	SM 3120	12-Nov-21/O	< 0.002		
Cadmium	mg/L	0.000070	EPA 200.8	12-Nov-21/O	< 0.000070		
Chromium	mg/L	0.002	SM 3120	12-Nov-21/O	< 0.002		
Cobalt	mg/L	0.005	SM 3120	12-Nov-21/O	< 0.005		
Copper	mg/L	0.002	SM 3120	12-Nov-21/O	0.209		
Iron	mg/L	0.005	SM 3120	12-Nov-21/O	3.50		
Lead	mg/L	0.0001	EPA 200.8	12-Nov-21/O	0.0047		
Lithium	mg/L	0.01	SM 3120	12-Nov-21/O	0.02		
Manganese	mg/L	0.001	SM 3120	12-Nov-21/O	0.220		
Mercury	mg/L	0.00002	SM 3112 B	12-Nov-21/O	0.00004		
Molybdenum	mg/L	0.01	SM 3120	12-Nov-21/O	< 0.01		
Nickel	mg/L	0.01	SM 3120	12-Nov-21/O	< 0.01		
Selenium	mg/L	0.005	EPA 200.8	12-Nov-21/O	< 0.005		

NOTE: Total & Fecal Coliform passed acceptable holding time upon arrival at the Lab.

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Final Report

C.O.C.: G095634 REPORT No. B21-36871

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 09-Nov-21

DATE REPORTED: 23-Nov-21

SAMPLE MATRIX: Waste Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test F

P.O. NUMBER:

WATERWORKS NO.

			Client I.D.		IQA02 End of Decant		
			Sample I.D.		B21-36871-1		
			Date Collect	ed	06-Nov-21		
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
Silver	mg/L	0.0001	EPA 200.8	12-Nov-21/O	0.0004		
Strontium	mg/L	0.001	SM 3120	12-Nov-21/O	0.071		
Thallium	mg/L	0.0003	EPA 200.8	12-Nov-21/O	< 0.0003		
Tin	mg/L	0.05	SM 3120	12-Nov-21/O	< 0.05		
Titanium	mg/L	0.005	SM 3120	12-Nov-21/O	0.039		
Uranium	mg/L	0.0003	EPA 200.8	15-Nov-21/O	< 0.0003		
Vanadium	mg/L	0.005	SM 3120	12-Nov-21/O	< 0.005		
Zinc	mg/L	0.005	SM 3120	12-Nov-21/O	0.128		
Total Coliform	cfu/100mL	1	MOE E3371	09-Nov-21/O	39000000		
Fecal Coliform	cfu/100mL	1	MOE E3371	09-Nov-21/O	1700000		

NOTE: Total & Fecal Coliform passed acceptable holding time upon arrival at the Lab.

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

GENERAL SAMPLE SUBMISSION FORM	SAMPLES SUBMITTE	ED TO:			TESTING RE	QUIREMENTS			REPORT NUN	BBR (Lab dise
	Kingston			O'Reg 153/04		Table (1 - 9)	Record of Sit		Dec.	
CADUCEZIN	Ottawa			O'Reg 406/19		Γable (1 - 9.1)	SPLP Table (1 - 9.1)		
CADUCLZ	Richmond Hill Barrie			RPI Coarse		CC Medium/Fine	Agricultural O'Reg 558 TO	10		
ENVIRONMENTAL LABORATORTES Client committed. Quality assured. Proudly Canadian.	London		 -	MISA		PWQO	Landfill Moni			
Gient Committee. Godiny disarrest. Producy Gardenin.	Windsor			Other:						
Are any samples to be submitted intended for Human	an Consumption under any	/ Drinking V	Nater Regulation	s?	Yes	No	(If yes, submit a	II Drinking Water Sar	nples on a Drinking Wat	er Chain of Custody)
Organization: City of Igaluit Address	BAY HEO	Invoicing	Address (if different)			ANALYSE	S REQUESTE)		OUND SERVICE ED (see back page)
Contact: Emmanuel Kayade	igaluit				ere			ninated		ranged in advance 200% Surcharge
Organization: City of Igaluit Contact: Emmanuel Kayode Tel: 867-222-462 Fax:	iu, XDAOHO				Que			Contaminate	Gold*	100% Surcharge 50% Surcharge
Email: e. Kayode a Igal wit. cq Quote #:		Project Na	ame/#:	478-	2			cted Highly	Bronze	25% Surcharge
Additional Info (email, cell, etc): P.O. #:	460	Additiona	il Info:		ST			nspected	Standard Specific D	5-7 days ate:
	d: WW=Waste Water, SW=Surfa	ce Water, GW	WATER THE SECOND ASSESSMENT OF THE PROPERTY OF THE PARTY	DISSERVATION OF THE PROPERTY O	Solid Sludge, S			s, F=Filter, Oil Oil	21-14	
No. Sample Source and/or Sample Identification	S.P.L.	Sample Matrix *	Date Collected (yy-mm-dd)	Time Collected	В	Indicate Test F y Using A Check Mar	or Each Sample rk In The Box Prov	ded	pH Temp.	#Boules/ Filtered
C. C. C. C. C. C. C. C. C. C. C. C. C. C	u/Total)	,	21-12-09	1.40pm		Test	ADI		6.55 28.3	
WIP RAW @ WIP-RON WIP POTABLE @ WIP-	Patable / Tatal	Dw				1001	1,5			\
			11	1-30pm			3		6.55 8.3	10(8/2)
3 WWTP Influent		MM	1!	1201 pm		lest	H		7.35	6
2 WWIP Effluent	1.2	WW	1/	12-17pm			2		7.48	6
							Sales Sales			110
							1	1201-	403	46
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							+++			
							+++			
SAMPLE SUBMISSION INFORMATION		NFORMATIO	N		INVOICING			ECEIVING INFORMA	TION (LABORATORY US	(EDNTA)
Sampled by: Submitted by:	Courier (Client account)	X	Invoice	Report by Fax		Received By (ouphasha	Signature:	
Print: Emmanuel transquel	Courier (Caduceon account)			Report by Email		Date Received		21112110	Time Received:	10:00 am
Sign: Hest	Drop Off		# of Pieces	Invoice by Email		Laboratory Pr	epared Bottles:	Yes	No	
21-12-65 21-12-65 Date (yy-mm-dd)/Time: Date (yy-mm-dd)/Time:	Caduceon (Pick-up)			Invoice by Mail		Sample Temp		4,9 Labe	led by:	0
Comments:	2 -> 2pe 4 -> 1>e	t, 2F	2, 2M, 2	etg, N	P. Bo	act x.	2		Page	of
2	11 - 100	1 D	M L	2 NID	Back	× 5			G 1	00317
	1	170	> IVI , ITC	771117	i conce	-			CofC, May 2020	Revision No. 23



QUOTATION FOR ANALYTICAL SERVICES

Quote #:

YD21_lqaluit_A

Organization:

City of Iqaluit

Contact: Telephone: Mike Hatfield 867-979-6363

Facsimile:

Facsimile: Email:

M.Hatfield@city.lqaluit.nu.ca

Project #:

TEST A - Drinking Water

Address: Additional Info: Box 460, Iqaluit NÜ, X0A 0H0
QUOTE # ('S) MUST BE ON C OF C TO APPLY if not listed, General pricing will be applied.

Additional Info:

Replacing Quote YD20 Igaluit_A

Additional Info

27-May-21

Valid Until:

31-Dec-21

Item #	Quantity	Analysis Request	Matrix	Unit Cost, \$	Amount, \$
1	1	Acidity (Subcontracted)	DW	35.15	35.15
2	1	Alkalinity	DW	15.00	15.00
3	1	Bicarbonate/ Carbonate	DW	18.25	18.25
4	1	Chloride/Sulphate	DW	25.00	25.00
5	1	Conductivity	DW	10.00	10.00
6	1	Hydroxide	DW	15.25	15.25
7	1	Redox Potential	DW	16.50	16.50
8	1	TDS	DW	18.25	18.25
9	1	TSS	DW	18.25	18.25
10	1	TOC	DW	25.00	25.00
11	1	TIC	DW	25.00	25.00
12	1	TOTAL METALS ICPOES AI, Ba, Be, Cr, Co, Cu, Fe, Li, Mn, Mo, Ni, Sn, Sr, Ti, V, Zn + Hardness ICPMS Sb, As, Cd, Pb, Se, Ag, TI, U CVAAS Hg	DW	96.00	96.00
13	1	DISSOLVED METALS ICPOES AI, Ba, Be, Cr, Co, Cu, Fe, Li, Mn, Mo, Ni, Sn, Sr, Ti, V, Zn + Hardness ICPMS Sb, As, Cd, Pb, Se, Ag, Tl, U CVAAS Hg	DW	96.00	96.00
14	1	Fecal Coliforms	DW	17.00	17.00
15	1	pH	DW	9.50	9.50
16	1	Turbidity	DW	15.25	15.25
17	1	Ottawa Airport Pick Up		25.00	25.00
	ping unless otherwise stat		Committee of the Commit	Subtotal	480.40

Environmental Surcharge of \$2 per sample set

 Subtotal
 480.40

 HST
 62.45

 Total Cost
 542.85

Kristine Cavanagh

Customer Service Representative

Caduceon Environmental Laboratories

kcavanagh@caduceonlabs.com

Cell: 819-230-9605 Office 613-526-0123



GENERAL CHAIN OF CUSTODY FORM

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Page	of

Please use our Drinking Water Chain of Custody Form for regulated drinking water samples

				Please use our Drinkin																		NFORM	ATTON:
REPORT	то:				Client					iffere					10						uote #:	IN OKI-I	
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Address:			2378 Holly Lane		Addre	ess.										1	Client P.O. #: P211214_TM						
			Ottawa ON, K1V 7F	1	4	K7K 6Z1									t Project #:	Project #:							
Contact:			Greg Clarkin		4															1			
Email:	gclark	kin@caduce	onlabs.com tyapic	@caduceonlabs.com	Email	l:	mmccormick@caduceonlabs.com 6135442001 Fax: 6135442770								-								
Phone:	613-526-012	.3	Fax: 613-526-1		Phon	e:	613	54420	001			Fax:	•	5135	44277	0		_		(N) ess	STORY AND ARREST		
REPORTI	ORTING/INVOICING FORMAT TURN AROUND TIME (TAT)*				1,0						ANA	LYSI	s REC	QUES	TED		_		?		1	THE RESERVE OF THE PARTY OF THE	USE ONLY
∏Fax	☑Email	□Mail	☐1 Business Day	☐2 Business Days	CONTAINERS						1						<u>. </u>	(aldi	EREI	/ED	W	ORK ORDI	ER NUMBER:
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□Hold	□Dispose	□Return		kend/holiday work		ξį	1							- 1		1	E	1	SIS	AIN			
	SAMPLIN	IG		DESCRIPTION	NUMBER	Acidity										1	FIELD pm (ir applicable)	FIELD TEMP (if applicable)	METALS FIELD FILTERED? (Y/N?)	CONTAINERS RECEIVED	TEMP	Btl. Typ	pe Lab ID
DATE (mm-dd-yy	TIME	MATRIX**	• *************************************	ppear On The Report)	Z	-	_	\vdash			_	-	\vdash	\dashv	+	+	=+	E	2 0	U	1 CMP	Du. Ty	Je Labib
12/09/21		DW		21-40345-1	-	X		\vdash	_	\vdash	_	-	\vdash	-	\dashv	+	+	\dashv					
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**Matrix	c: B=Biota	, GW=Grou	nd Water, U=Oii, i -, WW=Wastewate	P=Paint, S=Soil, SL=Slud	ge,			Z	-	JO.1105	j. 199 ∐In	dustr	ial / C	Comr	nercia	al .	_	□R	eside	ntial /	Parkland	ı [_Agricultural
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						F 60'	3-1121 (P) • 705-693-1124 (F) • customer.service@testmark.ca																



Final Report

C.O.C.: G100317 REPORT No. B21-40345

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

<u>Attention:</u> Emmanuel Kayode

DATE RECEIVED: 10-Dec-21

DATE REPORTED: 21-Dec-21 SAMPLE MATRIX: Drinking Water **Caduceon Environmental Laboratories**

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123 Fax: 613-526-1244

JOB/PROJECT NO.: Test A (WTP)

P.O. NUMBER: 460 WATERWORKS NO.

			Client I.D.		Test A- Raw WTP	Test A- Raw WTP (Total)	Test A- Potable WTP	Test A- Potable (Total)
			Sample I.D.		B21-40345-1	B21-40345-2	B21-40345-3	B21-40345-4
			Date Collecte	ed	09-Dec-21	09-Dec-21	09-Dec-21	09-Dec-21
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Hardness (as CaCO3)	mg/L	1	SM 3120	13-Dec-21/O	17		16	
Hardness (as CaCO3)	mg/L	1	SM 3120	13-Dec-21/O		17		16
Alkalinity(CaCO3) to pH4.5	mg/L	5	SM 2320B	10-Dec-21/O	17		12	
Bicarbonate(as CaCO3)	mg/L	5	SM 2320B	10-Dec-21/O	17		12	
Carbonate (as CaCO3)	mg/L	5	SM 2320B	10-Dec-21/O	< 5		< 5	
Hydroxide	mg/L	5	EPA 310.2	10-Dec-21/O	< 5		< 5	
Acidity (as CaCO3)	mg/L	5	Subcontract	17-Dec-21	< 5 ¹		< 5 1	
pH @25°C	pH Units		SM 4500H	10-Dec-21/O	7.67		6.20	
Conductivity @25°C	µmho/cm	1	SM 2510B	10-Dec-21/O	37		39	
TDS(ion sum calc.)	mg/L	1	Calc.	14-Dec-21/O	19		18	
Total Suspended Solids	mg/L	3	SM2540D	13-Dec-21/K	3		3	
Turbidity	NTU	0.1	SM 2130	13-Dec-21/O	0.3		0.3	
REDOX potential	mV		In-House	13-Dec-21/R	421		615	
Chloride	mg/L	0.5	SM4110C	13-Dec-21/O	1.8		3.2	
Sulphate	mg/L	1	SM4110C	13-Dec-21/O	< 1		< 1	
Aluminum	mg/L	0.01	SM 3120	13-Dec-21/O	< 0.01		< 0.01	
Aluminum	mg/L	0.01	SM 3120	13-Dec-21/O		< 0.01		< 0.01
Antimony	mg/L	0.0001	EPA 200.8	13-Dec-21/O	< 0.0001		< 0.0001	
Antimony	mg/L	0.0001	EPA 200.8	14-Dec-21/O		0.0003		0.0002
Arsenic	mg/L	0.0001	EPA 200.8	13-Dec-21/O	< 0.0001		< 0.0001	
Arsenic	mg/L	0.0001	EPA 200.8	14-Dec-21/O		< 0.0001		< 0.0001
Barium	mg/L	0.001	SM 3120	13-Dec-21/O	0.002		0.002	
Barium	mg/L	0.001	SM 3120	13-Dec-21/O		0.002		0.002
Beryllium	mg/L	0.002	SM 3120	13-Dec-21/O	< 0.002		< 0.002	
Beryllium	mg/L	0.002	SM 3120	13-Dec-21/O		< 0.002		< 0.002
Cadmium	mg/L).000015	EPA 200.8	13-Dec-21/O	< 0.000015		< 0.000015	

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Final Report

C.O.C.: G100317 REPORT No. B21-40345

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 10-Dec-21

DATE REPORTED: 21-Dec-21 SAMPLE MATRIX: Drinking Water **Caduceon Environmental Laboratories**

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test A (WTP)

P.O. NUMBER: 460 WATERWORKS NO.

			Client I.D.		Test A- Raw WTP	Test A- Raw WTP (Total)	Test A- Potable WTP	Test A- Potable (Total)
			Sample I.D.		B21-40345-1	B21-40345-2	B21-40345-3	B21-40345-4
			Date Collecte	ed	09-Dec-21	09-Dec-21	09-Dec-21	09-Dec-21
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Cadmium	mg/L).000015	EPA 200.8	14-Dec-21/O		< 0.000015		< 0.000015
Chromium	mg/L	0.002	SM 3120	13-Dec-21/O	< 0.002		< 0.002	
Chromium	mg/L	0.002	SM 3120	13-Dec-21/O		< 0.002		< 0.002
Cobalt	mg/L	0.005	SM 3120	13-Dec-21/O	< 0.005		< 0.005	
Cobalt	mg/L	0.005	SM 3120	13-Dec-21/O		< 0.005		< 0.005
Copper	mg/L	0.002	SM 3120	13-Dec-21/O	0.029		0.026	
Copper	mg/L	0.002	SM 3120	13-Dec-21/O		0.029		0.026
Iron	mg/L	0.005	SM 3120	13-Dec-21/O	0.040		0.019	
Iron	mg/L	0.005	SM 3120	13-Dec-21/O		0.050		0.026
Lead	mg/L	0.00002	EPA 200.8	13-Dec-21/O	0.00006		0.00006	
Lead	mg/L	0.00002	EPA 200.8	14-Dec-21/O		0.00008		0.00008
Lithium	mg/L	0.01	SM 3120	13-Dec-21/O	< 0.01		< 0.01	
Lithium	mg/L	0.01	SM 3120	13-Dec-21/O		< 0.01		< 0.01
Manganese	mg/L	0.001	SM 3120	13-Dec-21/O	0.015		0.005	
Manganese	mg/L	0.001	SM 3120	13-Dec-21/O		0.015		0.005
Mercury	mg/L	0.00002	SM 3112 B	14-Dec-21/O	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Molybdenum	mg/L	0.01	SM 3120	13-Dec-21/O	< 0.01		< 0.01	
Molybdenum	mg/L	0.01	SM 3120	13-Dec-21/O		< 0.01		< 0.01
Nickel	mg/L	0.01	SM 3120	13-Dec-21/O	< 0.01		< 0.01	
Nickel	mg/L	0.01	SM 3120	13-Dec-21/O		< 0.01		< 0.01
Selenium	mg/L	0.001	EPA 200.8	13-Dec-21/O	< 0.001		< 0.001	
Selenium	mg/L	0.001	EPA 200.8	14-Dec-21/O		< 0.001		< 0.001
Silver	mg/L	0.0001	EPA 200.8	13-Dec-21/O	< 0.0001	_	< 0.0001	
Silver	mg/L	0.0001	EPA 200.8	14-Dec-21/O		< 0.0001		< 0.0001
Strontium	mg/L	0.001	SM 3120	13-Dec-21/O	0.012		0.012	
Strontium	mg/L	0.001	SM 3120	13-Dec-21/O		0.012		0.012

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Final Report

C.O.C.: G100317 REPORT No. B21-40345

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

<u>Attention:</u> Emmanuel Kayode

DATE RECEIVED: 10-Dec-21

DATE REPORTED: 21-Dec-21 SAMPLE MATRIX: Drinking Water **Caduceon Environmental Laboratories**

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Ottawa Ontario K1V 7P1 Tel: 613-526-0123 Fax: 613-526-1244

JOB/PROJECT NO.: Test A (WTP)

P.O. NUMBER: 460 WATERWORKS NO.

			Client I.D.		Test A- Raw	Test A- Raw	Test A-	Test A-
					WTP	WTP (Total)	Potable WTP	Potable (Total)
			Sample I.D.		B21-40345-1	B21-40345-2	B21-40345-3	B21-40345-4
			Date Collecte			09-Dec-21	09-Dec-21	09-Dec-21
-					09-Dec-21	09-Dec-21	09-Dec-21	09-Dec-21
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Thallium	mg/L	0.00005	EPA 200.8	13-Dec-21/O	< 0.00005		< 0.00005	
Thallium	mg/L	0.00005	EPA 200.8	14-Dec-21/O		< 0.00005		< 0.00005
Tin	mg/L	0.05	SM 3120	13-Dec-21/O	< 0.05		< 0.05	
Tin	mg/L	0.05	SM 3120	13-Dec-21/O		< 0.05		< 0.05
Titanium	mg/L	0.005	SM 3120	13-Dec-21/O	< 0.005		< 0.005	
Titanium	mg/L	0.005	SM 3120	13-Dec-21/O		< 0.005		< 0.005
Uranium	mg/L	0.00005	EPA 200.8	13-Dec-21/O	< 0.00005		< 0.00005	
Uranium	mg/L	0.00005	EPA 200.8	14-Dec-21/O		< 0.00005		< 0.00005
Vanadium	mg/L	0.005	SM 3120	13-Dec-21/O	< 0.005		< 0.005	
Vanadium	mg/L	0.005	SM 3120	13-Dec-21/O		< 0.005		< 0.005
Zinc	mg/L	0.005	SM 3120	13-Dec-21/O	< 0.005		< 0.005	
Zinc	mg/L	0.005	SM 3120	13-Dec-21/O		0.009		0.010
Total Organic Carbon	mg/L	0.2	EPA 415.2	17-Dec-21/O	2.0		2.0	
TIC	mg/L	0.5	EPA 415.1	17-Dec-21/O	4.3		7.0	
Fecal Coliform	cfu/100mL	1	MOE	10-Dec-21/O	0		0	
Anion Sum	meq/L		Calc.	14-Dec-21/O	0.390		0.349	
Cation Sum	meq/L		Calc.	14-Dec-21/O	0.372		0.361	
% Difference	%		Calc.	14-Dec-21/O	2.37		1.78	
Ion Ratio	AS/CS		Calc.	14-Dec-21/O	1.05		0.965	
Sodium Adsorption Ratio	-		Calc.	14-Dec-21/O	0.0794		0.0763	
Conductivity (calc.)	µmho/cm		Calc.	14-Dec-21/O	39		37	
EC(calc.)/EC(actual)	-		Calc.	14-Dec-21/O	1.04		0.960	
TDS(calc.)/EC(actual)	-		Calc.	14-Dec-21/O	0.508		0.451	
Langelier Index(25°C)	S.I.		Calc.	14-Dec-21/O	-1.71		-3.33	

Subcontracted to Testmark Labs

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

C A D U C S COURSE CONTROL OF CON	GENERAL SAMPLE SUBMISSION FORM	SAMPLES SUBMITTE	D TO:			TESTING R	EQUIRE	MENTS				SEPORT NU	SBR (Lab ise	
ENVIOUNDE TALLAD LATCH TEST CONTROLLAD AND ADDRESS CONTROLLAD AND ADDRESS OF THE SERVICE CONTROLLAD AND ADDRESS OF THE SERVICE CONTROLLAD AND ADDRESS OF THE SERVICE CONTROLLAD AND ADDRESS OF THE SERVICE CONTROLLAD ADDRESS												Dec .		
Are any samples to be submitted intended for Human Consumption under any Defining Water Regulations? Organization Are any samples to be submitted intended for Human Consumption under any Defining Water Regulations? Organization City OF Lacture City OF Lacture Consult City OF Lacture No. X OA OHO Organization City OF Lacture No. X OA OHO Organization N					101.000 M	4	1000		-					
Are any samples to be submitted intended for Human Consumption under any Drinking Water Regulations? Type Yes No	STREET TO MAKE THE CONTROL CONTROL TO THE STREET WAS A STREET TO THE STREET WAS A STREET TO STREET THE STREET TO STREET THE STREET T				V-1200-00		1410122231114	ine	-					
Canadad Frame of the Control of the		Windsor			Other:									
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Sign: # of Pieces Invoice by Email Laboratory Prepared Bottles: Yes No 21-12-05 21-12-05 Caduceon (Pick-up) Date (yy-mm-dd)/Time:	Sampled by: Submitted by:		X	Invoice	Report by Fax			-		Oupha	Sin			
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QUOTATION FOR ANALYTICAL SERVICES

Quote #:

YD21_lqaluit_F

Organization:

City of Iqaluit

Contact:

Mike Hatfield

Telephone:

867-979-6363

Facsimile:

Email:

M.Hatfield@city.lqaluit.nu.ca

Project #: Address: TEST F - Sewage Lagoon Box 460, Iqaluit NU, X0A 0H0

Additional Info:

QUOTE # ('S) MUST BE ON C OF C TO APPLY if not listed, General pricing will be applied.

Additional Info:

Replacing Quote YD19_lqaluit_F

Date:

27-May-21

Valid Until: 3

31-Dec-21

Item #	Quantity	Analysis Request	Matrix	Unit Cost, \$	Amount, \$
1	1	BOD	WW	31.50	31.50
2	1	Total Coliform / Fecal Coliform	WW	32.50	32.50
3	1	Ammonia, NO2/NO3	WW	31.50	31.50
4	1	Total Phosphorus	WW	18.25	18.25
5	1	Orthophosphate	WW	18.25	18.25
6	1	Conductivity	WW	10.00	10.00
7	1	TSS	WW	18.25	18.25
8	1	pH	WW	9.50	9.50
9	1	TOTAL METALS ICPOES AI, Ba, Be, Cr, Co, Cu, Fe, Li, Mn, Mo, Ni, Sn, Sr, Ti, V, Zn ICPMS Sb, As, Cd, Pb, Se, Ag, Tl, U CVAAS Hg	ww	96.00	96.00
10	1	Ottawa Airport Pick Up		25.00	25.00
Prices do not include shippir	ng unless otherwise state	ed.		Subtotal	290.75

Environmental Surcharge of \$2 per sample set

25.00	25.00
Subtotal	290.75
HST	37.80
Total Cost	328.55

Kristine Cavanagh

Customer Service Representative

Caduceon Environmental Laboratories

kcavanagh@caduceonlabs.com

Cell: 819-230-9605 Office 613-526-0123



Final Report

C.O.C.: G100317 REPORT No. B21-40346

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 10-Dec-21 DATE REPORTED: 17-Dec-21

SAMPLE MATRIX: Waste Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1 Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test F

P.O. NUMBER: 460

WATERWORKS NO.

			Client I.D.	·	WWTP	WWTP	
					Influent	Effluent	
			Sample I.D.		B21-40346-1	B21-40346-2	
			Date Collecte	ed	09-Dec-21	09-Dec-21	
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
BOD(5 day)	mg/L	3	SM 5210B	10-Dec-21/K	180	126	
Total Suspended Solids	mg/L	3	SM2540D	13-Dec-21/K	2880	124	
Conductivity @25°C	µmho/cm	1	SM 2510B	10-Dec-21/O	369	310	
pH @25°C	pH Units		SM 4500H	10-Dec-21/O	7.26	7.65	
Nitrite (N)	mg/L	0.1	SM4110C	14-Dec-21/O	0.1	< 0.1	
Nitrate (N)	mg/L	0.1	SM4110C	14-Dec-21/O	< 0.1	< 0.1	
Ammonia (N)-Total	mg/L	0.01	SM4500- NH3-H	14-Dec-21/K	28.7	18.4	
o-Phosphate (P)	mg/L	0.002	PE4500-S	14-Dec-21/K	2.12	1.08	
Phosphorus-Total	mg/L	0.01	E3199A.1	14-Dec-21/K	5.83	3.19	
Aluminum	mg/L	0.01	SM 3120	13-Dec-21/O	1.35	0.17	
Antimony	mg/L	0.0005	EPA 200.8	14-Dec-21/O	0.0011	0.0008	
Arsenic	mg/L	0.0005	EPA 200.8	14-Dec-21/O	0.0008	< 0.0005	
Barium	mg/L	0.001	SM 3120	13-Dec-21/O	0.042	0.006	
Beryllium	mg/L	0.002	SM 3120	13-Dec-21/O	< 0.002	< 0.002	
Cadmium	mg/L).000070	EPA 200.8	14-Dec-21/O	0.00144	0.000151	
Chromium	mg/L	0.002	SM 3120	13-Dec-21/O	0.005	< 0.002	
Cobalt	mg/L	0.005	SM 3120	13-Dec-21/O	< 0.005	< 0.005	
Copper	mg/L	0.002	SM 3120	13-Dec-21/O	0.464	0.198	
Iron	mg/L	0.005	SM 3120	13-Dec-21/O	4.94	0.346	
Lead	mg/L	0.0001	EPA 200.8	14-Dec-21/O	0.0538	0.0016	
Lithium	mg/L	0.01	SM 3120	13-Dec-21/O	< 0.01	< 0.01	
Manganese	mg/L	0.001	SM 3120	13-Dec-21/O	0.162	0.077	
Mercury	mg/L	0.00002	SM 3112 B	15-Dec-21/O	0.00110	< 0.00002	
Molybdenum	mg/L	0.01	SM 3120	13-Dec-21/O	< 0.01	< 0.01	
Nickel	mg/L	0.01	SM 3120	13-Dec-21/O	< 0.01	< 0.01	
Selenium	mg/L	0.005	EPA 200.8	14-Dec-21/O	< 0.005	< 0.005	

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie



Final Report

C.O.C.: G100317 REPORT No. B21-40346

Report To:

City of Iqaluit PO Box 460,

Iqaluit NU X0A 0H0

Attention: Emmanuel Kayode

DATE RECEIVED: 10-Dec-21 DATE REPORTED: 17-Dec-21

SAMPLE MATRIX: Waste Water

Caduceon Environmental Laboratories

2378 Holly Lane

Ottawa Ontario K1V 7P1

Tel: 613-526-0123

Fax: 613-526-1244

JOB/PROJECT NO.: Test F

P.O. NUMBER: 460

WATERWORKS NO.

			Client I.D.		WWTP Influent	WWTP Effluent		
			Sample I.D.		B21-40346-1	B21-40346-2	1	
			Date Collecte	ed	09-Dec-21	09-Dec-21		
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed				
Silver	mg/L	0.0001	EPA 200.8	14-Dec-21/O	0.0008	< 0.0001		
Strontium	mg/L	0.001	SM 3120	13-Dec-21/O	0.040	0.021		
Thallium	mg/L	0.0003	EPA 200.8	14-Dec-21/O	< 0.0003	< 0.0003		
Tin	mg/L	0.05	SM 3120	13-Dec-21/O	< 0.05	< 0.05		
Titanium	mg/L	0.005	SM 3120	13-Dec-21/O	0.038	0.007		
Uranium	mg/L	0.0003	EPA 200.8	14-Dec-21/O	0.0003	< 0.0003		
Vanadium	mg/L	0.005	SM 3120	13-Dec-21/O	< 0.005	< 0.005		
Zinc	mg/L	0.005	SM 3120	13-Dec-21/O	0.396	0.087		
Total Coliform	cfu/100mL	1	MOE	10-Dec-21/O	64000000	7900000		
Fecal Coliform	cfu/100mL	1	MOE	10-Dec-21/O	4300000	2700000		

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

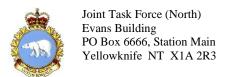


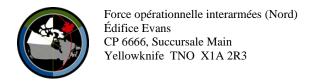
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Igaluit

CANADIAN ARMED FORCES – ROWPU "OPERATION LENTUS" REPORT







3350-0 (JTFN J Engr Ops)

13 April 2022

Amy Elgersma Chief Administrative Officer, City of Iqaluit Box 460 Iqaluit, Nunavut X0A 0H0

ENGINEERING CLOSEOUT REPORT – OPERATION LENTUS 21-05

References: A. Nunavut Water Board (NWB) Type "A" Water License No. 3AM-IQA1626

- B. Emergency Amendment No. 6 to 3AM-IQA1626 15 October 2021
- C. Letter from NWB, Reverse Osmosis Water Purification Unit (ROWPU) 30 October 2021.
- 1. In reference C, the NWB opined that the operation of ROWPU unit(s) by the Canadian Armed Forces (CAF) generally meets the requirements of Part F of Reference A, subject to the same restrictions as outlined in reference B. As part of Operation LENTUS 21-05, the Canadian Armed Forces (CAF) deployed two ROWPU suites and associated equipment to Iqaluit from 23 October 2021 to 7 January 2022. A summary of operations is enclosed.
- 2. Due to harsh weather conditions and snow cover, we have not yet been able to complete a Simplified Environmental Study (SES), which is an additional due-diligence measure conducted to characterize site conditions and ensure stakeholder satisfaction. The completion of the SES is planned for June 2022. Once completed, the SES will be sent to your office for your records.
- 3. To meet the requirements of Part F of Reference A in the context of Operation LENTUS 21-05, the enclosed documents constitute my Engineering Closeout Report for the CAF ROWPU deployment for Operation LENTUS 21-05. Any questions or concerns about the enclosed documents can be addressed to me, Major A.R. Colpitts at (867) 445-4062, or to my operations officer, Captain L.M.W. Morrissey, at (867) 873-6880.

Andrew. R. Colpitts, C.D., P.Eng

Major

Joint Engineer

Joint Task Force (North)

Enclosures: 5

Operations Summary
Daily Operating Log
Equipment List
Abbreviated Environmental Effects Determination Report
Simplified Environmental Study

Enclosure 1 – Operations Summary Engineering Closeout Report – Operation LENTUS 21-05

<u>OPERATIONS SUMMARY – OPERATION LENTUS 21-05</u> REVERSE OSMOSIS WATER PURIFICATION UNITS (ROWPU)

BACKGROUND

1. On 13 October 2021, the Government of Nunavut (GN) declared a state of emergency for water quality in Iqaluit, NU, after contamination was discovered in the City's water supply. On 20 October 2021, a Request for Assistance (RFA) from the Territory was received by the Department of National Defence (DND) through the Department of Public Safety Canada.

OPERATIONS

- 2. <u>20 October 2021</u>. The Government of Nunavut submitted an RFA to Public Safety Canada due to a water quality emergency in the City of Iqaluit, NU.
- 3. <u>21 October 2021</u>. Five members of the Canadian Armed Forces (CAF) arrived in Iqaluit and were placed under the command of the Joint Task Force North Detachment Iqaluit commander, Major Scott Purcell. These members were tasked to reconnoitre possible locations where a Reverse Osmosis Water Purification Unit (ROWPU) could be deployed and set up to help reduce dependence on bottled water. Over the next three days, the remainder of the ROWPU operation team and all equipment deployed to Iqaluit to be ready for operation.
- 4. <u>22 October 2021</u>. During the course of the reconnaissance, multiple locations were inspected and assessed for suitability.
 - a. <u>Site 1 Geraldine Lake Primary Site</u>. This site is located at the edge of Lake Geraldine, to the northeast of the City's water treatment plant. This site was discounted due to access restrictions for City of Iqaluit water trucks and restricted size.
 - b. <u>Site 2 Geraldine Lake Secondary Site (Saputi Road)</u>. This site is located adjacent to Lake Geraldine, at the end of Saputi Road. This location was deemed the most preferable due to security, water quality, overall site access and layout. Through discussion with the City, it was identified that this site was not available unless the ROWPU could be set up at the bottom of Saputi Road, due to the slope of the road causing dangerous driving conditions for the city's water trucks in the coming freeze, should operations have gone on longer than two to three weeks.
 - c. <u>Site 3 Geraldine Lake Tertiary Site (Anuri Street)</u>. This site is located on the southeast side of Lake Geraline at the end of Anuri Street. This site was discounted due to access restrictions for City of Iqaluit water trucks and restricted size.
 - d. <u>Site 4 Sylvia Grinnell River Site</u>. The last location visited was the Sylvia Grinnell River, co-located with the City of Iqaluit emergency water source. This location was deemed suitable in terms of site access and terrain. One major advantage of this site was its concurrent use by the City of Iqaluit to fill water trucks with raw water. The primary disadvantage of this site was the temperature of the source water. The water temperature was deemed to be below the minimum safe operating temperature (4° Celsius) for intake water of the ROWPU. Operations at the Sylvia Grinnell River site would require

Enclosure 1 – Operations Summary Engineering Closeout Report – Operation LENTUS 21-05

- extensive infrastructure to warm intake water it to an acceptable operating temperature at a rate that would not limit production capacity.
- e. <u>Site 5 Koojesse Inlet</u>. Koojesse Inlet was considered as a possible site but discounted due to added complexity and reduced performance of ROWPU operations for saltwater sources. In addition, tidal action would cause the source water to have been unavailable for several hours each day.
- 5. <u>Site Selection</u>. The eventual decision was made to set up and conduct operations at the Site 4 Sylvia Grinnell River.
- 6. <u>27 October 2021</u>. As part of the process to find a solution to the City's desire to reduce bottled water dependence, the CAF was asked to investigate whether sufficient power could be provided using a CAF deployable capability to operate the city's Mobile Water Treatment Plant (MWTP). The MWTP had been recently purchased and was then located in Iqaluit but had not yet been commissioned.
 - a. On 27 October, a two-member CAF assessment team met with a representative from the City's engineering department (Mr. Clow) to determine requirements. The City asked whether the CAF would be able to provide 600V, 100A, 3-phase power.
 - b. While power generation for the 60kVA load could be met, the assessment team's determination was that CAF deployable power generation would not be suitable as the maximum voltage supplied by CAF deployable generators is 480V. Use of a CAF deployable generation system would require the procurement and installation of a transformer and associated equipment.
 - c. It was determined that it would be more feasible for the City to use local power to run the MWTP, instead of CAF 60kw 208v generator with a 208/600v step up transformer.
- 7. 30 October 2021. The Nunavut Water Board (NWB) issued an amendment to the City of Iqaluit's water license number 3AM-IQA1626, approving the operation of the ROWPU at the Sylvia Grinnell River. This amendment was further to the NWB Emergency Amendment No. 6 to the City's water license and tied to the City's declared state of emergency. The amendment would be valid until the end of the state of emergency.
- 8. <u>31 October 2021</u>. In an email from the Chief Administrative Officer (CAO), the City of Iqaluit confirmed that CAF operation of the ROWPU can commence.
- 9. <u>1 November 2021</u>. Operations commenced at the Sylvia Grinnell River, equipment was set up and the site prepared for ROWPU operations. Raw water was drawn and heating commenced. Since the ROWPU must be kept from freezing when not in operation, the ROWPU were not yet moved to the site as site preparation was still underway.
- 10. <u>2 November 2021</u>. Operations ceased due to winds gusting to 70km/hr., which lifted and damaged tents and heaters. The site was cleared of all equipment and moved to the Quick Reaction Area (QRA) on the west side of the airport runway to assess damage and reconstitute. Plans were made to restart operations the following day. This was the first day that the river had frozen on the top and therefore

Enclosure 1 – Operations Summary Engineering Closeout Report – Operation LENTUS 21-05

extra precautions had to be taken to ensure that submersed pumps and equipment (strainers) were not damaged.

- 11. <u>3 November 2021</u>. Operations recommenced with the setup of equipment at the site. The first ROWPU unit was brought to the site and put into operation.
- 12. <u>23 November 2021</u>. Operations ceased due to damage to shelters and equipment from high winds caused by a winter storm. Wind and heavy snowfall forced the ROWPU to be shut down before it sustained damage from freezing. Equipment was cleaned up and moved to the QRA to assess damage. Once cleanup was complete, an assessment was completed to determine the next steps. A decision was made to pursue continued operation of the ROWPU plant inside the QRA, bringing raw water from the Sylvia Grinnell River Site to be warmed, purified and stored.
- 13. 24-29 November 2021 Equipment was moved from the Sylvia Grinnell River to the QRA for reconstitution and to continue operations in the QRA. During this time the CAF secured approvals to disperse concentrate into ditching in vicinity of the QRA. A plan for transporting raw water from the Sylvia Grinnell River Site was developed and additional equipment was brought into Iqaluit.
- 14. <u>30 November 2021</u>. Water production operations commenced in the QRA, with CAF vehicles delivering raw water from the Sylvia Grinnell River.
- 15. <u>9 December 2021</u>. When the Chief Public Health Officer of the GN lifted the "Do Not Consume" order for Iqaluit, production of purified water at the QRA ceased. Any remaining purified water was transferred to City/Territorial holding tanks. The final amount of permeate distributed to the city was approximately 40,000 liters. The process of placing the ROWPU into preservation began, as well as the tearing down and pre-packing of equipment, in preparation for shipment back to its base of origin.

WITHDRAWAL

16. <u>10 December 2021 to 7 January 2022</u>. All CAF personnel involved in the operation were returned to their home units by 17 December 2021, excluding personnel who are permanently posted to Iqaluit. All CAF equipment was prepared for transport and held in the QRA until its return to base of origin. All equipment was removed by 7 January 2022.

Enclosure 2 – Daily Operation Log Engineering Closeout Report – Operation LENTUS 21-05

DAILY OPERATING LOG FOR OP LENTUS 21-05 – IQALUIT, NU

Date	Operations Y/N	Raw Water Drawn*	Permeate Produced	Permeate Distributed*
21 Oct 21	N			
22 Oct 21	N			
23 Oct 21	N			
24 Oct 21	N			
25 Oct 21	N			
26 Oct 21	N			
27 Oct 21	N			
28 Oct 21	N			
29 Oct 21	N			
30 Oct 21	N			
31 Oct 21	N			
01 Nov 21	Y	28,000 L		
02 Nov 21	Y	28,000 L		
03 Nov 21	Y	28,000 L		
04 Nov 21	Y			
05 Nov 21	Y			
06 Nov 21	Y	11,000 L	8,491 L	0
07 Nov 21	Y	11,000 L	18,873 L	27,000 L
08 Nov 21	Y	14,000 L	56,487 L	27,000 L
09 Nov 21	Y	14,000 L	36,556 L	11,000 L
10 Nov 21	Y	40,000 L	15,295 L	11,000 L
11 Nov 21	Y	6,000 L	22,536 L	3,000 L
12 Nov 21	Y	42,000 L	23,815 L	11,000 L
13 Nov 21	Y			11,000 L
14 Nov 21	Y	52,000 L	23,344 L	11,000 L
15 Nov 21	Y	68,000 L	3,943 L	19,000 L
16 Nov 21	Y		35,013 L	
17 Nov 21	Y	40,000 L		11,000 L
18 Nov 21	Y	22,000 L	19,511 L	9,000 L
19 Nov 21	Y	48,000 L	11,030 L	20,000 L
20 Nov 21	Y	22,000 L	18,878 L	11,000 L
21 Nov 21	Y	32,000 L	10,838 L	11,000 L
22 Nov 21	Y		16,358 L	22,000 L
23 Nov 21	Y	22,000 L	35,909 L	
24 Nov 21	N		7,853 L	
25 Nov 21	N		3,484 L	
26 Nov 21	N		12,698 L	
27 Nov 21	N			
29 Nov 21	N	30,000 L		
30 Nov 21	N	60,000 L		
01 Dec 21	Y	60,000 L	13,823 L	
02 Dec 21	Y	37,800 L	49,668 L	11,000 L

<u>UNCLASSIFIED</u>

Enclosure 2 – Daily Operation Log Engineering Closeout Report – Operation LENTUS 21-05

Date	Operations Y/N	Raw Water Drawn*	Permeate Produced	Permeate Distributed*
03 Dec 21	Y	10,500 L	6,779 L	22,000 L
04 Dec 21	Y	27,000 L	11,744 L	11,000 L
05 Dec 21	Y	55,000 L	29,897 L	13,650 L
06 Dec 21	Y	28,000 L	15,169 L	15,000 L
07 Dec 21	Y	33,600 L	13,187 L	16,000 L
08 Dec 21	Y		15,714 L	17,000 L
09 Dec 21	Y		10,491 L	22,000 L
10 Dec 21	Y		7,886 L	29,000 L
11 Dec 21	N			11,000 L
12 Dec 21	N			

^{*} Denotes water totals are approximations

Enclosure 3 – Equipment Engineering Closeout Report – Operation LENTUS 21-05

EQUIPMENT – OPERATION LENTUS 21-05

- 1. Description of operation and equipment being used:
 - a. Reverse Osmosis Water Purification Unit (ROWPU):
 - (1) Overall length -229.25" (19.1ft);
 - (2) Width -89.87" (7.5ft);
 - (3) Height 84.92" (7.07ft);
 - (4) Weight -19000lbs;
 - (5) Generator Diesel fuelled, 40 Kw;
 - (6) Capable of purifying up to 5,250 litres per hour;
 - (7) Max elevation from source to inlet (feed pump) -20ft;
 - (8) Feed capacity 264 litres per minute; and
 - (9) Distribution capacity 166 litres per min.
 - b. The ROWPU can be operated in three modes depending on the parameters of the source (raw) water. The three modes essentially produce potable water by separating dissolved solids from the raw water. During the operation we operated in the first pass mode due to the relatively cleaner raw water. This mode has the capacity to output up to 5250 ltrs per hour, this of course is also dependant on the raw water temperature.
 - c. The process for water purification in first pass mode for this operation is as follow:
 - (1) Raw water was drawn from the Sylvia Grinnell River through a diesel powered trash pump. The trash pump had a strainer on the intake and was inside of a pail on a buoy attached to a 2" armoured hose, with the outlet of the pump pushing the water into a series of onion shaped bladders hooked up in series, under modular tent in order to warm it up. The water was circulated through a water heater in order to bring the raw water to its minimum required temperature of 4 degrees Celsius;
 - (2) The raw water was pulled from the onion bladders into the ROWPU via a feed pump, which has an inlet capacity of 264 LPM. The raw water was brought into the ROWPU and passed through a self-cleaning strainer. The strainer removed small granular materials down to a nominal diameter of 60 microns, these impurities were flushed out of the strainer continuously and discharged with the return (concentrate) water;

Enclosure 3 – Equipment Engineering Closeout Report – Operation LENTUS 21-05

- (3) After the raw water leaves the self-cleaning strainer it passed through four UF modules, hooked up in series, which suspend particles that are larger than 0.02 microns;
- (4) The raw water then passed through the booster pump where it was pressurized to a level required by the process pumps. The raw water was delivered to the RO modules at very high pressure via the process pumps (2 for first pass). In the RO module the high pressure raw water was separated into clean (permeate) water, and return (concentrate water);
- (5) The permeate is pushed out to a series of terra tank bladders (capacity approx. 13000 Ltrs) and chlorinated, by an automated chlorine system, to prevent biological contamination while the water is stored; and
- (6) Once permeate was ready to be distributed it was pumped from the terra tanks into city trucks via a distribution pump which has an output capacity of 166 LPM.
- d. ROWPU ancillary equipment specifications:
 - (1) Feed pump capacity 264 LPM; discharge pressure 30 to 47 psi; 3 Hp motor;
 - (2) Self-cleaning Strainer 60 micron;
 - (3) UF module -0.02 micron:
 - (4) Booster pump max discharge pressure 39 psi; capacity 166 LPM;
 - (5) Process pump max discharge pressure 1160 psi; capacity 83 LPM; and
 - (6) Distribution pump capacity 166 LPM; discharge pressure 30 to 47 psi.
- e. Total equipment moved to Iqaluit to support operation:
 - (1) 2 ROWPU;
 - (2) 2 Heavy Equipment Support Vehicle;
 - (3) 8 five kilowatt generator;
 - (4) 2 portable lighting trailer;
 - (5) 10 Hermann Nelson heater;
 - (6) 3 fuel fired water heater;
 - (7) 7 onion style water bladder; and
 - (8) 7 terra tank enclosed bladder.

Department of National Defence (DND)

Abbreviated Environmental Effects Determination (AEED) Report

Project: Install and operate a Reverse Osmosis Water Purification Unit (ROWPU) in Iqaluit

Prepared by: Major Bernardt van Zyl

Date: 31 October 2021

Version: Final

Part 1. Project Information

1.1 Title of Proposed Project

Install and operate a Reverse Osmosis Water Purification Unit (ROWPU) in Iqaluit, NU.

1.2 Originating Directorate, Base, or Unit

The originating Establishment is Joint Task Force North as a part of OP LENTUS 21-005.

1.3 Location of Proposed Project

Latitude: 63.7638126 Longitude: -68.5772497

The project is located within the municipal boundary of the City of Iqaluit, Nunavut, Canada. The site is located on the eastern bank of the Sylvia Grinnell River and comprises of approximately 795m² in area.



Figure 1. Aerial photo showing site relative to the City of Iqaluit

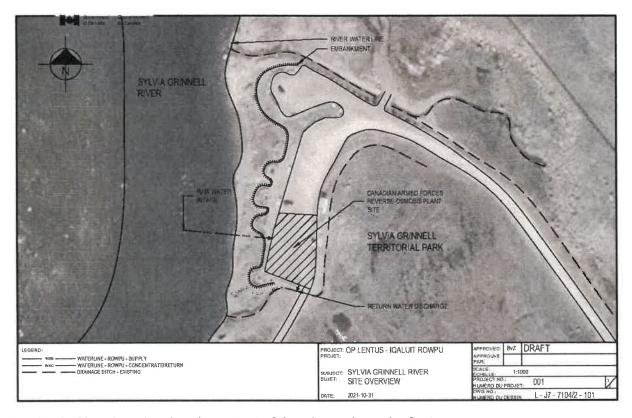


Figure 2. Site plan showing the extent of the site and nearby features.

1.4 Project Summary

CAF will install a ROWPU in Iqaluit to support the Request For Assistance (RFA) from the Territory of Nunavut. The RFA is in response to a state of emergency caused by a contamination of the city's water source or water treatment plant.

1.5 Applicability of the DND EIA Directive

This Physical Activity does not meet the definition of a project under s.82 or 83 of the *IAA* as it is not to be carried out on federal lands.

1.6 AEED Start Date

Start date of the effects determination process date is 31 October 2021.

1.7 EIA number

EIA Number:

1.7.1 Canadian Impact Assessment Registry Number

This number is provided by ADM(IE) after the Project has been submitted to the Defence EIA Portal and registered on the Canadian Impact Assessment Registry.

1.8 Provincial and Municipal Government Involvement

This physical activity is in support of the City of Iqaluit and the Territory of Nunavut. Water licensing, wash water disposal, potable water distribution and contracting support will be provided or coordinated through the City of Iqaluit.

This activity will fall under the City of Iqaluit's water licence granted by the Nunavut Water Board. Written approval will be solicited from the city confirming this prior to drawing or releasing water.

The ROWPU site is expected to generate the following quantities of water daily, these numbers are highly dependent on city's ability to haul and distribute permeate water:

Raw water draw from lake: 50,000 L/day

Permeate (potable) water production: 25,000 L/day

Return water discharge: 25,000 L/day

Wash water: 7,000 L/day

1.9 Other Federal Departments or Third Party Groups

This physical activity will take water and deposit waste under the City of Iqaluit's Nunavut Water Board License, 3AM-IQA1626. An emergency amendment was issued to the water licence on 15 October 2021 to allow water to be drawn from water sources other than the ones listed in the licence

1.10 Contacts

1.10.1 Establishment Point of Contact

a) Name: Major Scott Purcell

b) E-mail Address: scott.purcell@forces.gc.ca

1.10.2 Project OPI

a) Name: Captain Lee Morrissey

b) E-mail Address: lee.morrissey@forces.gc.ca

1.11 Other Reference Numbers (If Applicable)

Not applicable

Part 2. Environmental Effects Discussion

2.1 Applicability of the DND Abbreviated Report Criteria

This screening is being done without a legal trigger to assist with planning environmental considerations and documenting mitigations.

2.2 Accepted Mitigation Measures and Monitoring

Installation of the ROWPU and all fuel containing devices or vessels shall by placed in the gravel parking lot directly east of the river. In the event that diesel feed pumps must be installed on the river bank, they shall be placed entirely inside spill containment berms and fueled by jerry can only. Additionally a spill response kit will be permanently located at the pumps.

Waste water (from cleaning the system) must be collected and disposed of appropriately. If chlorine is used in the water treatment process, ensure that any return water does not exceed 0.02mg/L chlorine. Wash water produced during start-up, cleaning and shut-down will be collected on site in bladders and hauled by the city to the city waste water treatment plant.

Hazmat (e.g., chlorine, decontamination chemicals, POL) shall be stored in covered, secondary containment on the gravel pad as far as possible from the lake. Fueling of jerry cans from a fuel truck will only occur within the POL point's containment pad. The POL point shall be at a distance of 30m or more from the river.

Appropriate spill kits must be on site during set up, operation and removal of the ROWPU. All spills must be cleaned up immediately. In the event of a spill, initiate immediate spill response and remediate based on environmental requirements and report to Project OPI. All spills will be reported to the NT-NU Spill Line (867-975-4295, or spills@gov.nt.ca).

Return water from the ROWPU systems will be discharged into a dry drainage ditch leading to the river at least 30m from the river level. This water only contains dissolved solids already present in source water. Once daily samples will be taken of this water and supplied to municipal, territorial or federal agencies upon request for testing. The water is to be diffused and released on clean rock or a staked plastic tarp to minimize soil erosion.

The volumes of water withdrawn will be tracked and reported to the Project OPI for furtherance to the City of Iqaluit.

No plans to expand the current site. No plans to remove vegetation or soil from the site.

In and out clearances of the site will be completed to ensure mitigation measures have been implemented and have been effective.

2.3 Indigenous Community Engagement

Due to the emergency nature of this physical activity, no indigenous community engagement was completed.

2.4 Public Participation

Due to the emergency nature of this physical activity, no public participation was completed. A Public Affairs Officer has been tasked to the Operation during the deployment phase.

Part 3. <u>Environmental Effects Determination</u>

On the basis of this DND AEED Report, it is project on the environment is as follows:	nas been determined that the impact of this
The Project is not likely to cause signification can proceed.	ant adverse environmental effects. The Project
mitigated. The Project must not proceed through the appropriate chain of comma	adverse environmental effects that cannot be and must be referred to Governor in Council and before it can potentially proceed in its current ascope (parameters and/or site location) are w EDD be submitted through the Portal.
DND AEED Report Prepared by:	
Name: Major Bernardt van Zyl	OC RP Ops Det Yellowknife
C=CA, O=GC, OU=DND-MDN, OU=Personnel, OU=INTERN, CN="VAN ZYL, BERNARDI 741" 2021.103.11623.07-04'00'	31 October 2021
Signature	Date
DND AEED Report Reviewed by:	
Name: Will Wyman	Env O RP Ops Unit North
Digitally signed by WYMAN, WILLIAM 866 Date: 2021.11.01 06:49:48 -04'00'	01 November 2021
Signature	Date
DND AEED Report Accepted by: The undersigned accepts the determination a	and recommendations of this environmental effects
determination report. The undersigned also a recommendations of the report into the Projection	ccepts the responsibility to incorporate the
Name: Major Scott Purcell	TF Comd
Signature	

Simplified Environmental Study

This template should be used for site characterization of Austere Range sites and other small-scale, short-duration activities on non-DND property. Return this completed report to the JTFN HQ J Engr within 14 days after the completion of the activity.

References:							
A. L-J7-7104/2-101 – Sylvia Grinnell Riv	ver Site Overview						
3. L-J7-7104/2-102 – Sylvia Grinnell River Plant Setup							
	C. Abbreviated Environmental Effects Determination – River Site – Signed 2021-11-01						
D. Licence Agreement – Signed 2021-10							
SECTION A - REPORT PARTICUL							
Title of Activity:	OP LENTUS – Iqaluit ROWPU						
2. Date of Study/Visit:	31 October 2021						
3. Report Completed By							
a. Name:	Bernardt van Zyl						
b. Rank/Classification:	Major						
c. Position:	OC – RP Ops Det Yellowknife						
d. Phone:	867 765 8609						
e. Email:	Bernardt.vanzyl@forces.gc.ca						
Report Reviewed By							
a. Name:	Andrew Colpitts						
b. Rank/Classification:	Major						
c. Position:	JEngr JTFN						
d. Phone:	CSN 766-6029						
e. Email:	Andrew.Colpitts@forces.gc.ca						
5. Exercise On-Site Commander							
a. Name:	Scott Purcell						
b. Rank:	Major						
c. Position:	Det Comd – JTFN Det Nunavut						
6. Unit CO							
a. Name:							
b. Rank:							
c. Position:							
7. Local Site Point of Contact:							
a. Name:	Major Scott Purcell						
b. Organisation (if applicable):	JTFN						
c. Phone:	867-222-1179						
d. Email:	Scott.purcell@forces.gc.ca						
8. Land Owner or Administrator							
a. Name:	Dion FitzPatrick (Representative of)						
b. Organisation (if applicable):	Government of Nunavut						
c. Phone:	867-222-1749						
d. Email:	grinnell@qiniq.com						
9. Weather Information							
a. Temperature (°C):	-3°C						
b. Sky Conditions (clear,	Partly cloudy						
cloudy, snowing, Etc.):	r artiy Goudy						

c. Visibility (clear, reduced, Fog (XXm))	Clear
d. Ground Condition (Dry, Damp, Wet)	Bare and frozen.

SECTION B - LOCATION INFORMA	TION
(ALL LOCATIONS IN DECIMAL DEG	
Location name or name of	City of Igaluit, Nunavut
nearest town or geographic feature:	
Alternate location name:	
3. Locations (MGRS or Lat-Long)	
a. Firing Line (Left Flank):	N/A
b. Firing Line (Right Flank):	N/A
c. Target Line (Left Flank):	N/A
d. Target Line (Right Flank):	N/A
e. Left Flank Backstop (Put NA	N/A
if not applicable):	
f. Right Flank Backstop (Put	N/A
NA if not applicable):	
g. Admin Area:	63.7638126, -68.5772497
h. POL Point:	63.7642138, -68.5792429
i. Ammo Point:	N/A
j. Site Access Point:	63.7645878, -68.5787966
k. Other Locations (Indicate)	
(1)	
(2)	
(3)	
(4)	
(5)	
(6)	
(7)	
(8)	
4. Current Site Use	
a. Site	Parking Lot for Territorial Park
b. Surrounding Lands	Park
5. Historical Site Use	
a. Site	Unknown
b. Surrounding Lands	Unknown
6. Other Important Site Information:	
	k of the Sylvia Grinnell River in a parking lot for the
Sylvia Grinnell Territorial Park.	

Construction (List pertinent details, especially pre-existing damage or contamination) 1. Structures Location, size, construction type, approx. age. (Residences, Industrial, Outbuildings, Wind Turbines, Pipelines, Power Lines, etc.) 2. Transportation Roads/Bridges/Tracks/Trails 3. Vehicles List Vehicles on the site (including derelict) 4. Water-Related Construction Wells, Reservoirs, Retention Ponds, Irrigation Systems, Tile Drains, Culverts, Ditches, Boat Launches, Docks, Storm Water Drains, Septic Tanks/Beds, Storage Tanks, etc 5. Cultural Monuments, Ceremonial Sites, Cemeteries Natural Landscape 6. Terrain Hills, Berms, Cliffs, Quarries, Rock Faces 7. Vegetation Grasses, Gardens, Forested or Treed areas 8. Natural Water Bodies Creek, stream, river, lake, pond, wetland, marsh 9. Animals Nesting sites, Livestock pens, Paddocks, etc 10. Other Pre-Existing Damage / Concerns 11. Surface Contamination (e.g. oil sheen on valer, soil staining) 12. Quarrying, digging, extraction or filling 14. Soil Damage (e.g. rutting, erosion) 15. Debris or Solid Waste Mil Crosion along river bank and in drainage ditch on east side. Shelter for park display sign, 5m Lx 2m W x 2m H, wood, 10 years. Gravel road access through park. Sarble for park display sign, 5m Lx 2m W x 2m H, wood, 10 years. Shelter for park display sign, 5m Lx 2m W x 2m H, wood, 10 years. Gravel road access through park. Parking lot has drainage ditch on east side. Nil Parking lot has drainage ditch on east side. Nil Park display sign. Parking lot has drainage ditch on east side. Nil Park display sign. Parking lot has drainage ditch on east side. Nil Park display sign. Nil Parking lot has drainage ditch on east side. Nil Nil Stream, river dake, pond, wetland, marking lot his drainage ditch on east side. Nil Nil Creek, stream, river, lake, pond, wetland, marking lot his drainage ditch on east side. Nil Nil Textisting Damage / Concerns 13. Tree Cutting / Clearing Nil 14. Soil Damage (e.g. rutting, erosion) Site, Milling water tr	SECTION C - SITE DESCRIPTION (Must also	be identified on the site sketch)
1. Structures Location, size, construction type, approx. age. (Residences, Industrial, Outbuildings, Wind Turbines, Pipelines, Power Lines, etc.) 2. Transportation Roads/Bridges/Tracks/Trails 3. Vehicles List Vehicles on the site (including derelict) 4. Water-Related Construction Wells, Reservoirs, Retention Ponds, Irrigation Systems, Tile Drains, Culverts, Ditches, Boat Launches, Docks, Storm Water Drains, Septic Tanks/Beds, Storage Tanks, etc 5. Cultural Monuments, Ceremonial Sites, Cemeteries Natural Landscape 6. Terrain Hills, Berms, Cliffs, Quarries, Rock Faces 7. Vegetation Grasses, Gardens, Forested or Treed areas 8. Natural Water Bodies Creek, stream, river, lake, pond, wetland, marsh 9. Animals Nesting sites, Livestock pens, Paddocks, etc 10. Other Tre-Existing Damage / Concerns 11. Surface Contamination (e.g. oil sheen on water, soil staining) 12. Quarrying, digging, extraction or filling 14. Soil Damage (e.g. rutting, erosion) 15. Debris or Solid Waste Minor trash on site and surrounding areas, including burnt debris in fire pits to west of site. Minor trash on site and surrounding areas, including burnt debris in fire pits to west of site. Park display sign, 5m Lx 2m W x 2m H, wood, 10 years. Gravel road access through park. Roads/Bridges/Tracks/Trails Nil Parking lot has drainage ditch on east side. Parking lot has drainage ditch on east side. Parking lot has drainage ditch on east side. Parking lot has drainage ditch on east side. Nil Park display sign. Park display sign. Parking lot has drainage ditch on east side. Nil Flat with river bank to west of site. Nil Nil Nil Sylvia Ginnell River to west of site. Nil Nil Pre-Existing Damage / Concerns Nil Nil Nil Nil Pre-Existing Damage / Concerns 15. Debris or Solid Waste Minor trash on site and surrounding areas, including burnt debris in fire pits to west of site. Nil Providence of previous range activity (casings or targets found) Nil Nil Nil Refer to Ref A and Ref B for site details Parking lot has drainage ditch		
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22. Command Posts	20. Ablution Areas	
22. Command Posts	21. Kitchen / Grey Water Storage Areas	
23. Supply Points	·	
	23. Supply Points	

24. Fuelling Areas / POL Points	
25. Communications Site(s)	
26. Range / Ammunition Use	
27. Trenches or Digging	
28. Boat Launch	
29. Other Activities	

SECTION D - Site Damage Report

Complete this section only if ALL of the following conditions are true:

- 1. This report is made after the completion of a DND activity; and

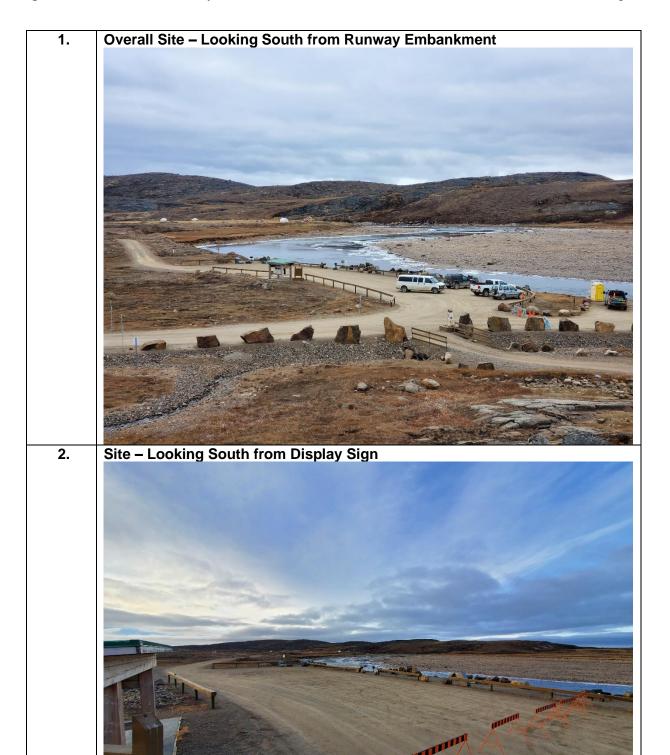
Z. THE ua	maye was causeu as a	difect result of DIND activity of the	SILE
Correspor	nding photos of dama	ge must be provided and logged	in Section F
Damaged Area	Location (MGRS or Lat/Long)	Description of Damage	Land Owner/Administrator Notified? (Yes/No)
1.			
2.			
3.			
4.			
5.			
6.			

SECTION E – Actions taken and further recommendations
General Comments/Actions Required – Insert comments regarding what actions were taken to address issues in Section D. Also include possible recommended actions by landowner or by DND. These recommendations do not constitute acceptance of any liability for damages.

SECTION F – Diagrams & Photos

Photo Log: Must have pictures of any pre-existing issues, unit activities (biv, ranges, POL point) before setup, after setup, and after tear-down, and mitigation measures implemented if applicable. Photos must be Date/time stamped

Number Description

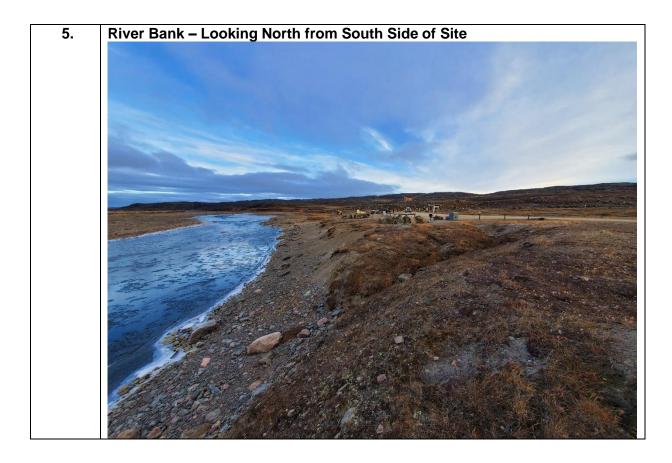


3. Park Display Sign and Structure



4. Site – Looking West from East Side of Site





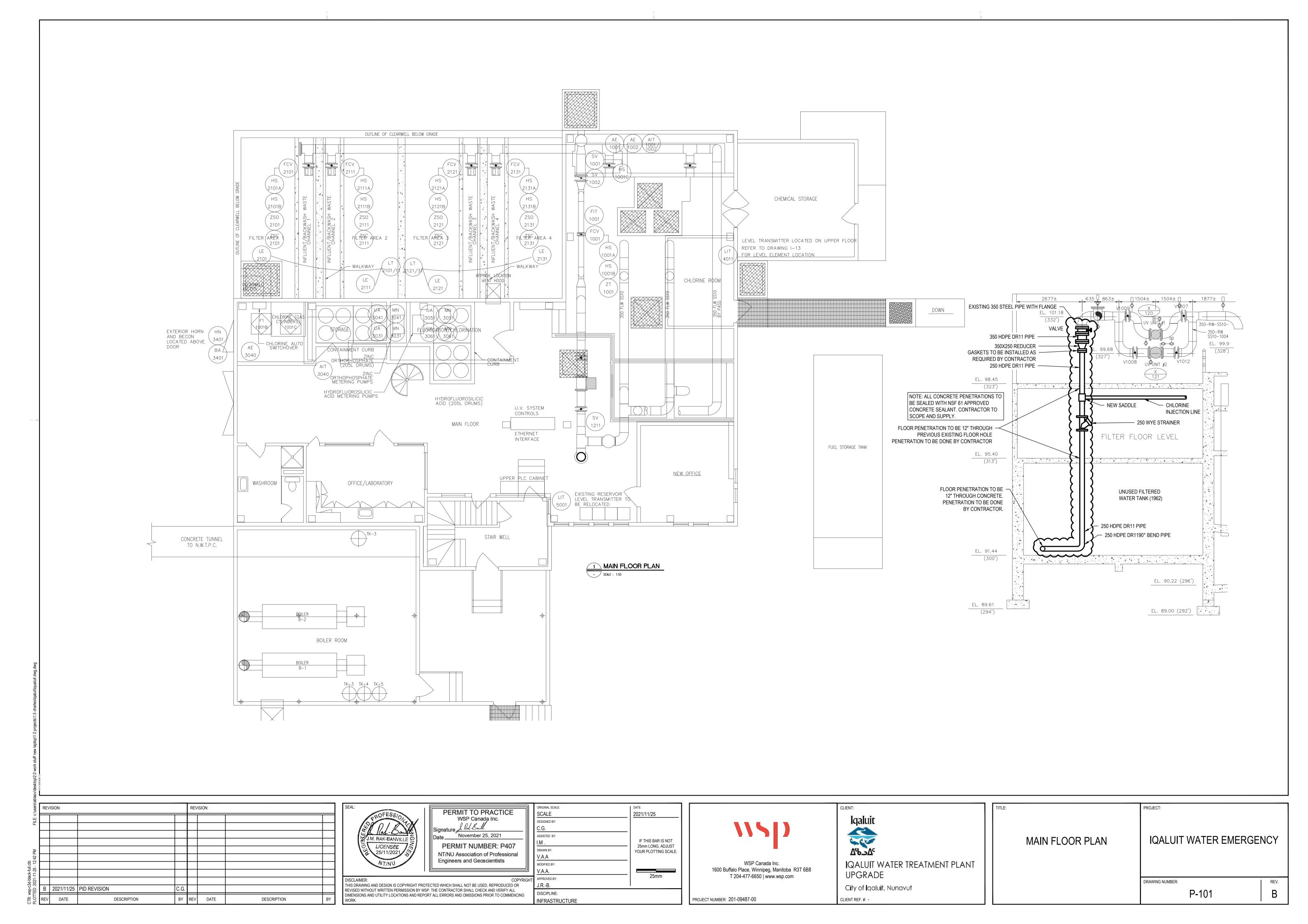
SITE SKETCH (Mandatory)	
Attached as Ref A and B	

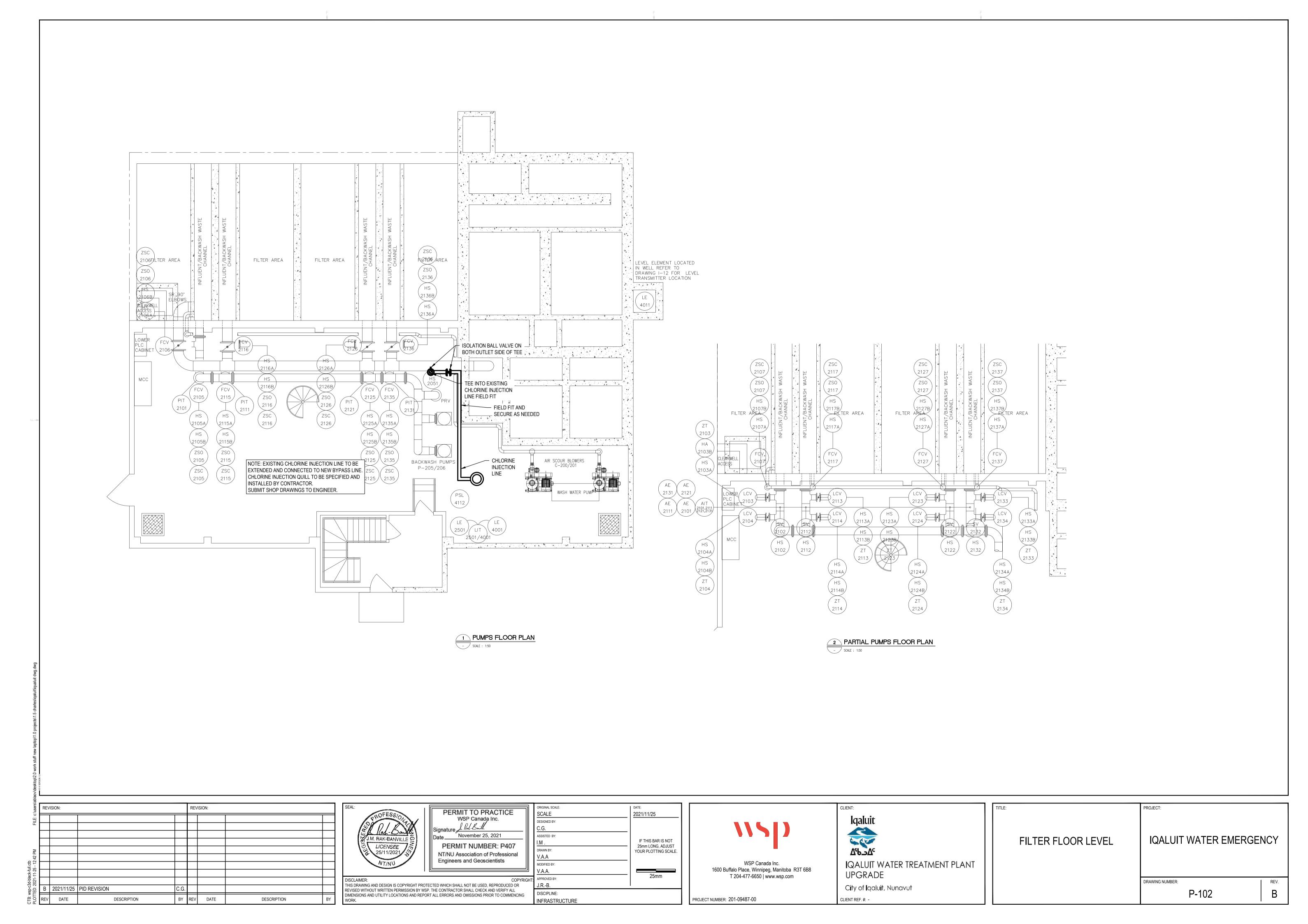
MAP BOUNDARY TRACE (Mandatory for Ranges)
N/A

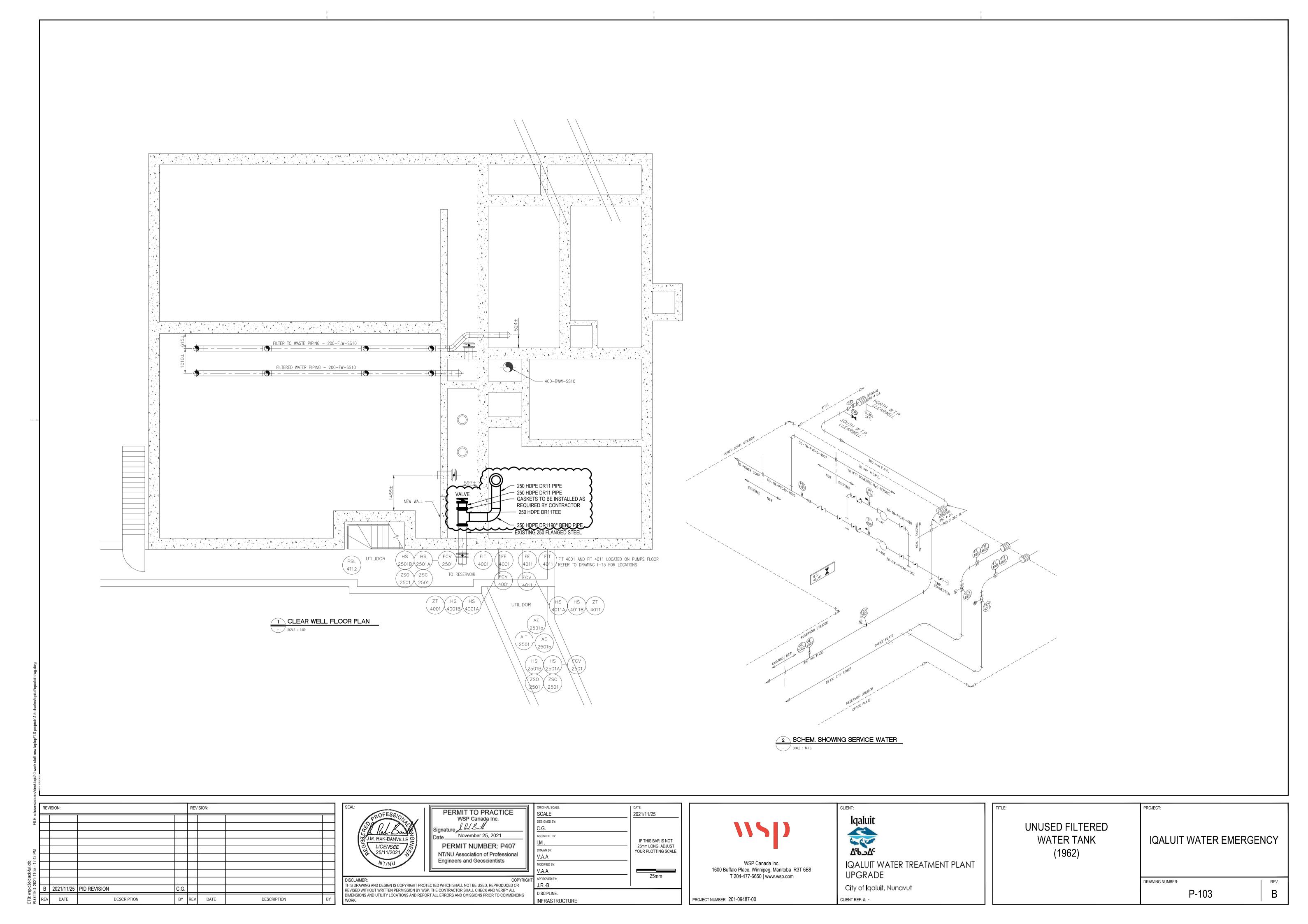
APPENDIX F WTP BYPASS DRAWINGS

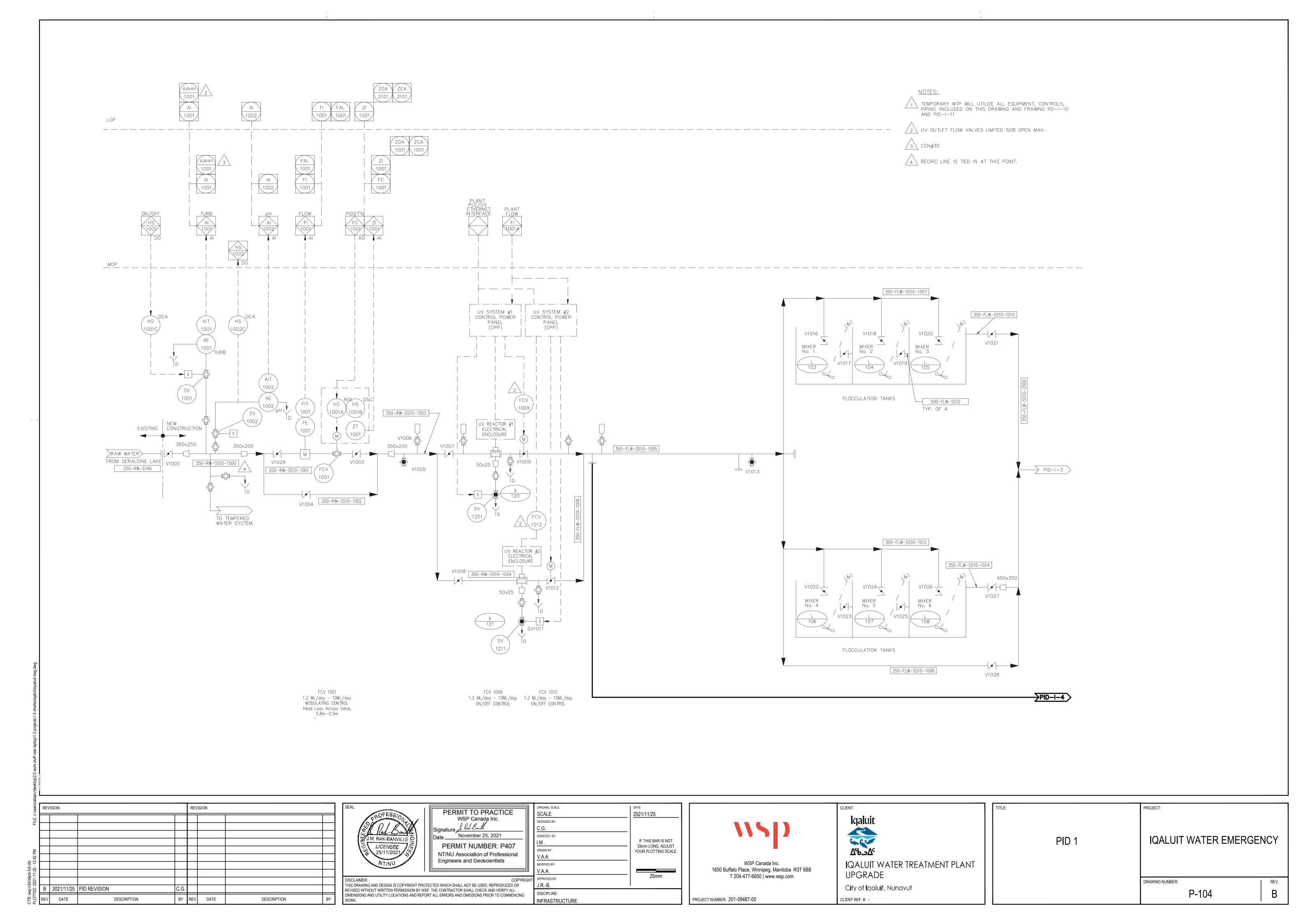
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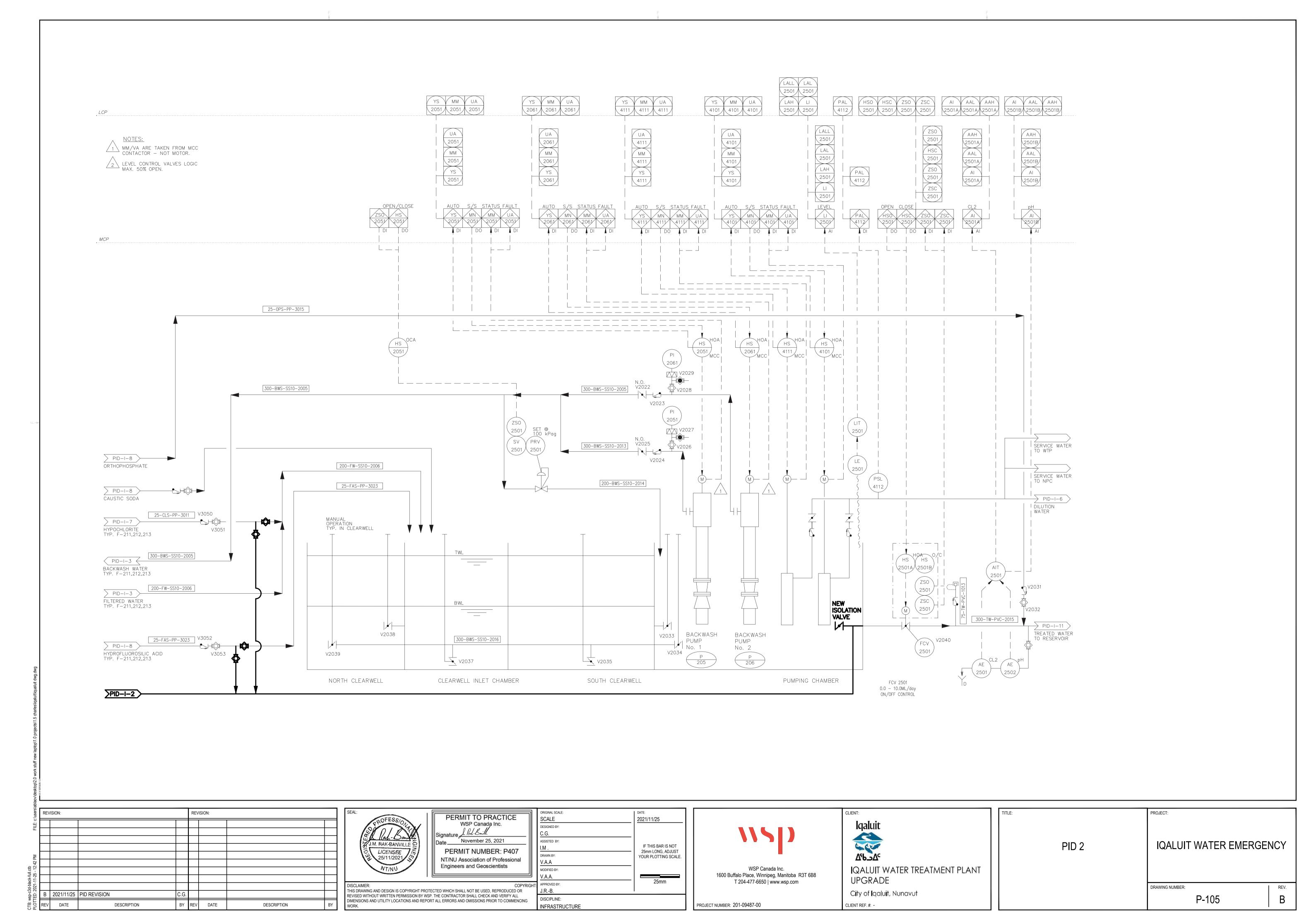
Igaluit













Igaluit



Project Summary Report:

Iqaluit 2021 Lake Geraldine Resupply (Apex Pumping): Report of Activities

Final

November 26, 2021

Prepared for:
City of Iqaluit
Iqaluit, Nunavut

Prepared by:

Nunami Stantec Limited

Project Number: 144903156

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Appendices

APPENDIX A Equipment Manifest September 17, 2021

Nunami Stantec Limited ii

Executive Summary

This report presents results of monitoring undertaken pursuant to water licence 3AM-IQA1626 Amendment No. 4, and specifically activities to be reported on per Schedule B, Item q of the licence as they pertain to the 2021 Niaqunguk River (Apex River) Supplementary Pumping Program (SPP). The 2021 SPP was completed between May 26, 2021 (kickoff meeting) and September 17, 2021 (demobilization). Works and activities completed include:

- Mobilization of equipment and infrastructure to Niaqunguk River pumping sites.
- Placement of pumps, screens, and connection to manifolds at Niagunguk River.
- Installation and operation of pumps in Niagunguk River.
- Conveyance of water from Niagunguk River to Lake Geraldine.
- Supporting activities such as power supply, maintenance, refueling, and daily monitoring.
- Demobilization of equipment and infrastructure (except semi-permanent pipeline).

Supplementary pumping from the Niaqunguk River to the Lake Geraldine Reservoir was completed between June 24 to June 28, 2021. A total of 76,320 m³ were pumped with maximum daily pumped volumes of 17,280 m³. Pumping records were maintained by the contractor at the pumping site but had not been provided to City's representative (Nunami Stantec Limited) for review and tabulation at the time of issuance of this report. No supplementary pumping occurred between June 29 and September 17, 2021, when Lake Geraldine water level was recorded at 111.295 masl, or approximately 1,667,097 m³. Equipment was demobilized thereafter.

Nunami Stantec Limited iii

Iqaluit 2021 Lake Geraldine Resupply (Apex Pumping): Report of Activities Abbreviations

November 26, 2021

Abbreviations

kilometre	km
metre	m
cubic metres per second	m³/s
milligram per litre	mg/L
City of Iqaluit	City
Fisheries and Oceans Canada	DFO
Mean annual discharge	MAD
metres above sea level	masl
Universal Transverse Mercator	UTM
	WSC

Nunami Stantec Limited iv

1 INTRODUCTION

1.1 Background

The City of Iqaluit (City) obtains and distributes potable water from Lake Geraldine, an engineered reservoir located approximately 1-kilometer (km) north of the City center. Owing to the need to supplement the reservoir in 2018 and 2019 on an emergency basis from the nearby Niaqunguk River, the City applied to the Nunavut Water Board to supplement the Lake Geraldine Reservoir from the Niaqunguk River during summer months on an annual basis until 2026 (the term of the licence). In September 2019, the City received an amendment (Amendment #4) to is type A water licence 3AM-IQA1626 to permit supplementation from the Niaqunguk River on an annual basis as and if required (the Supplementary Pumping Program – SPP) (Nunavut Water Board 2019). The SPP is facilitated by a semi-permanent pipeline from the Niaqunguk River to Lake Geraldine installed in 2019. Temporary pumping infrastructure is required to be installed and operated annually to withdraw water. Supplementary pumping (non-emergency) was previously completed during the 2020 summer season.

In May 2021, a contractor was retained by the City of Iqaluit (City) to complete the SPP during the open water season of 2021. Oversight was provided by Nunami Stantec, also under contract to the City. The objective of the SPP was to maximize the volume of water in the reservoir prior to the onset of freezing conditions in compliance with the water licence. Notably, the water licence permits a maximum of 500,000 cubic metres (m³) to be extracted from Niagunguk River for transfer to the Lake Geraldine Reservoir.

1.2 Purpose of this Report

This report presents results of monitoring undertaken pursuant to water licence 3AM-IQA1626 Amendment No. 4 and includes a summary of the 2021 Apex River Pumping Project. Items included are:

- 1. A summary of the SPP including lessons learned, based on monitoring and mitigation.
- 2. GPS co-ordinates (in degrees, minutes and seconds of latitude and longitude) and datum for the locations of all water withdrawals.
- 3. The daily and monthly quantities in cubic metres of fresh Water withdrawn from the Niaqunguk River watershed at Monitoring Station No. IQA-10.
- 4. The daily water levels and/or flow rates in the Niaqunguk River when withdrawals are occurring at Monitoring Station No. IQA-10.

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2 PROJECT WORKS AND ACTIVITIES

The 2021 SPP was completed between May 26, 2021 (kickoff meeting) and September 17, 2021 (demobilization). It should be noted that pumping activities were limited to a few days in June (June 24-28). Works and activities completed include:

- Mobilization of equipment and infrastructure to Niaqunguk River pumping sites.
- Placement of pumps, screens, and connection to manifolds at Niagunguk River.
- Installation and operation of pumps in Niagunguk River.
- Conveyance of water from Niagunguk River to Lake Geraldine.
- Supporting activities such as power supply, maintenance, refueling, and monitoring.
- Demobilization of equipment and infrastructure (except semi-permanent pipeline).

The location of works and activities is shown in Figure 2-1. The Niaqunguk River pumping site was previously setup in 2018 and 2019, and the location in 2020 was fixed by the need to connect to a semi-permanent pipeline installed in 2019, and the location of a Water Survey of Canada (WSC) hydrological monitoring station located immediately upstream of the pumping site. The 2021 SPP followed the same protocol and operation as in 2020.

Water was pumped from the Niaqunguk River using three high-head 94 Hp submersible pumps and conveyed overland to Lake Geraldine. Pumps were housed in a screened cage to meet the Fisheries and Oceans Canada (DFO) Freshwater Intake End-of-Pipe fish Screen Guidelines (Department of Fisheries and Oceans 1995). Pumping took place continuously between June 24, 2021 and June 28, 2021. All temporary infrastructure and equipment were demobilized by September 17, 2021. An access trail and semi-permanent pipeline between the Niaqunguk River and Lake Geraldine have remained in place for future pumping requirements.

A total of 76,320 m³ were withdrawn from the Niaqunguk River and directed to Lake Geraldine during the SPP in 2021. Lake Geraldine was filled to the spillway elevation by June 28, 2021 and continued overflowing for a period of time due to natural recharge. Pumping was not required during the remainder of the open water season, with the Lake Geraldine water level recorded at 111.295 masl, or 1,667,097 m³ on September 17, 2021. Pumping rates were at the maximum pumping capacity (~200 L/s) over the pumping period. Lake Geraldine levels are summarized in Figure 4-1.

Prior to, during and after supplementation activities, Nunami Stantec conducted daily monitoring of river discharge and Lake Geraldine levels (WSC stations), as well as daily monitoring and guidance of pumping rates to the contractor (Tower Arctic Ltd., TAL).

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Figure 2-1 Iqaluit 2021 Apex Pumping Project Site Overview



2-1 Nunami Stantec Limited

3 OPERATIONAL MONITORING PLAN

The Operational Monitoring Plan was designed to be implemented during water withdrawal activities to maintain compliance with Type A Water Licence 3AM-IQA1626 and discussions with the Water Licence Inspector and DFO.

The objective of monitoring activities was to observe hydrologic conditions in Niaqunguk River during pumping operations and to inform changes in pumping rates that were required variably throughout the program. Water withdrawals of less than 10% of Instantaneous Flow (IF) when natural flows in the Niaqunguk River are below 30% of Mean Annual Discharge (MAD), are permitted without additional authorization by DFO. Nunami Stantec used WSC station data to advise TAL on when pumping operations could begin and when pumping rates needed to be changed based on river flows. Each day levels in Lake Geraldine and flows in Niaqunguk River were obtained from WSC stations, while comparing pumping logs provided by TAL, to advise on the maximum pumping rates to remain within withdrawal limits.

A summary of monitoring locations and activities completed during the program is presented in Table 3-1.

Table 3-1 2021 Monitoring Location Summary

Monitoring Location ID	Latitude	Longitude	Monitoring Parameter	Method	Data Source (Nunami Stantec, Contractor, or WSC Location)
SNP IQA-10	63.760535	-68.475915	Pumped Flow and Volume	Volumetric Flow Meter	Contractor
"Apex River at Apex" (station ID: UH10UH002)	63° 44' 09"	68° 27' 05"	Water level and flow data for Niaqunguk River approximately 4 km downstream of pump site	Access data online	wsc
"Apex River 1km Above Bridge to Nowhere" (station ID: 10UH015)	63° 45' 41"	68° 28' 37"	Water level immediately upstream of Apex pump site	Access data online	WSC
"Lake Geraldine Near Iqaluit" (station ID: 10UH013)	63° 45' 23"	68° 30' 15"	Water level in Lake Geraldine	Access data online	WSC

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4 METHODS & RESULTS

The intent of the daily monitoring program was to maintain compliance with the water licence, and to monitor, record, and analyze the effects of the 2021 Apex River Pumping Project on the natural system. The following sections describe the methods undertaken to collect data during the 2021 SPP.

4.1 Water Withdrawal Pumping Volumes

Permitted extraction volumes for the 2021 SPP were limited to 10% of IF at the withdrawal location when flows were above 30% MAD in the Niagunguk River.

Daily, Nunami Stantec recorded the following data and observations:

- Average daily flows recorded at WSC "Apex River at Apex" station 10UH002 (WSC Apex) were downloaded and analyzed
- Daily average pump volumes at SNP IQA-10 as recorded by the contractor on an hourly basis and provided to Nunami Stantec; average pump rates were calculated for the daily period when pumps were operational.

To calculate 30% MAD, Nunami Stantec used the available period of record for the WSC Apex River at Apex station 10UH002 from 1973 to 2017 (> 35-year record and excluding 0 values). Nunami Stantec calculated a MAD of 1.056 m³/s, which equates to a 30% MAD of 0.316 m³/s (Nunami Stantec 2019).

Pumping from the Niaqunguk River to the Lake Geraldine Reservoir was completed between June 24 to June 28, 2021. A total of 76,320 m³ were pumped with maximum daily pumped volumes of approximately 17,280 m³. Pumping records were maintained by TAL at the pumping site but complete records had not been received by Stantec at the time of submission of this report.

Nunami Stantec Limited 4-1

4.1.1 Operational Challenges

Operationally, the system performed as per the design. Based upon learned knowledge from previous years and emergency supplementations completed in 2018 and 2019, and the non-emergency operation of the Apex River semi-permanent infrastructure, Nunami Stantec and the City understood the challenges with operation and importance of daily monitoring for compliance with the water licence. Different from 2018 and 2019, the system was operational during the spring melt and Lake Geraldine was filled with water captured during the Niaqunguk River spring freshet, as the system was operated in 2020.

Two challenges were identified earlier in the project.

1. WSC Stations Data Availability

WSC stations require spring setup by WSC staff every year, including calibration. Due to Covid-19 related travel restrictions, WSC was delayed in setting up these stations and bringing data online. This setup was able to be completed before pumping operations began. Future pumping should be aware of this potential data limitation.

2. Ice at Niaqunguk River

The SPP was planned to be initiated at the start of freshet when flows in the Niaqunguk River were highest. Ice-cover of the Niaqunguk River was present in June of 2021 as in 2020. The contractor was required to break ice and prepare the location for pumping operations. We This will likely occur during each year of pumping.

4.2 Niaqunguk River Flows

The Water Survey of Canada (WSC) Station 10UH015 (Apex River at 1 km above Bridge to Nowhere) was not reporting discharges and the downstream WSC Station 10UH002) was not operational leading up to, and during, the pumping operations. Therefore, flows at the Flows in the Niaqunguk River were measured by Stantec leading up to, and during, the pumping operations in the river. The flow measurements were obtained using the mid-section method and an Acoustic Doppler Velocimeter (Sontek Flowtracker2).

Table 4-1: Niagunguk River Flow Measurements

Date	Measured Flow (m ³ /s)		
Tuesday, June 22, 2021	3.310		
Thursday, June 24, 2021	3.695		
Monday, June 28, 2021	1.839		

All flow measurements during the active pumping period showed flows to be above 30% MAD. The maximum pump capacity (200 L/s) was permitted if 200 L/s was less than 10% of the river flow; therefore given that river flow was greater than 2 m³/s during pumping operations, maximum pumping rates were permitted from June 24-28, 2021. The June 28, 2021 flow measurement, which was slightly below 2 m³/s, coincided with ceasing of pumping for 2021.

Nunami Stantec Limited 4-2

November 26, 2021

4.3 Lake Geraldine Water Level

Water levels in the Lake Geraldine Reservoir were monitored throughout the 2021 SPP using WSC data from the Lake Geraldine Near Iqaluit station (Station 10UH013). Water levels in the Lake Geraldine Reservoir were higher in the spring of 2021 compared with the previous three years. This increase in water levels compared with previous years may be due to the City's continued efforts to reduce leaks and wastage throughout the system. In general, 2021 was a high-water year and minimal pumping was required to supplement the Lake Geraldine storage volumes. Water levels remained just below the reservoir spill point into mid-September as seen in Figure 4-1. Compared to the previous two years of pumping, the reservoir was filled to its spill point earlier in the summer, largely due to the high meltwater contributions during freshet. Early initiation of pumping activities while flows are highest, is recommended in future years. A summary of Lake Geraldine water levels for 2021 is shown in Figure 4-1.

Nunami Stantec Limited 4-3

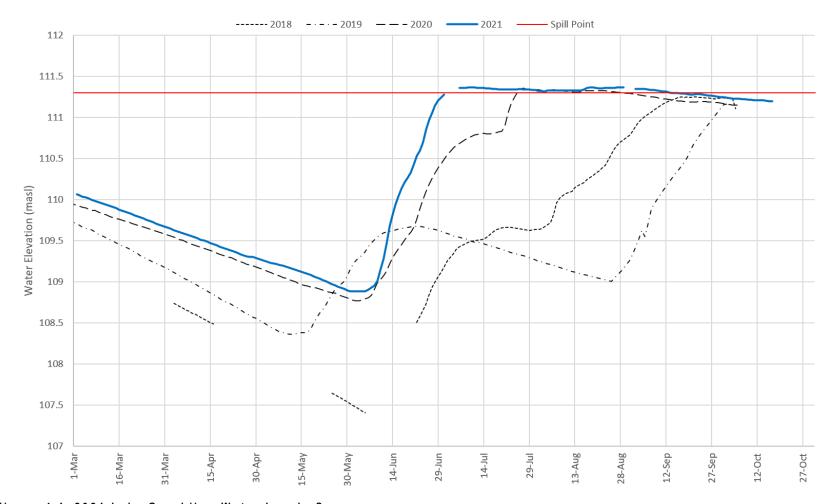


Figure 4-1 2021 Lake Geraldine Water Levels Summary

5 DEMOBILIZATION

Demobilization occurred in September and was concluded on September 17, 2021 with a formal equipment handover from TAL to the City. On this day, Nunami Stantec, the City (Shane Turner), and TAL (Eric Jacobsen) participated in a formal equipment handover. The manifest from this handover can be found in Appendix A.

Two low point drains were installed along the pipeline route in September.

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6 CONCLUSION

Pumping from the Niaqunguk River to the Lake Geraldine Reservoir was completed between June 24 to June 29, 2021 in accordance with water licence 3AM-IQA1626 Amendment No. 4. A total of 76,320 m³ were pumped with a maximum daily pumped volume of approximately 17,280 m³. Pumping records were maintained by the contractor at the pumping site but had not been provided to Stantec at the time of writing. Pumping was not required later in the summer / early fall with the Lake Geraldine water level recorded at 111.295 masl, or 1,667,097 m³ on September 17, 2021.

Lessons learned during the 2021 pumping program that should be considered in future years pumping programs include:

- Be prepared to complete field flow measurements at the pumping site before ice break up in the event that WSC stations are not online, to avoid delay in pumping.
- Follow up with WSC regarding the ongoing development of a rating curve for the Apex Above Bridge to Nowhere station 10UH015. Once this curve is verified and discharge data published during the pumping period, pumping activities can be determined based on water level measurements alone at the pumping site.
- Have a flow measurement device (e.g., Flowtracker2) available in case WSC stations are not reporting the required data when it is needed (for reasons of station malfunction or maintenance issues).
- Be prepared to facilitate some ice breakup at the pumping site so that pumping operations are not delayed if ice is present during freshet flows.
- Within the Request for Tender, request a contractor standby rate for non-pumping periods that require only site security and no active pumping.
- Contractor to provide records daily in 2022.

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7 LIMITATIONS

This document titled Final Report: Iqaluit 2021 Lake Geraldine Resupply (Apex Pumping): Report of Activities was prepared by Nunami Stantec Ltd. ("Nunami Stantec") for the account of the City of Iqaluit (the "Client"). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Nunami Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Nunami Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Nunami Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Nunami Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

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8 CLOSURE

Nunami Stantec Ltd. has prepared this report for the sole benefit of the City of Iqaluit (the City) for the purpose of summarizing the results from water withdrawal and environmental monitoring during the supplementary pumping from the Niaqunguk River in June 2021. This document was prepared to summarize pumping activities from the 2021 pumping program. The report may not be relied upon by any other person or entity, other than for its intended purposes, with the express written consent of Nunami Stantec Ltd. and the City. Any use of this report by a third party, or any reliance on decisions made based upon it, are the responsibility of such third parties.

The information provided in this report was compiled from existing documents and data provided by the City, and by field data compiled by Nunami Stantec Ltd. This report represents the best professional judgement of our personnel available at the time of its preparation. Nunami Stantec Ltd. reserves the right to modify the contents of this report, in whole or in part, to reflect any new information that becomes available. If any conditions become apparent that differ significantly from our understanding of conditions presented in this report, we requested that we be notified immediately to reassess the conclusions provided herein.

Respectfully Submitted,

NUNAMI STANTEC LIMITED

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Iqaluit 2021 Lake Geraldine Resupply (Apex Pumping): Report of Activities Appendix A: Equipment Manifest October 2, 2020

November 26, 2021

APPENDIX A

Equipment Manifest September 17, 2021



Equipment Manifest and Project Closeout

To:

Arny Elgersma, CAO

From:

Matt Follett, M.A.Sc., P.Eng.

City of Iqaluit

Nunami Stantec Ltd.

File:

144903156

Apex Pumping 2021

Date:

September 17, 2021

Reference: 144903156 _ Apex Pumping 2021 _ Equipment Manifest and Project Closeout

The Lake Geraldine Resupply of 2021 included pumping from the Apex River directly to Lake Geraldine. To complete this task, a number of items were mobilized permanently in 2019 (i.e. Apex River 300mm pipe), however, other items required demobilization and return to the City of Iqaluit (City) Coke Plant (City-owned equipment). Work was carried out by Tower Arctic Ltd.

At this time, it is understood that partial disconnection of electrical and fuel components has occurred. Demobilization was completed, with equipment handover to the City, on September 17, 2021.

The following list summarizes the equipment returned following the project demobilization. If any items have been missed from this list, please make note of them in the rows provided at the end of the table and have all parties sign.

Item	Notes	Signoff (Initials)			
		City of Igaluit	Nunami Stantec	Tower Arctic	Notes
Apex Pumps	The City owns the three (3) pumps that were used in the Apex Pumping project. It is understood that these are at the Coke Plant. Pumps: Sulzer ABS submersible drainage pump (J604, spec sheet attached for records)	5.4.	W	A	Outside. Will be moved inside by City.
Apex Fish Screens	It is understood that these are at the Coke Plant.	s.t.	Fr	4	Outside. Will be moved inside by City.
Operator Shack	The operator shack has been delivered to the Coke Plant. Please confirm location in a note.	s.t.	MJ.	H	Outside
Manifolds	1 x Apex	5.+.	M	E.	Outside. Will be moved inside by City.
Flow Meters	3 x Apex	5.7.	m	ZAS.	Outside. Will be moved inside by City.

+ Pump CONTROLS SEACON + GENERATOR SEACON
Design with community in mind

要

fm https://stantec-my.sharepoint.com/personal/matt_foliett_stantec_com/documents/active/144903156 _ apex pumping 2021/02_ca/02_04_projectcloseout/144902988 _ equipment manifest and project closeout _ 10012020.docx

September 17, 2021 Matthew Hamp, City of Iqaluit Page 2 of 3

Reference:

144903156 _ Apex Pumping 2021 _ Equipment Manifest and Project Closeout

Hoses	Flexible hoses used for connection from pumps to manifold.	5.1.	M	E.J	In green seacan
Electrical Cable and Equipment (Panels, Soft Starts)	Container for generator and pump panels has been delivered to the Coke Plant.	5.1.	M	E.J	In green seacan
Apex Generator	The City-owned generator was used in the 2020 resupply program and has been delivered to the Coke Plant.	5.5	M	E.J	Grey seacan
Fuel Tanks	The City owns one fuel tank for the system and an additional tank has been quoted within CO No. 3. *Confirm what was delivered in notes	s.t.	M	E.J	Outside.
Fuel Pipe and Valve	CO No. 3 indicates some piping and a fire valve to be purchased by the City. *Confirm what was delivered in notes	s.T.	M	E.J	In seacan
Outhouse		5.T.	M	E.J	Outside
Additional Fuel in Tanks	5,555 L total	5.4.	M	E.J	Included on final PC

September 17, 2021 Matthew Hamp, City of Iqaluit Page 3 of 3

Reference:

144903156 _ Apex Pumping 2021 _ Equipment Manifest and Project Closeout

All parties in attendance of this equipment handover have initialed above in agreeance of the accuracy of this document. Field review of equipment was completed between 13:30 – 14:30 on Friday, September 17, 2021. In attendance were:

- Shane Turner, City of Iqaluit
- Eric Jacobsen, Tower Arctic Ltd.
- Matt Follett, Nunami Stantec Ltd.

There are no outstanding items related to this project.

Nunami Stantec Ltd.

Matt Follett, M.A.Sc., P.Eng. Associate Civil Engineer

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Email: Matt.Follett@stantec.com