



## **ATTACHMENT 18**

### **LTWP Detailed Design Report - Appendix C - Geotechnical Workplan**

# Appendix C

## Geotechnical Investigation Report

City of Iqaluit

# Workplan for Geotechnical Investigations

**Long Term Water Program – Supply and Storage  
Iqaluit, Nunavut**

February 2024



Workplan for Geotechnical Investigation  
Long Term Water Program – Supply and Storage  
Iqaluit, Nunavut

# Workplan for Geotechnical Investigations

**Long Term Water Program – Supply and Storage**

**Iqaluit, Nunavut**

February 2024

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## Acronyms and Abbreviations

Arcadis	Arcadis Canada Inc.
ABA	Acid-Base Accounting
ABG	Adaptive Baseline Geotechnical Ltd.
ARD	Acid Rock Drainage
CIRNAC	Crown–Indigenous Relations and Northern Affairs Canada
City	City of Iqaluit
cm	centimetres
CS	Crosshole Seismic
CSA	Canadian Standards Association
DFO	Fisheries and Oceans Canada
DS	Downhole Seismic
GBR	Geotechnical Baseline Report
GPS	Global Positioning System
HASP	Health and Safety Plan
LG	Lake Geraldine
LQ	Lake Qikiqtaalik
LTWP	Long Term Water Program
masl	metres above sea level
mbgs	metres below ground surface
m	metre
mm	millimetres
SPMDD	Standard Proctor Maximum Dry Density

# 1 Introduction

This workplan has been prepared by Arcadis Canada Inc. (Arcadis) for the City of Iqaluit (City) and establishes the procedures to be followed to complete geotechnical investigations for the Long-Term Water Program (LTWP) – Supply and Storage project. These investigations will assist in assessing existing site features and underground conditions at the project site in Iqaluit, Nunavut, shown in **Figure 1**. Field work associated with these investigations will begin in early 2024.

This workplan has been prepared in accordance with the requirements outlined in Appendix G – *Supplementary Scope of Work of the Request for Proposal 2023-RFP-048* issued by the City of Iqaluit, the *Screening Decision Report No.: 23YN040* prepared by Nunavut Impact Review Board (NIRB) dated November 2, 2023, and applicable Northern Infrastructure Standardization Initiative standards.

## 1.1 Project Site

The project site is located within the municipal boundary of the City, at and between the following water bodies: Lake Geraldine (LG), an unnamed grouping of two lakes to be flooded to create a new reservoir (New Reservoir), the Niaqunnguk River (Apex River), and Lake Qikiqtalik (LQ). The site consists primarily of undeveloped tundra.

Site details including the location of key water bodies are shown in **Figure 2**.

## 1.2 Background

The LTWP involves the design and construction of new infrastructure for the City's water supply to meet population growth projections. Information on the project design is in the development phase. Based on the concept design the new infrastructure is anticipated to include the following:

- Construction of a reservoir using a rock-fill dam and dykes around an unnamed grouping of two lakes located northeast of LG;
- The construction of a pump station at Lake Qikiqtalik (LQ); and
- Construction of a pipeline to convey water from the LQ to the new reservoir.

To advance the engineering design of these upgrades, and ahead of future permitting phases, geotechnical field investigations are required to support foundation and construction designs.

## 1.3 Subcontractor

The services of Adaptive Baseline Geotechnical Limited (ABG) have been retained by Arcadis to complete the proposed geotechnical investigations. ABG are experienced in geotechnical drilling work in the Arctic and have extensive experience designing structures on permafrost soils. Furthermore, ABG is experienced in topographic/bathymetric survey and has an office in Iqaluit.

ABG operates in conjunction with Canadrill, an independent drilling subcontractor based in Iqaluit. Drilling equipment for the project will be supplied and operated by Canadrill, under the supervision of ABG and/or Arcadis.

## 2 Scope of Work

The purpose of these geotechnical investigations is to study the surface and subsurface conditions of proposed locations for the future pump station, key areas along the proposed conveyance, potential borrow areas, the reservoir area, and the proposed retention structure footprints. Geotechnical information is required to inform structure foundation designs, blasting/excavation programs, retention structure design and overall program feasibility. Various geotechnical parameters must be obtained from site-specific samples to proceed with design, permitting and construction activities.

As per the Request for Proposal 2023-RFP-048 issued by the City, the geotechnical investigation is to include the following:

- If permafrost is encountered, its ice content will be recorded;
- If unfrozen soil is present, perform Shelby Tube tests, Atterberg limits, sieves, and soil chemistry as necessary;
- Determine Rock Quality Designation (RQD) of recovered rock core;
- Collect and preserve samples of intact bedrock core for determination of unconfined compressive strength, shear strength and associated parameters;
- Carry out permeability tests at the borehole locations;
- Determine in-place unit weights for soils and rock samples;
- Install monitoring wells in boreholes and collect information on stabilized groundwater levels to infer groundwater flow direction;
- Obtain samples of each soil type encountered, the first sample being at a depth not greater than 750mm and succeeding samples at not more than 1500mm increments of depth. Record whether samples are dry, moist, or wet;
- Record penetration values of Standard Penetration Test at the top of each soil stratum commencing at 750mm depth and at increments not greater than 750mm down to appropriate bearing stratum;
- Restore the Site to its original state upon completion of on-Site work;
- Develop a geotechnical investigation report which includes but is not limited to: (a) subsurface profiles showing rock and soil materials and geological formations, including presence of faults, buried channels, and weak layers or zones where encountered; and (b) characteristics and properties of soils and the weaker types of rock; and
- Remove monitoring wells per applicable regulations upon completion of the project.

It has been further requested that laboratory test results be submitted to the Nunavut Impact Review Board (NIRB) as well as Crown–Indigenous Relations and Northern Affairs Canada (CIRNAC) regarding the acid rock drainage and metal leaching potential of encountered bedrock. The results should include locations (latitude/longitude) where acid rocks have been encountered, including discussion of results of the geochemical test programs which have been performed on the materials to determine acid generation and contaminant leaching potential.

In order to meet the objectives specified and obtain other information required for the proposed structure and system designs, the following items are proposed as a preliminary geotechnical investigation program:

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1. Prepare a site-specific Health and Safety Plan (HASP);
2. Incorporate publicly available information (e.g., Geological Survey of Canada maps) obtained during the Conceptual Design Phase and observations from the preliminary site visit conducted in September 2023 into the strategy for site-specific geotechnical investigation;
3. Advance boreholes at 27 locations using a combination of air-rotary and coring drill methods. The boreholes will be advanced during two different mobilizations: air rotary drilling requires larger drilling equipment and site access will thus be easier during the winter/spring months; coring operations require flowing water as a lubricant and can only be performed during the summer/autumn.

A brief summary of proposed boreholes is provided here; a detailed borehole rationale is provided in **Table 1** and proposed borehole and test pit locations are shown in **Figures 3-5**:

- Ten locations under the Dam 1 alignment to assess characteristics including depth of overburden, solution cavities, fissures, orientation of joints, gouge zones, faults, etc;
  - Eight locations under the alignments of the remaining proposed Dyke/Spillway for the same;
  - Four locations in the proposed reservoir footprint to a target elevation of 115masl to assess rock characteristics needed to develop the blasting and excavation plans;
  - Two locations in the Apex River and one (1) adjacent the river to assess the overburden and rock characteristics needed to develop river crossing foundation designs;
  - One location at the proposed quarry location adjacent the Road to Nowhere to assess rock characteristics needed to develop the blasting and excavation plans; and
  - One location at the proposed Pumphouse location to assess rock characteristics for structure foundation design and wet well construction.
4. Advance test pits at 14 locations using a locally procured excavator to assess potential borrow sources, obtain material samples, and investigate key areas along the proposed pipeline from LQ to NR. Test pits will be advanced to bedrock or a maximum depth of three meters below ground surface (mbgs);
  5. Perform a program of in-situ and laboratory testing to obtain required geotechnical parameters. Please refer to Section 3.7 for more details;
  6. Install thermistors in ten boreholes to assess subsurface temperatures, obtain existing baseline data and confirm presence/absence of taliks, ice lenses, etc.;
  7. Install piezometers and/or perform packer testing in 11 boreholes to confirm groundwater levels (if present), groundwater flow direction, and estimate rock mass permeability;
  8. Perform downhole geophysical testing to obtain site-specific seismic response values needed for design; and
  9. Prepare draft and final geotechnical reports outlining the findings of the investigation. A Geotechnical Baseline Report, as specified in RFP documents, will be provided under separate cover to be included as part of the project's construction tender documents.

In accordance with the Supplementary Scope of Work of the Request for Proposal 2023-RFP-048, written approval will be obtained before exceeding the estimated cost of work, either in field or in the laboratory.

## 3 Field Investigation and Methodology

### 3.1 Health and Safety Plan (HASP)

A site-specific HASP has been prepared by ABG for these geotechnical investigations. The HASP provides specific guidelines and established safety practices and procedures for the field activities associated with this project (e.g., drilling and test pitting). The HASP includes the requirements for wearing appropriate personal protective equipment, project safety training, potential hazards, contingency plans, and emergency contact information. The HASP will be reviewed and understood by all Arcadis and ABG field personnel prior to commencing any field work. All Arcadis and ABG field personnel will have received the proper health and safety training prior to the start of the field program.

Field teams will be fully briefed and will have a copy of the HASP available on site during any field activities. At the start of fieldwork a site-specific Health and Safety Tailgate meeting will be held to review all hazards and control measures specific to the work that day. A tailgate attendance form will be signed by all personnel involved in the day's work. At any point when the scope of work changes or previously unrecognized hazards arise, work will cease and a brief additional Tailgate Meeting will be held to update the form and agree upon a safe course of action.

### 3.2 Utility Clearance

The City has confirmed that no buried utilities (e.g., water, sewer, fuel, electrical etc.) are known to be present within the site boundaries shown in **Figure 2**. Aboveground utilities associated with the emergency water pumping activities from Apex River and LQ are present at the site. All drilling and test pitting activities will be conducted at least 3m from these aboveground utilities.

Should underground services be identified, the services will be located before continuing intrusive activities in the area. A copy of the locates performed will then be provided to the City.

### 3.3 Boreholes

Borehole advancement will take place over two mobilizations. The larger air hammer equipment requires frozen ground/water, as such the first mobilization will occur during the winter months. The coring rig is ATV-transportable and requires flowing water for operation so the second mobilization is planned for the summer of 2024. This second mobilization will also include the proposed test pits and material sampling, which require the ground to be thawed.

All drilling and excavating activities will be conducted in general accordance with Canadian National Standard CAN/BNQ 2501-500: *Geotechnical Site Investigations for Building Foundations in Permafrost Zones*, Canadian Standards Association (CSA) PLUS 4011:19 *Technical guide: Infrastructure in permafrost: A guideline for climate change adaptation*, and CSA W205:19 *Erosion and sedimentation management for northern community infrastructure*. Borehole logging will be in general accordance with ASTM D2487 *Standard Practice for Classification of Soils for Engineering Purposes* and ASTM D4083 *Standard Practice for the Description of Frozen Soils*.

A preliminary site visit has been conducted and proposed borehole locations are shown in **Figures 3, 4 and 5** attached at the rear of this report. **Table 1**, also included at the rear of this report, provides the rationale for borehole placement. Several locations have air hammer and coring holes co-located in order to obtain the required geotechnical information to properly inform the relevant structure design.

### 3.3.1 Air Hammer Boreholes

The initial mobilization will consist of the air hammer drill rig. This equipment is capable of operating in winter conditions, with the snow cover making it possible to traverse the tundra with minimal impact. Support vehicles will include skidoos with sleds to transport the peripheral machinery, supplies and fuel. For more information on mobilization and preventative measures, please refer to the refueling, spill control, and erosion and sediment control plans provided in **Appendices A, B, and C**, respectively.

The air hammer drill rig will be supplied and operated by Canadrill under the supervision of ABG. This equipment is capable of penetrating the overburden (boulder fields), proving the depth to competent rock, clearing borehole locations, and operating in winter conditions. Boreholes will be advanced one run at a time, with drilling conditions monitored and logged as the bit progresses. Boreholes will be advanced to a minimum depth of 5m below the elevation deemed to be competent rock surface, or until equipment refusal.

These boreholes will be used to evaluate stratigraphy, bedrock profile, ground temperature profile (through the installation of thermistors, where indicated), in-situ ice content, and other observations. As a part of the initial air hammer drilling, ABG will use a downhole camera to further evaluate bedrock quality (e.g., initial assessments of weathering, fracture regimes, infilling, RQD, etc.). All of these parameters will be used to inform the detailed design process. Rock chip samples, suitable for ABA and shake flask testing, will also be obtained by air hammer drilling.

Two boreholes (AT2023-22 and AT2023-23) are proposed in the Apex River, to prove depth to rock for pipeline crossing foundations. These boreholes can only be advanced after the river has frozen solid. A Department of Fisheries and Oceans Canada (DFO) permit will be required to perform this work. No flowing water is expected, and drill procedures will be largely the same as on land. Additional precautions specified as part of the permitting process will be followed.

Thermistors and/or piezometers will be installed in air hammer boreholes to allow for modelling of the thermal/groundwater regimes in the area. A detailed borehole rationale is provided in **Table 1** and proposed borehole locations are shown in **Figures 3-5** attached. All boreholes with the 'AT' designation are to be advanced using the air hammer drill rig.

### 3.3.2 Diamond Drill (Coring) Boreholes

The second mobilization will include an ATV-transported exploration coring rig and an excavator (for test pits, discussed further in Section 3.6 below). This equipment is not capable of operating in winter conditions, requiring water flow through the drill tooling and thawed ground for the excavator. Support vehicles will include ATVs to transport the peripheral machinery, supplies and fuel. For more information on mobilization and preventative measures, please refer to the refueling, spill control, and erosion and sediment control plans provided in **Appendices A, B, and C**, respectively.

As in the previous mobilization, the diamond drill rig will be supplied and operated by Canadrill under the supervision of ABG/Arcadis. The equipment will be used at previously cleared locations (co-located with air

hammer holes) and on areas already identified to be bedrock at surface (i.e., holes inside the reservoir footprint, for the pumphouse and proposed quarry). Boreholes will be advanced in 1.6m runs (5ft), with core samples retrieved for RQD assessment, fracture mapping and geotechnical testing.

Packer testing and installation of piezometers will occur in several cored holes. Slug tests may be later performed in installed piezometers, and, if possible, groundwater samples retrieved. Basic groundwater parameters (including the requested porewater salinity) may be tested if deemed necessary. A detailed borehole rationale is provided in **Table 1** and proposed borehole locations are shown in **Figures 3,4 and 5** attached. All boreholes with the 'BH' designation are to be advanced using the coring rig.

### 3.4 Thermistor Installation

Thermistors will be installed in ten boreholes: one at each reservoir retention structure location; one at the pumphouse location; and one at the Apex River. At each location, one multi-bead thermistor will be installed downhole to allow for ground temperature monitoring. Thermistors will be installed in the open boreholes and allowed to freeze. They will be finished with concrete into the bedrock surface and a lockable roadbox or monument.

Multiple thermistor locations are intended to provide evaluation of the ground temperature profile around the proposed reservoir area as a whole. The goal is to provide a baseline and ongoing temperature profiles to assess the presence of a talik in the area of the reservoir and the potential for freezeback inside retention structures. Local temperature profiles will also influence dam/dyke design.

Boreholes to be outfitted with thermistors are indicated in **Table 1** and proposed thermistor locations are shown on **Figure 3**.

### 3.5 Piezometer Installation

Similarly, piezometers will be installed in 11 boreholes at reservoir retention structure locations. Piezometers will be installed using standard methods for standpipe piezometers; a pre-determined screening interval will be surrounded by filter sand with a bentonite seal above the filter pack interval. Piezometers will be finished at surface with lockable monument casings.

Boreholes to be outfitted with piezometers are indicated in **Table 1** and proposed piezometer locations are shown on **Figure 3**.

### 3.6 Test Pits

Approximately 14 test pits will be advanced to assess the depth and extent of potential borrow sources. Four potential borrow sources have been identified and are shown on **Figure 5**. ABG will mobilize a local excavator and supervise excavation and sampling activities. Test pits will be terminated at either bedrock/permafrost or the maximum reach of the excavator. All test pits will be backfilled and compacted using the bucket of the excavator to closely match the grade of the surficial conditions encountered prior to intrusive activities. Test pit rationale is provided in **Table 1** and proposed test pit locations are shown in **Figures 4 and 5**.

This work would be best performed when the active layer is as near as possible to the maximum depth of thaw, i.e., August or September 2024.

Soil in the test pits will be examined by the Arcadis field technician upon recovery for purposes of describing and recording texture, colour, odour, moisture content as well as evidence of environmental impacts (odour and staining).

Samples from representative stratigraphy at each proposed borrow source will also be obtained. The first sample will be collected at a depth not greater than 750mm and succeeding samples at not more than 1500mm increments of depth. Soil samples will be submitted to accredited laboratories for geotechnical testing.

## 3.7 Geotechnical Testing

In order to obtain geotechnical parameters necessary for structure and system design, both in-situ and laboratory testing is required.

### 3.7.1 In-Situ Testing

#### 3.7.1.1 Packer Testing

In order to achieve estimates of underlying bedrock permeability, packer testing is proposed at the cored holes advanced at each dam, dyke or spillway location. These locations are indicated on **Figure 3**.

Specific regions at each borehole (previously identified through coring) will be isolated using inflatable bladders on an apparatus called a packer system; when lowered to the target depth, the bladders are hydraulically inflated using fluid in drill rods to seal against the edges of the borehole. Permeability testing is then performed on the isolated interval (pressure injections of clean water). Pressure and flow rates are recorded during a test and analytical methods (e.g., Thiem equation) are used to determine the hydraulic conductivity of the unit and transmissivity of the zone.

#### 3.7.1.2 Slug Testing

Slug tests are similarly proposed in the piezometers to be installed at specified borehole locations. Piezometers do not have the ability to isolate specific intervals as packer testing does, but slug testing can provide useful information over the screened intervals.

Slug testing can also be performed at multiple times, to provide a baseline and then to assess any changes in groundwater flow direction, unit transmissivity, etc. as construction progresses.

#### 3.7.1.3 Seismic Testing

A seismic velocity profile is required for earthquake design analyses for the proposed structures. Overburden at site is expected to be minimal and will be removed from underneath any structure foundations. Downhole Seismic (DS) testing is proposed to obtain the shear and compressional wave depth vs. velocity profiles for the bedrock at site. Seismic testing is recommended at a minimum of three locations across the site for data comparison purposes.

DS testing consists of using a source capable of generating shear and compressional waves at the surface of a cored borehole, while matching component geophone receivers are lowered to pre-determined depths in the borehole. Receivers (a minimum of three) are generally spaced 1.5 – 3m apart and secured against the side of

borehole casing in order to allow detection of seismic waves generated by the source. The data obtained will be used to generate the required velocity vs. depth profiles, and in turn determine rock parameters.

### 3.7.2 Laboratory Testing

Testing on recovered rock core samples will include:

- RQD determination;
- Unconfined compressive strength testing;
- Direct shear testing; and
- Unit weight testing.

Testing on recovered soil samples will include:

- Natural moisture content;
- Grain size analyses (hydrometer if required, but only sieve testing is expected);
- Atterberg limit testing (if required, not expected);
- Standard Proctor testing;
- Unit weight determination; and
- Shear box testing.

As requested, Acid Rock Drainage (ARD) testing will also be performed on at least three recovered rock chip samples:

- Acid Base Accounting (ABA) using the standard Sobek procedure;
- Static water leaching testing (TCLP);
- Kinetic testing (Humidity Cell Tests via ASTM D5744); and
- Shake-flask testing.

## 3.8 Waste Management

All waste including food, domestic wastes, debris, and petroleum-based chemicals (e.g., greases, gasoline, glycol-based antifreeze) will be secured at all times to avoid release into the environment and prevent wildlife access. Such waste products will be disposed of appropriately at Canadrill's Iqaluit headquarters or another approved facility.

Drilling spoils (rock chips from air hammer, rock flour/mud from coring) will be used as borehole backfill, where possible, or discharged to ground in the immediate area.

For further information on waste management and handling practices, please refer to the Refueling, Spill Response, and Erosion and Sediment Control Plans included as **Appendices A, B and C**, respectively.

## 3.9 Surveying

A Global Positioning System (GPS) with a horizontal accuracy of +/- 1m or less will be used to record the location of all borehole and test pit locations. The geodetic elevation of ground surface (+/- 5cm) at all borehole and test pit locations will be surveyed and related to a known geodetic benchmark.

## 4 Reporting

Following the completion of the field programs, unexpected conditions and scope of work changes will be reported to the City before equipment is removed from the site. Arcadis will prepare a geotechnical investigation report detailing the field observations and testing results. This report will inform the design process and further geotechnical baseline reporting, to be included in the project's construction tender documents. The requirements for these reports are outlined in the subsections below.

### 4.1 Geotechnical Investigation Report

The Geotechnical Investigation Report will communicate the findings of the geotechnical investigations. The report will include but not be limited to the following:

- A detailed description of the soil investigation, including details of the method of soil boring used, a description of the general geology of the area and a drawing showing the actual location and elevation of the boreholes;
- A description of the physical properties, cohesion and friction angles, soil constraints for at rest, active and passive conditions, unit weights for the various soil strata found in each borehole and the elevation of the stabilized water table;
- A summary of the observations obtained during borehole advancement, in a coordinated series of logs with note of any special conditions or irregularities;
- Noted groundwater conditions and estimated flow rates for drainage;
- Safe bearing capacity and founding elevations for soils encountered;
- Recommendations for the design and construction of an intake structure, overland water pipe and reservoir (retention structures) in an arctic climate;
- Recommended foundation factors for seismic design;
- Advice on any special construction difficulties that may be encountered;
- Recommended frost protection depth to underside of footings;
- Possible effects of groundwater during construction;
- Suitability of excavated material as backfill; and
- Any additional information of interest or significance.

The report will be supported with photographs whenever possible and submitted in PDF format.

### 4.2 Geotechnical Baseline Report

A Geotechnical Baseline Report (GBR) will be prepared for inclusion in the construction tender documents. The GBR will be the sole source contractual document that defines what sub-surface physical conditions are to be assumed to be encountered in the execution of the work. The GBR will also outline the key project constraints and requirements to enable the tenderer to appreciate the key project issues. The GBR will include parameters that state the physical characteristics of the ground and groundwater conditions, as well as the most likely ground behavior to be encountered during the various excavation, ground treatment and preparation, piling and

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trenching, foundation installations, and granular filling operations. It will provide design and construction considerations as outlined in the Appendix G – *Supplementary Scope of Work of the Request for Proposal 2023-RFP-048* issued by the City.

For the GBR, a ground classification system will be developed and include but not be limited to:

- Profile type;
- Expected ground behaviour.
- Grouting type and sequence.
- Expected deformations for the ground type and the means to control the deformations.
- Expected ranges of ground mass parameters that could affect the productivity and cost of the methods of construction.
- Geotechnical "Hold Points".
- Required monitoring during construction.
- General description of the geology and hydrogeology of the works.
- Anticipated groundwater levels including items such as inflows, estimated pumping volumes and rates, anticipated groundwater chemistry and temperature.
- Estimates for parameters such as maximum/differential settlement.
- Natural hazards such as boulders, cavities, and other obstructions, high or low top of bedrock.
- Man-made hazards or other obstructions such as buried utilities, buried debris, unexploded ordnance, engineered and/or reclaimed ground, waste tips, contaminated ground, and ground water within the impact zone.

## 5 Proposed Schedule

Given the strictures around equipment operating requirements, the necessity of thawed/frozen ground and permit turnaround times, the following schedule is proposed. Scheduling considerations include:

- Air hammer mobilization depends on land and water body crossings. Frozen tundra and snowpack is required to protect the land, and ice thicknesses are required for river/pond crossings. As such, this equipment cannot be mobilized until winter;
- Air hammer boreholes in the Apex River require that the river be frozen to full depth (no flowing water). Late March 2024 is the effective timeline for this condition. They are also dependent on obtaining a DFO permit;
- Diamond drilling operations require liquid water (>0°C) and clear terrain (summer months 2024);
- Test pit operations require ground thawed to maximum extent (August/September 2024); and
- Laboratory testing requires samples to be transported south. Several of the tests proposed require lengthy procedure times.

<b>Work Item</b>	<b>Date</b>
Air hammer drilling	February – April 2024
Diamond drilling (coring)	June – July 2024
Test pits and material sampling	August – September 2024
Draft Geotechnical Investigation Report	November 2024
Draft Geotechnical Baseline Report	November 2024

## 6 References

Nunavut Impact Review Board (NIRB). 2023. *Screening Decision Report NIRB File No.: 23YN040. NPC File No.: 150099. Dated 2 November 2023.*

City of Iqaluit (Iqaluit). 2023. *Request for Proposal, Long Term Water Program Raw Water Supply and Storage Owner's Engineer 2023-RFP-048. P7201-950302569-68 (1.0).*

Standards Council of Canada. 2017. *Geotechnical Site Investigations for Building Foundations in Permafrost Zones. CAN/BNQ 2501-500/2017.*

Canadian Standards Association (CSA). May 2019. PLUS 4011:19 *Technical guide: Infrastructure in permafrost: A guideline for climate change adaptation.*

Canadian Standards Association (CSA). November 2019. W205:19 *Erosion and sedimentation management for northern community infrastructure.*

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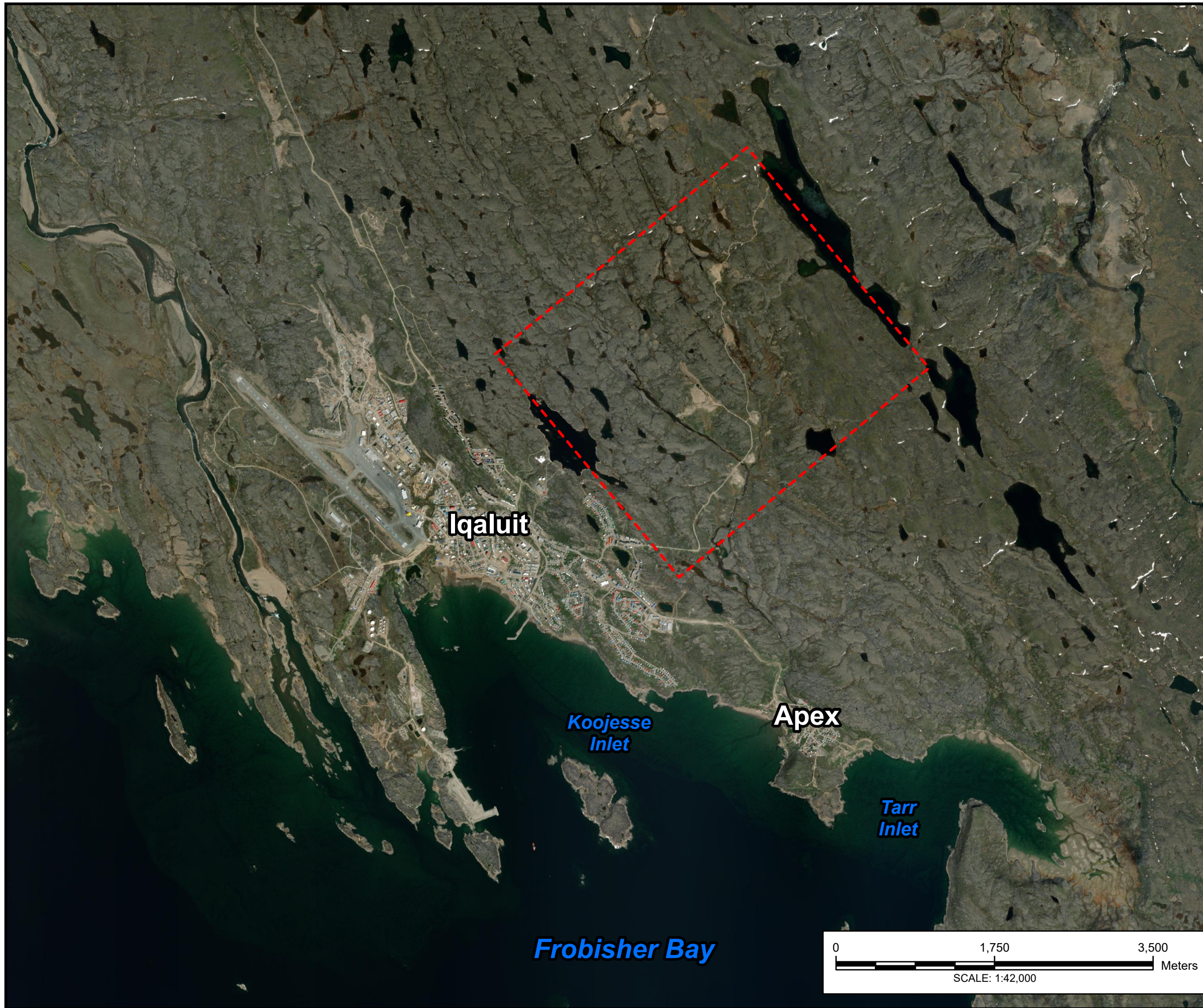
American Society for Testing and Materials. June 2001. ASTM D4083 *Standard Practice for the Description of Frozen Soils.*

# Tables

Table 1: Borehole Rationale

Name	Equipment	Media	Area	Intrumentation	Latitude	Longitude	Target Depth (into rock)	Testing	Notes
AT2023-1a	Air Track	Overburden/Rock	Dam 1	-	63.758495°	-68.489936°			Prove depth of overburden, surface of rock and obtain samples for ABA testing. Verify no natural drainage channel exists.
BH2023-1b	Coring	Rock	Dam 1	-	63.758495°	-68.489936°	5m		Prove depth of competent bedrock, initial fracture mapping and obtain core samples. Verify no natural drainage channel exists.
AT2023-2a	Air Track	Overburden/Rock	Dam 1	Piezometer	63.758481°	-68.492076°		ABA	Prove depth of overburden, surface of rock and obtain samples for ABA testing. Verify no natural drainage channel exists. Throat area.
BH2023-2b	Coring	Rock	Dam 1	-	63.758481°	-68.492076°		Rock Strength, Packer	Prove depth of competent bedrock, initial fracture mapping and obtain core samples. Verify no natural drainage channel exists. Throat area.
AT2023-3	Air Track	Overburden/Rock	Dam 1	-	63.758554°	-68.492972°			Prove depth of overburden, surface of rock and obtain samples for ABA testing. Verify no natural drainage channel exists. Throat area.
AT2023-4a	Air Track	Overburden/Rock	Dam 1	Piezometer	63.758791°	-68.493746°			Prove depth of overburden and obtain samples for ABA testing. Verify no natural drainage channel exists. Throat area.
BH2023-4b	Coring	Rock	Dam 1	Thermistor	63.758791°	-68.493746°		Packer	Prove depth of competent bedrock, initial fracture mapping and obtain core samples. Verify no natural drainage channel exists. Throat area.
AT2023-5a	Air Track	Overburden/Rock	Dam 1	Piezometer	63.759400°	-68.494230°			Prove depth of overburden and obtain samples for ABA testing. Verify no natural drainage channel exists. Throat area.
BH2023-5b	Coring	Rock	Dam 1	-	63.759400°	-68.494230°		Rock Strength, Packer	Prove depth of competent bedrock, initial fracture mapping and obtain core samples. Verify no natural drainage channel exists. Throat area.
AT2023-6	Air Track	Overburden/Rock	Dam 1	-	63.759803°	-68.494193°		Packer	Prove depth of overburden and obtain samples for ABA testing. Verify no natural drainage channel exists.
AT2023-7a	Air Track	Overburden/Rock	Dam 1	Piezometer	63.760191°	-68.494175°			Prove depth of overburden and obtain samples for ABA testing. Verify no natural drainage channel exists.
BH2023-7b	Coring	Rock	Dam 1	-	63.760191°	-68.494175°		Packer	Prove depth of competent bedrock, initial fracture mapping and obtain core samples. Verify no natural drainage channel exists.
AT2023-8	Air Track	Overburden/Rock	Dam 1	-	63.760619°	-68.494205°			Prove depth of overburden and obtain samples for ABA testing. Verify no natural drainage channel exists.
AT2023-9a	Air Track	Overburden/Rock	Dam 1	Piezometer	63.761033°	-68.494186°			Prove depth of overburden and obtain samples for ABA testing. Verify no natural drainage channel exists.
BH2023-9b	Coring	Rock	Dam 1	Thermistor	63.761033°	-68.494186°		Packer	Prove depth of competent bedrock, initial fracture mapping and obtain core samples. Verify no natural drainage channel exists.
AT2023-10	Air Track	Overburden/Rock	Dam 1	-	63.761476°	-68.494168°			Prove depth of overburden and obtain samples for ABA testing. Verify no natural drainage channel exists.
AT2023-11	Air Track	Rock	Reservoir	-	63.761116°	-68.491907°		Geophys	Rock mass characteristics for blasting/excavation program. Deeper hole (115m elevation).
AT2023-12a	Air Track	Overburden/Rock	Dyke 2	Piezometer	63.762490°	-68.495520°			Prove depth of overburden and obtain samples for ABA testing. Verify no natural drainage channel exists.
BH2023-12b	Coring	Rock	Dyke 2	Thermistor	63.762490°	-68.495520°		Packer	Prove depth of competent bedrock, initial fracture mapping and obtain core samples. Verify no natural drainage channel exists.
AT2023-13a	Air Track	Overburden/Rock	Dyke 3	Piezometer	63.763542°	-68.497307°			Prove depth of overburden and obtain samples for ABA testing. Verify no natural drainage channel exists.
BH2023-13b	Coring	Rock	Dyke 3	Thermistor	63.763542°	-68.497307°		Rock Strength, Packer	Prove depth of competent bedrock, initial fracture mapping and obtain core samples. Verify no natural drainage channel exists.
AT2023-14	Air Track	Rock	Reservoir	-	63.763882°	-68.495232°		Geophys	Rock mass characteristics for blasting/excavation program. Deeper hole (115m elevation).
AT2023-15a	Air Track	Overburden/Rock	Dyke 4	Piezometer	63.764812°	-68.497963°			Prove depth of overburden and obtain samples for ABA testing. Verify no natural drainage channel exists.
BH2023-15b	Coring	Rock	Dyke 4	Thermistor	63.764812°	-68.497963°		Packer	Prove depth of competent bedrock, initial fracture mapping and obtain core samples. Verify no natural drainage channel exists.
AT2023-16	Air Track	Overburden/Rock	Dyke 5	-	63.765028°	-68.494255°			Prove depth of overburden and obtain samples for ABA testing. Verify no natural drainage channel exists.
AT2023-17a	Air Track	Overburden/Rock	Dyke 6	Piezometer	63.764509°	-68.492361°		ABA	Prove depth of overburden and obtain samples for ABA testing. Verify no natural drainage channel exists.
BH2023-17b	Coring	Rock	Dyke 6	Thermistor	63.764509°	-68.492361°		Packer	Prove depth of competent bedrock, initial fracture mapping and obtain core samples. Verify no natural drainage channel exists.
AT2023-18	Air Track	Overburden/Rock	Dyke 6	-	63.764015°	-68.491339°			Prove depth of overburden and obtain samples for ABA testing. Verify no natural drainage channel exists.
AT2023-19a	Air Track	Overburden/Rock	Spillway	Piezometer	63.763003°	-68.488937°			Prove depth of overburden and obtain samples for ABA testing. Verify no natural drainage channel exists.
BH2023-19b	Coring	Rock	Spillway	Thermistor	63.763003°	-68.488937°		Rock Strength, Packer	Prove depth of competent bedrock, initial fracture mapping and obtain core samples. Verify no natural drainage channel exists.
AT2023-20	Air Track	Rock	Reservoir	-	63.762530°	-68.490415°		Geophys	Rock mass characteristics for blasting/excavation program. Deeper hole (115m elevation).
AT2023-21	Air Track	Overburden/Rock	Reservoir	-	63.760388°	-68.487991°		ABA	Prove depth of overburden. Obtain samples for ABA testing. Rock mass characteristics for blasting program.
AT2023-22	Air Track	Overburden/Rock	Apex River	-	63.760559°	-68.476179°			Fisheries and Oceans Canada (DFO) permit required. Rock mass characteristics for river crossing foundation.
AT2023-23	Air Track	Overburden/Rock	Apex River	-	63.760526°	-68.476910°			DFO permit required. Rock mass characteristics for river crossing foundation.
BH2023-24	Coring	Rock	Apex River	Thermistor	63.760393°	-68.477335°		Rock Strength	Rock mass characteristics for river crossing foundation. Core sample for RQD, compressive strength.
AT2023-25	Air Track	Overburden/Rock	Initial Quarry	-	63.754844°	-68.470698°		ABA	Rock mass characteristics for initial quarry area (prove rock, inform blasting and excavation planning).
AT2023-26a	Air Track	Rock	Pumphouse	Thermistor	63.782826°	-68.455537°			Rock mass characteristics for pumphouse foundation design and wet well construction. Deeper hole, full depth of well (attempt 15mbgs).
BH2023-26b	Coring	Rock	Pumphouse	-	63.782826°	-68.455537°		Rock Strength	Rock mass characteristics for pumphouse foundation design and wet well construction.
AT2023-27a	Air Track	Overburden/Rock	Dyke 8	Piezometer	63.758571°	-68.482721°			Prove depth of overburden and obtain samples for ABA testing. Verify no natural drainage channel exists.
BH2023-27b	Coring	Rock	Dyke 8	Thermistor	63.758510°	-68.482734°		Rock Strength, Packer	Prove depth of competent bedrock, initial fracture mapping and obtain core samples. Verify no natural drainage channel exists.
TP2023-1	Excavator	Sand Borrow	Shooting Range	-	63.761430°	-68.473772°		GS, Proctor, Shear	Prove depth of sand deposit; obtain samples for geotechnical testing. Must be 30m from high water mark.
TP2023-2	Excavator	Sand Borrow	Shooting Range	-	63.762296°	-68.468263°		GS, Proctor, Shear	Prove depth of sand deposit; obtain samples for geotechnical testing. Must be 30m from high water mark.
TP2023-3	Excavator	Sand Borrow	Shooting Range	-	63.764161°	-68.471623°		GS, Proctor, Shear	Prove depth of sand deposit; obtain samples for geotechnical testing. Must be 30m from high water mark.
TP2023-4	Excavator	Sand Borrow	Shooting Range	-	63.762790°	-68.471169°		GS, Proctor, Shear	Prove depth of sand deposit; obtain samples for geotechnical testing. Must be 30m from high water mark.
TP2023-5	Excavator	Sand Borrow	Lower Sand	-	63.768474°	-68.464148°		GS, Proctor, Shear	Prove depth of sand deposit; obtain samples for geotechnical testing. Must be 30m from high water mark.
TP2023-6	Excavator	Sand Borrow	Lower Sand	-	63.768929°	-68.465217°		GS, Proctor, Shear	Prove depth of sand deposit; obtain samples for geotechnical testing. Must be 30m from high water mark.
TP2023-7	Excavator	Sand Borrow	Lower Sand	-	63.769402°	-68.464806°		GS, Proctor, Shear	Prove depth of sand deposit; obtain samples for geotechnical testing. Must be 30m from high water mark.
TP2023-8	Excavator	Sand Borrow	Upper Sand	-	63.774429°	-68.466697°		GS, Proctor, Shear	Prove depth of sand deposit; obtain samples for geotechnical testing. Must be 30m from high water mark.
TP2023-9	Excavator	Sand Borrow	Upper Sand	-	63.775184°	-68.468239°		GS, Proctor, Shear	Prove depth of sand deposit; obtain samples for geotechnical testing. Must be 30m from high water mark.
TP2023-10	Excavator	Sand Borrow	Upper Sand	-	63.775675°	-68.467136°		GS, Proctor, Shear	Prove depth of sand deposit; obtain samples for geotechnical testing. Must be 30m from high water mark.
TP2023-11	Excavator	Sand Borrow	Washout	-	63.776849°	-68.464294°		GS, Proctor, Shear	Investigate conditions around the road washout location.
TP2023-12	Excavator	Sand Borrow	Qikiqtalik Esker	-	63.780495°	-68.455177°		GS, Proctor, Shear	Prove depth of sand deposit; obtain samples for geotechnical testing. Must be 30m from high water mark.
TP2023-13	Excavator	Sand Borrow	Qikiqtalik Esker	-	63.781461°	-68.456297°		GS, Proctor, Shear	Prove depth of sand deposit; obtain samples for geotechnical testing. Must be 30m from high water mark.
TP2023-14	Excavator	Sand Borrow	Qikiqtalik Esker	-	63.782598°	-68.458198°		GS, Proctor, Shear	Prove depth of sand deposit; obtain samples for geotechnical testing. Must be 30m from high water mark.

# Figures



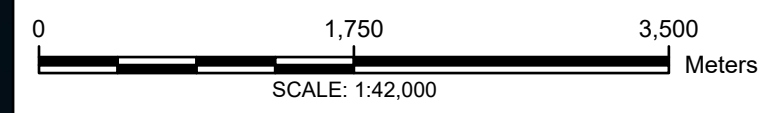
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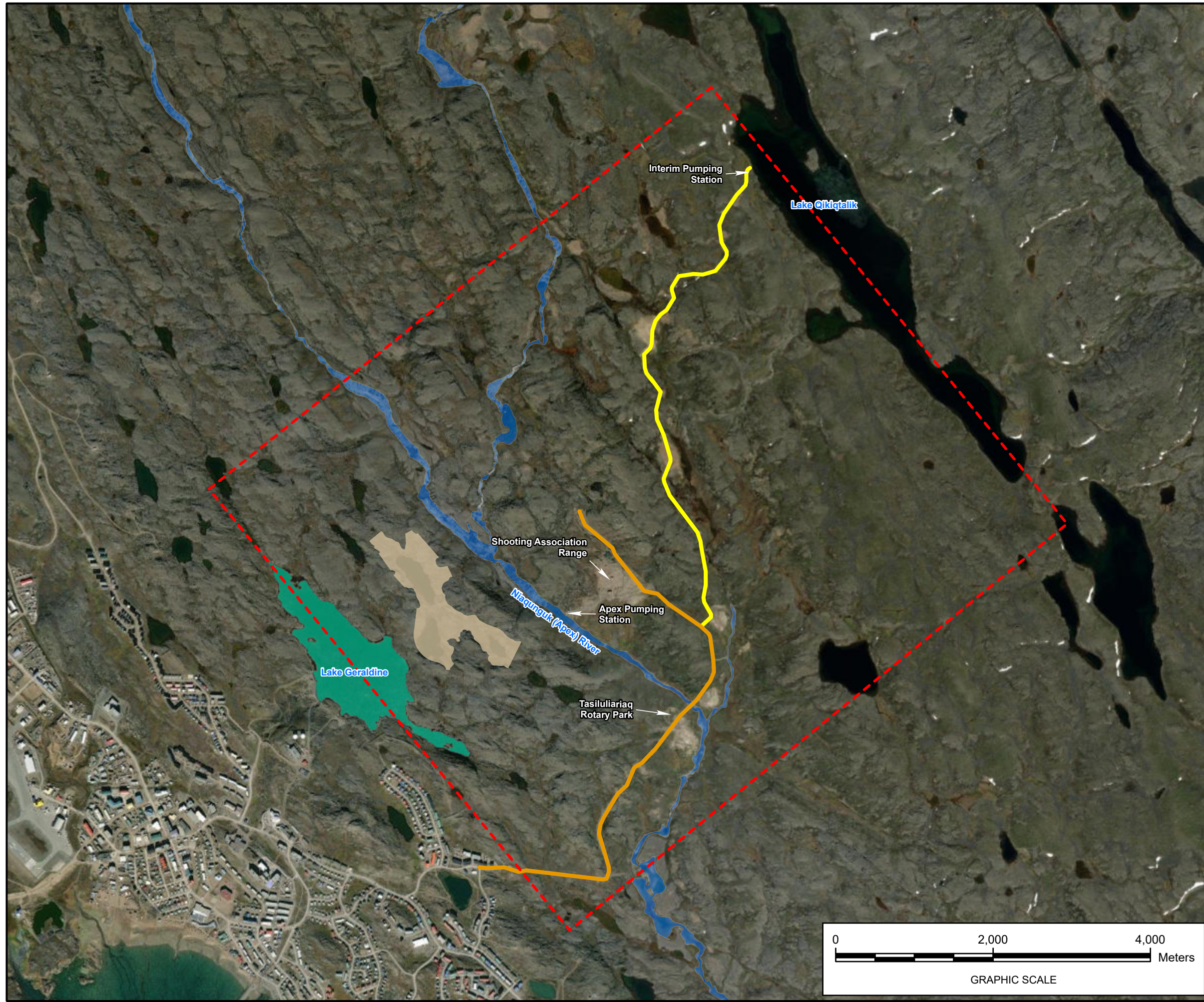
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
WORK PLAN FOR GEOTECHNICAL INVESTIGATIONS  
LONG TERM WATER PROGRAM IN IQALUIT, NUNAVUT  
CITY OF IQALUIT

**SITE LOCATION PLAN**





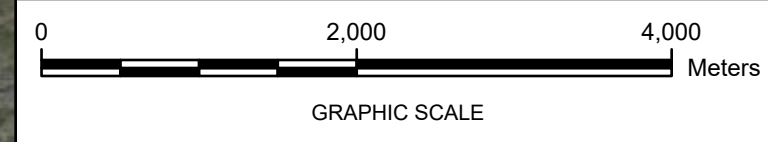
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-  Access Road to Lake Qikiqtalik
-  Road To Nowhere
-  Proposed Reservoir
-  Watercourse

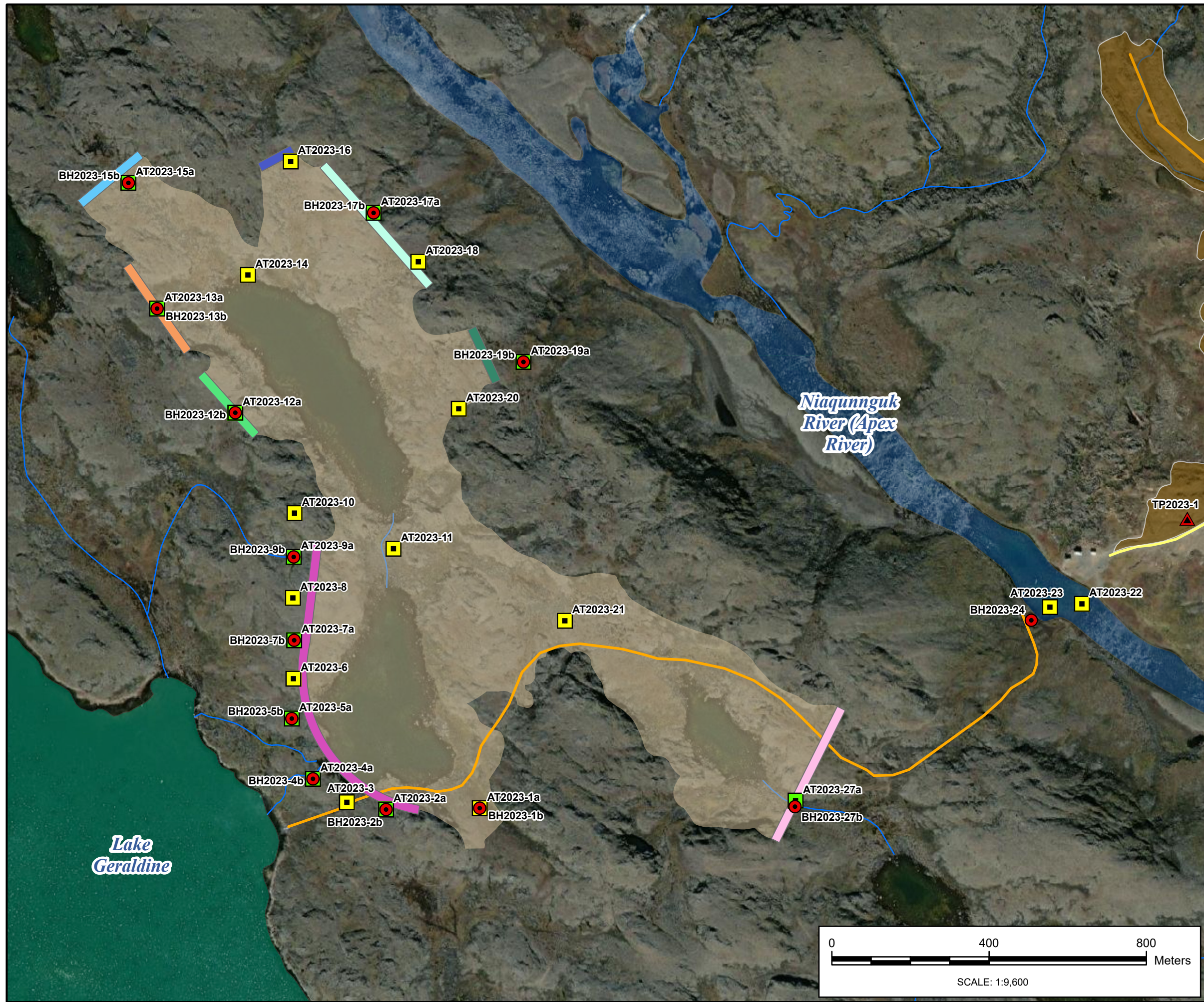


WORK PLAN FOR GEOTECHNICAL INVESTIGATIONS  
LONG TERM WATER PROGRAM IN IQALUIT, NUNAVUT  
CITY OF IQALUIT

**SITE PLAN**



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**LEGEND**

- PROPOSED CORE HOLE LOCATION
- PROPOSED AIR TRACK HOLE LOCATION
- PROPOSED INSTRUMENTED AIR TRACK HOLE LOCATION
- ▲ PROPOSED TEST PIT LOCATION
- EXISTING WATER PIPELINE PATH
- ACCES ROAD TO APEX RIVER
- WATERCOURSES
- PROPOSED RESERVOIR
- DAM1
- DYKE2
- DYKE3
- DYKE4
- DYKE5
- DYKE6
- DYKE7(SPILLWAY)
- DYKE8
- PROPOSED BORROW 1: SHOOTING RANGE
- LAKE GERALDINE
- WATERCOURSE

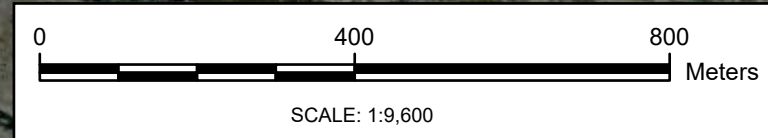
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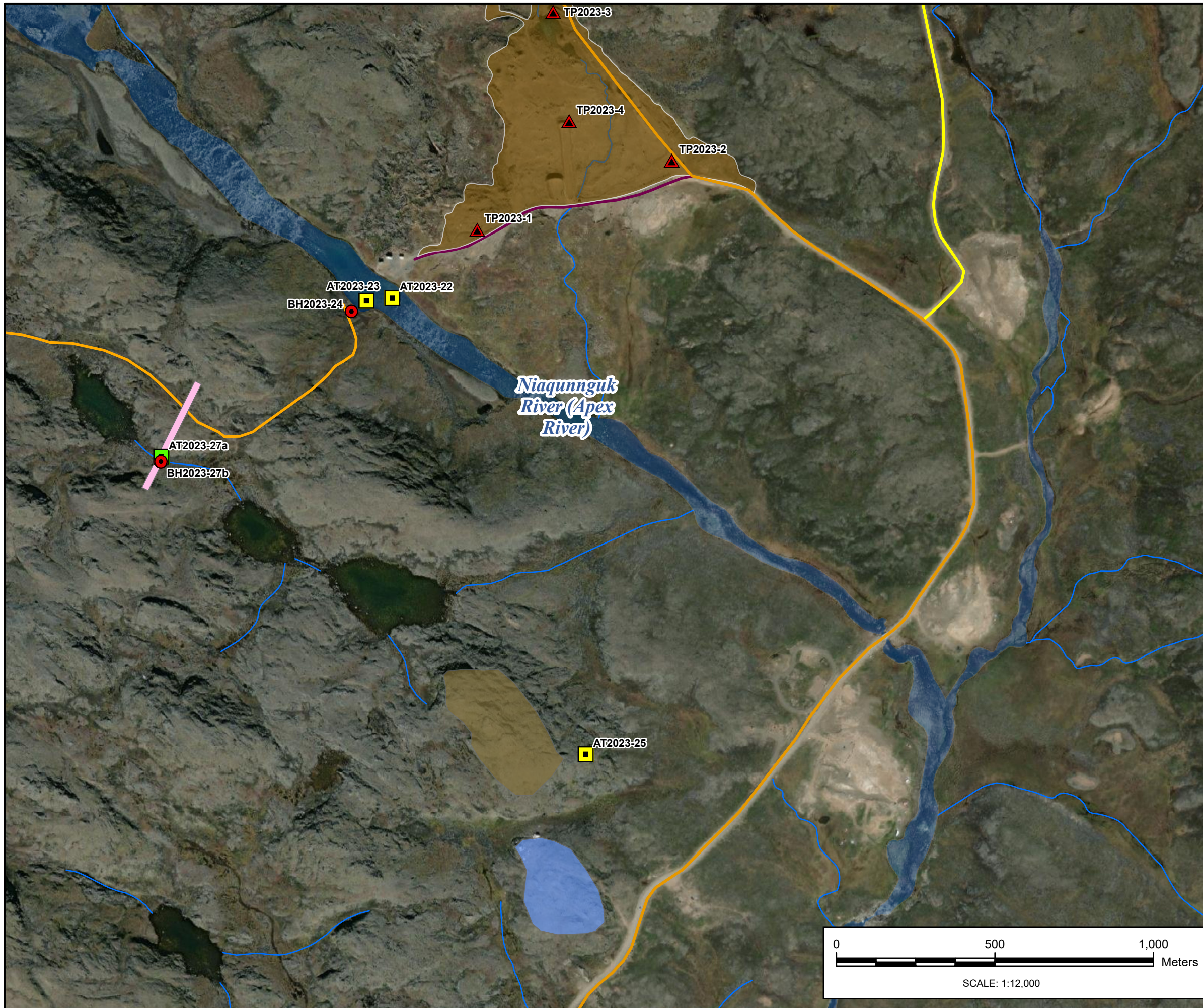


WORK PLAN FOR GEOTECHNICAL INVESTIGATIONS  
LONG TERM WATER PROGRAM IN IQALUIT, NUNAVUT  
CITY OF IQALUIT

**PROPOSED INVESTIGATION LOCATIONS  
- RESERVOIR**



City: SYR Div/Group: I/MDV Last Saved By: mayyar7350 T:\\_ENV\City of Iqaluit\Pro\Work\_Plan\_Figures\_Geotechnical\_Investigations.aprx\Figure4 PROPOSED INVESTIGATION LOCATIONS2 21-03-2024 09:50



**LEGEND**

- Proposed Core Hole Location
- Proposed Air Track Hole Location
- Proposed Instrumented Air Track Hole Location
- Proposed Test Pit Location
- Access Road to Lake Qikiqtalik
- Existing Water Pipeline Path
- Watercourses
- Acces Road to Apex River
- Watercourse
- Proposed Borrow 1: Shooting Range
- Knob 09
- Knob 10
- Dyke8

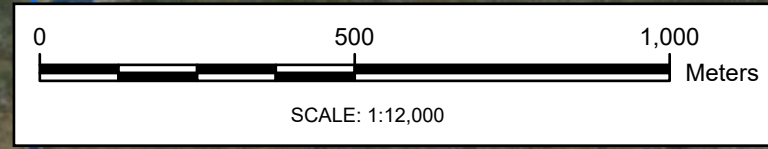
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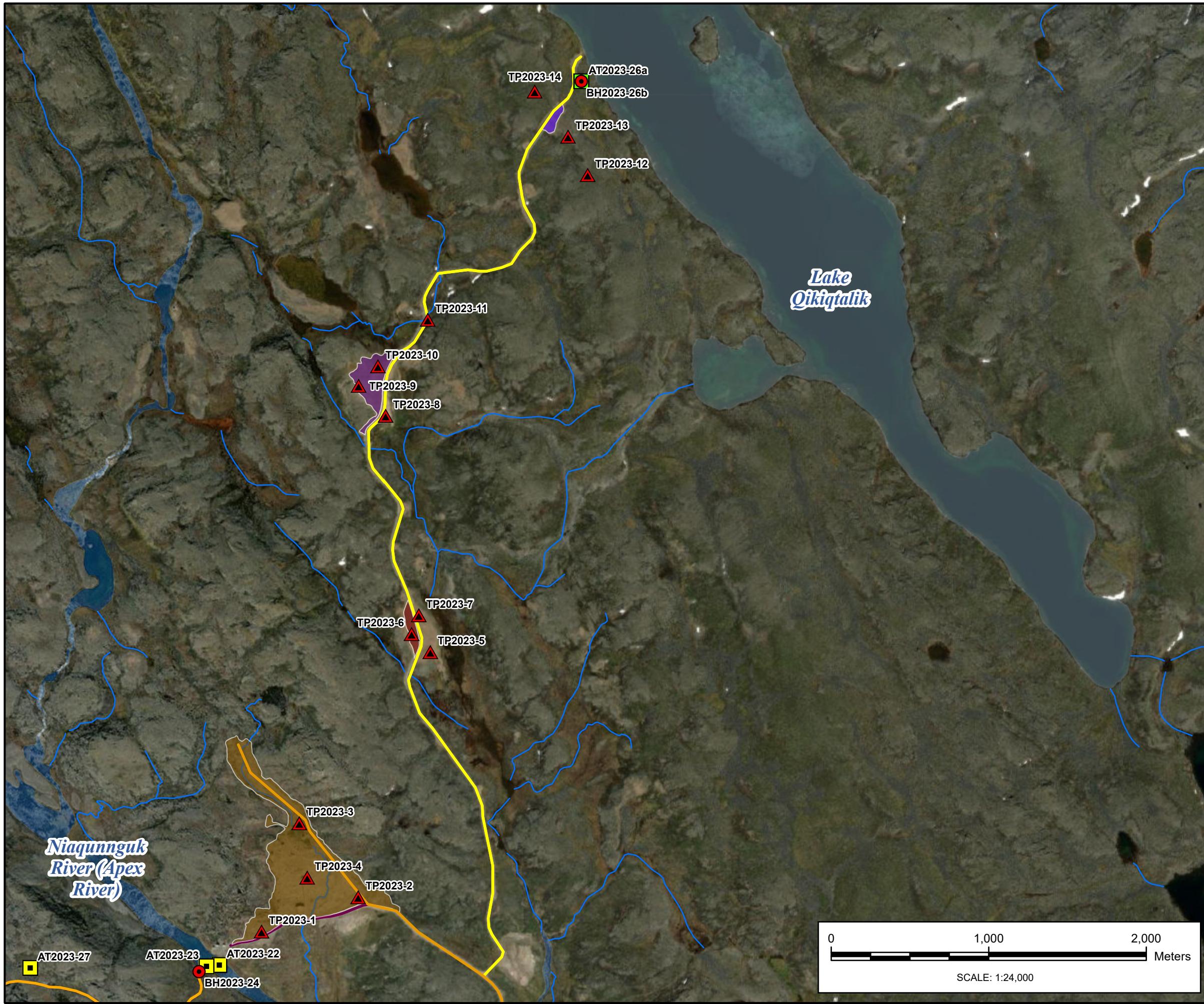
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2. BASEMAP SOURCE: ESRI NAIP IMAGERY WEB SERVICE.



WORK PLAN FOR GEOTECHNICAL INVESTIGATIONS  
LONG TERM WATER PROGRAM IN IQALUIT, NUNAVUT  
CITY OF IQALUIT

**PROPOSED INVESTIGATION LOCATIONS  
- APEX RIVER AND ACCESS**



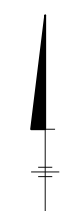


**LEGEND**

- Proposed Core Hole Location
- Proposed Air Track Hole Location
- Proposed Instrumented Air Track Hole Location
- Proposed Test Pit Location
- Existing Water Pipeline Path
- Access Road to Lake Qikiqtalik
- Road To Nowhere
- Acces Road to Apex River
- Watercourses
- Watercourse
- Lake Qikiqtalik
- Proposed Borrow 2: Lower Sand Deposit
- Proposed Borrow 3: Upper Sand Deposit
- Proposed Borrow 1: Shooting Range
- Proposed Borrow 4: Qikiqtalik Esker

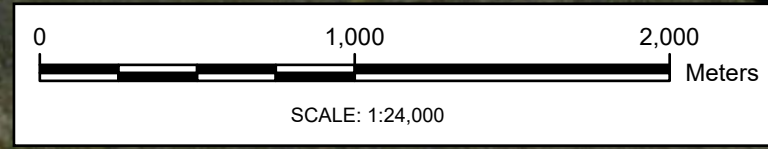
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WORK PLAN FOR GEOTECHNICAL INVESTIGATIONS  
LONG TERM WATER PROGRAM IN IQALUIT, NUNAVUT  
CITY OF IQALUIT

**PROPOSED INVESTIGATION LOCATIONS  
- BORROW AND PUMPHOUSE AREAS**



# Appendix A

## A: Refueling Plan

# Refueling Plan



## Long Term Water Project - Geotechnical Investigations

**PREPARED FOR**  
City of Iqaluit

**DATE**  
November 9, 2023

**PREPARED BY**  
Arcadis Canada Inc. and  
Adaptive Baseline Geotechnical Ltd.

**ARCADIS REF**  
30192375

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## Introduction

This document outlines the Refueling Plan for the geotechnical investigations that will be undertaken by Arcadis Canada Inc. (Arcadis) and Adaptive Baseline Geotechnical Ltd. (ABG) for the Long Term Water Project in Iqaluit, Nunavut. The geotechnical investigations will be conducted within the site area northeast of Lake Geraldine shown on **Figure 1**. Field work associated with these investigations will commence in fall of 2023, with completion anticipated during the summer of 2024.

## Overview of Refueling Practices

When refueling and/or servicing activities occur onsite, the following conditions will be met:

- The in-field refueling or servicing of equipment or vehicles will occur a minimum of thirty-one (31) meters away from the high water mark of any waterbody;
- Spill kits with sorbent materials will be present;
- Equipment and containers for collection of impacted soil/snow will be present; and,
- Drip pans and/or other protective devices will be used to prevent spills of petroleum products and other potentially hazardous liquids (e.g., antifreeze).

No fuel storage areas will be established onsite as part of these geotechnical investigations.

Any laydown areas established onsite will be located a minimum of thirty-one (31) meters away from any known sensitive habitats or the high water mark of any waterbody.

## Refueling Procedure

The following steps will be taken when refueling:

1. Engine of equipment or vehicle will be shut off;
2. Drip pans and/or other protective devices will be setup to catch spilt fuel;
3. Attendant will be present for the duration of the refueling to prevent overflow; and,
4. Smoking will be prohibited during refueling.

Additional refueling procedures are outlined in ABG's site-specific health and safety plan.

## Refueling of Diesel Drill Rig

A pickup truck with a 995 litre (L) capacity fuel tank will be used for refilling the air track drill rig (Make: Joy, Model: MS4 E5) when boreholes are being completed. When refueling, the rig will be moved out to the road and the refueling will occur on the Road to Nowhere/Road to Unnamed Lake. The rig will utilize approximately 500 L of diesel per day.

When drilling around Lake Geraldine or locations far from established roads, fuel will be transported out to the drill rig by skidoo and sled or by ATV and trailer.

## Refueling of Gasoline Vehicles and Equipment

All gasoline vehicles will be refilled directly at gas stations in the city of Iqaluit. A core drill will be refueled in the field as necessary utilizing the precautions outlined in this document. It is anticipated that approximately 5 L of gasoline and 0.5 L of mixed (50:1 2-stroke oil) gas will be utilized per day to operate the drill.

## Fuel Types and Properties

Both diesel and gasoline fueled vehicles and equipment will be used during these geotechnical investigations. Typical physical and chemical properties of the fuels are outlined below.

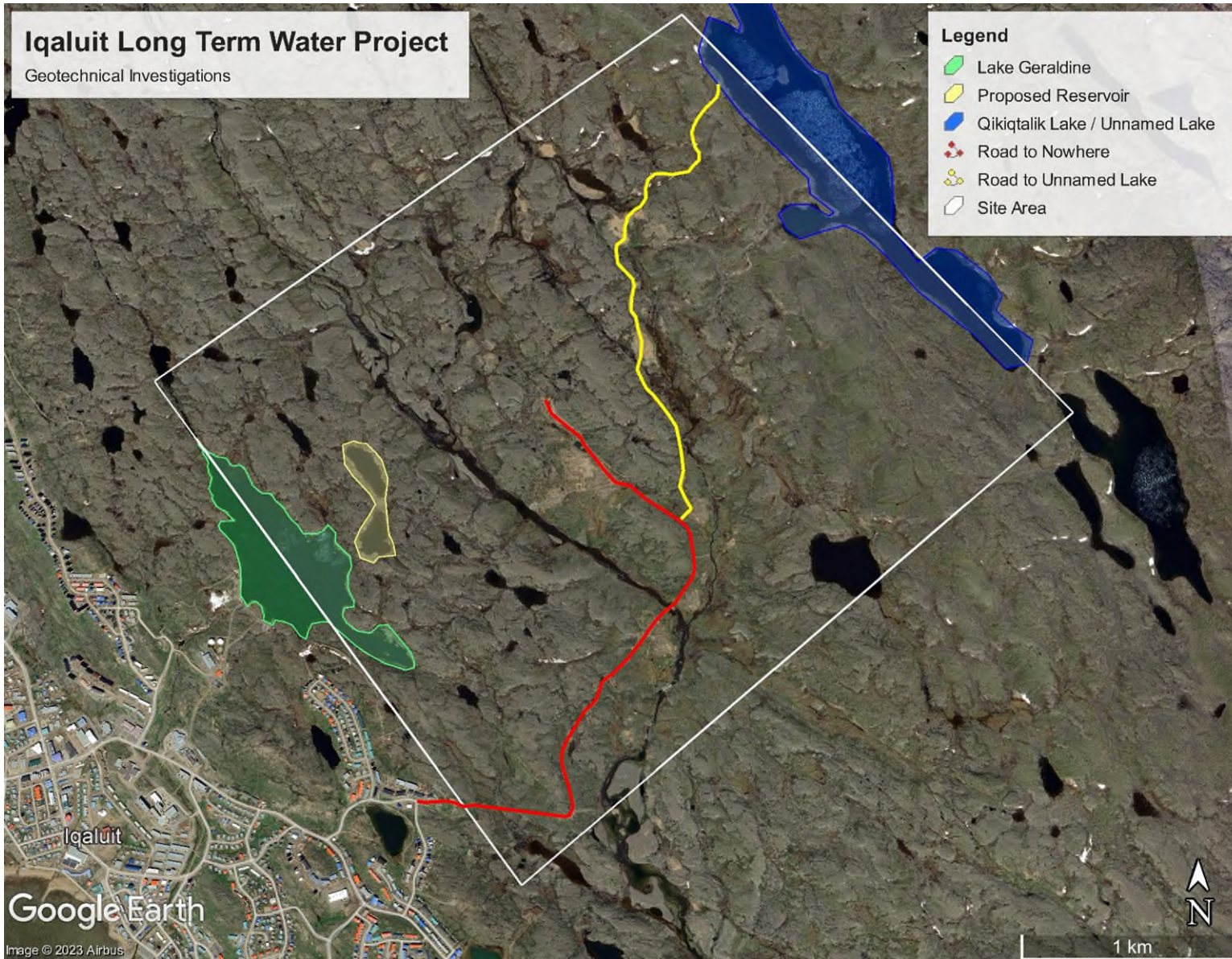
**Table 1. Fuel Type and Properties for LTWP Geotechnical Investigations**

Fuel Type	Properties
Diesel	Appearance: Clear, blue, or red Flashpoint: 40°C (diesel) Odour: Petroleum Pour point: -50°C to -6°C Solubility: Insoluble Viscosity: Not viscous Vapour: Will sink to ground levels Specific gravity: Floats on water (0.8 to 0.9)
Gasoline	Appearance: colorless Flashpoint: -50°C Odour: Petroleum Freezing point: -60°C Solubility: Insoluble Viscosity: Not viscous Vapour: Will sink to ground level Specific gravity: Floats on water (0.7-0.8)

Should fuel be spilt, refer to the procedures outlined in the **Emergency Spill Response Plan**.

# Refueling Plan

## Long Term Water Project - Geotechnical Investigations



**Figure 1: Site Plan**

# Appendix B

## B: Emergency Spill Response Plan

# Emergency Spill Response Plan



## Long Term Water Program - Geotechnical Investigations

**PREPARED FOR**  
City of Iqaluit

**DATE**  
February 23, 2024

**PREPARED BY**  
Arcadis Canada Inc.

**ARCADIS REF**  
30192375

### 1. Introduction

This document outlines the spill response procedures for the geotechnical investigations that will be undertaken by Arcadis Canada Inc. (Arcadis) and Adaptive Baseline Geotechnical Ltd. (ABG) for the Long Term Water Program (LTWP) in Iqaluit, Nunavut, on behalf of the City of Iqaluit (City). The geotechnical investigations will be conducted within the site area northeast of Lake Geraldine as shown on **Figure 1**, appended.

The proactive measures to be implemented during equipment and vehicle refueling/servicing to minimize the chances of introducing petroleum products and other potentially hazardous liquids into the environment are outlined separately in the LTWP **Refueling Plan**.

### 2. Spill Response Procedure

As described in ABG's Site Specific Health and Safety Plan and in the unlikely event of a fuel or hazardous material spill, the following actions will be taken:

- Immediately stop work activities and assess the hazard to persons and the environment.
- If possible and safe to do so, stop the source of the spill and shutdown sources of ignition.
- Use spill kits to contain spill(s). Spill kits will be stored at all working sites.
- Identify spilled material and consult safety data sheet (SDS) for appropriate containment and clean-up procedures.
- Determine if additional, external clean-up support is required. This may include the construction of a secondary berm around the incident to capture the spill.
- Spilled hazardous material, such as fuels or lubricants, will be contained and transferred into an appropriate container; remaining residues will be mixed with unconsolidated absorbent materials and transferred into appropriate containers.
- Containers with spilled material will be sealed and transported south for disposal in accordance with applicable regulations.

### 3. Spill Notification

In the event of a spill, the following notification procedure shall be implemented:

- ABG onsite personnel will notify their project manager. The ABG project manager will then notify the Arcadis geotechnical team (Charles Gravelle, Ryan Janzen, and Elliott Holden) within 3 hours for a major spill incident (i.e., reportable under Nunavut regulations) and 24 hours for a minor spill incident (i.e., not reportable under Nunavut regulations).
- Arcadis will then notify the project manager from the City (Tami Adeleke) and representatives from Colliers Project Leaders (Ramesh Krishnan or Richard Sithole). The City and Colliers representative will

be notified within 4 hours for major spill incidents (i.e., reportable under Nunavut regulations) and within 48 hours for minor spill incidents (i.e., not reportable under Nunavut regulations).

- ABG will notify the Nunavut Department of Environment 24-hour spill report line in the event of a major spill incident.

## 4. Spill Reporting

Reportable spills will be reported to the Nunavut Department of Environment 24-hour spill report line (1-867-920-8130) or the spill report form in **Appendix A** will be filled out and sent by e-mail to [spills@gov.nt.ca](mailto:spills@gov.nt.ca). Minimum reportable spill quantities are outlined in **Table 1**. Should a substance be spilled that is not listed in **Table 1**, Schedule B of the Spill Contingency Planning and Reporting Regulations for Nunavut shall be consulted to establish the requirement to report the spill.

When a call is made to the 24-hour spill report line, the following information should be known to the best of the caller's ability:

- Date and time of spill;
- Location of spill (e.g., GPS coordinates);
- Direction spill is moving;
- Name and phone number of a contact person close to the location of spill;
- Type of contaminant spilled and quantity spilled;
- Cause of spill;
- Whether spill is continuing or has stopped;
- Description of existing containment;
- Action taken to contain, recover, clean up and dispose of spilled contaminant;
- Name, address and phone number of person reporting spill; and,
- Name of owner or person in charge, management or control of contaminants at time of spill.

## 5. Spill Classification and Reporting Requirements

The following table provides information on the types of fuel and oil to be used in these geotechnical investigations along with spill reporting requirements.

**Table 1. Fuel and Oil Classification for LTWP Geotechnical Investigations**

Fuel or Oil Type and Use	Properties	Schedule B Classification	Reporting Requirement
<b>Diesel</b> Diesel will be used to fuel an air track drill rig (Make: Joy, Model: MS4 E5) and excavator (Make: CAT).	Appearance: Clear, blue, or red Flashpoint: 40°C (diesel) Odour: Petroleum Pour point: -50°C to -6°C Solubility: Insoluble Viscosity: Not viscous Vapour: Will sink to ground levels Specific gravity: Floats on water (0.8 to 0.9)	Item Number: 6. Transportation of Dangerous Goods Act Class: 3.1, 3.2, 3.3 Description of Contaminant: Flammable Liquid	Spill ≥ 100 litres must be reported to 24-hour spill report line.

<b>Fuel or Oil Type and Use</b>	<b>Properties</b>	<b>Schedule B Classification</b>	<b>Reporting Requirement</b>
<p><b>Gasoline</b></p> <p>Gasoline will be used to fuel vehicles for transportation and for a core drill.</p>	<p>Appearance: colorless                      Flashpoint: -50°C                      Odour: Petroleum                      Freezing point: -60°C                      Solubility: Insoluble                      Viscosity: Not viscous                      Vapour: Will sink to ground level                      Specific gravity: Floats on water (0.7-0.8)</p>	<p>Item Number: 6.                      Transportation of Dangerous Goods Act                      Class: 3.1, 3.2, 3.3                      Description of Contaminant:                      Flammable Liquid</p>	<p>Spill ≥ 100 litres must be reported to 24-hour spill report line.</p>
<p><b>Hydraulic Oil</b></p> <p>Regular hydraulic oil (T04 10W) will be used for the drill rigs.</p>	<p>Appearance: Straw yellow liquid                      Flashpoint: 215°C                      Odour: Petroleum                      Pour point: -25°C                      Solubility: Generally Insoluble                      Viscosity: Medium                      Vapour: Few vapours emitted                      Specific gravity: Floats on water (0.9)</p>	<p>Item Number: 20.                      Transportation of Dangerous Goods Act                      Class: none                      Description of Contaminant: Other contaminants</p>	<p>Spill ≥ 100 litres must be reported to 24-hour spill report line.</p>
<p><b>Automatic Transmission Fluid (ATF)</b></p> <p>ATF will be used in the compressor to run the air track drill rig.</p>	<p>Appearance: Red                      Flashpoint: 178°C                      Odour: Petroleum                      Pour point: -40°C                      Solubility: Soluble in hydrocarbons; insoluble in water                      Viscosity: Medium                      Vapour: Few vapours emitted                      Specific gravity: Floats on water (0.8-0.9)</p>	<p>Item Number: 20.                      Transportation of Dangerous Goods Act                      Class: none                      Description of Contaminant: Other contaminants</p>	<p>Spill ≥ 100 litres must be reported to 24-hour spill report line.</p>
<p><b>Lubrication Oil</b></p> <p>Lubrication oil will be used to reduce the friction, heat, and wear between mechanical components that are in contact with each other.</p>	<p>Appearance: Amber liquid                      Flashpoint: 190°C - 220°C                      Odour: Petroleum                      Pour point: -35°C - -40°C                      Solubility: Generally Insoluble                      Viscosity: Medium                      Vapour: Few vapours emitted                      Specific gravity: Floats on water (0.9)</p>	<p>Item Number: 20.                      Transportation of Dangerous Goods Act                      Class: none                      Description of Contaminant: Other contaminants</p>	<p>Spill ≥ 100 litres must be reported to 24-hour spill report line.</p>

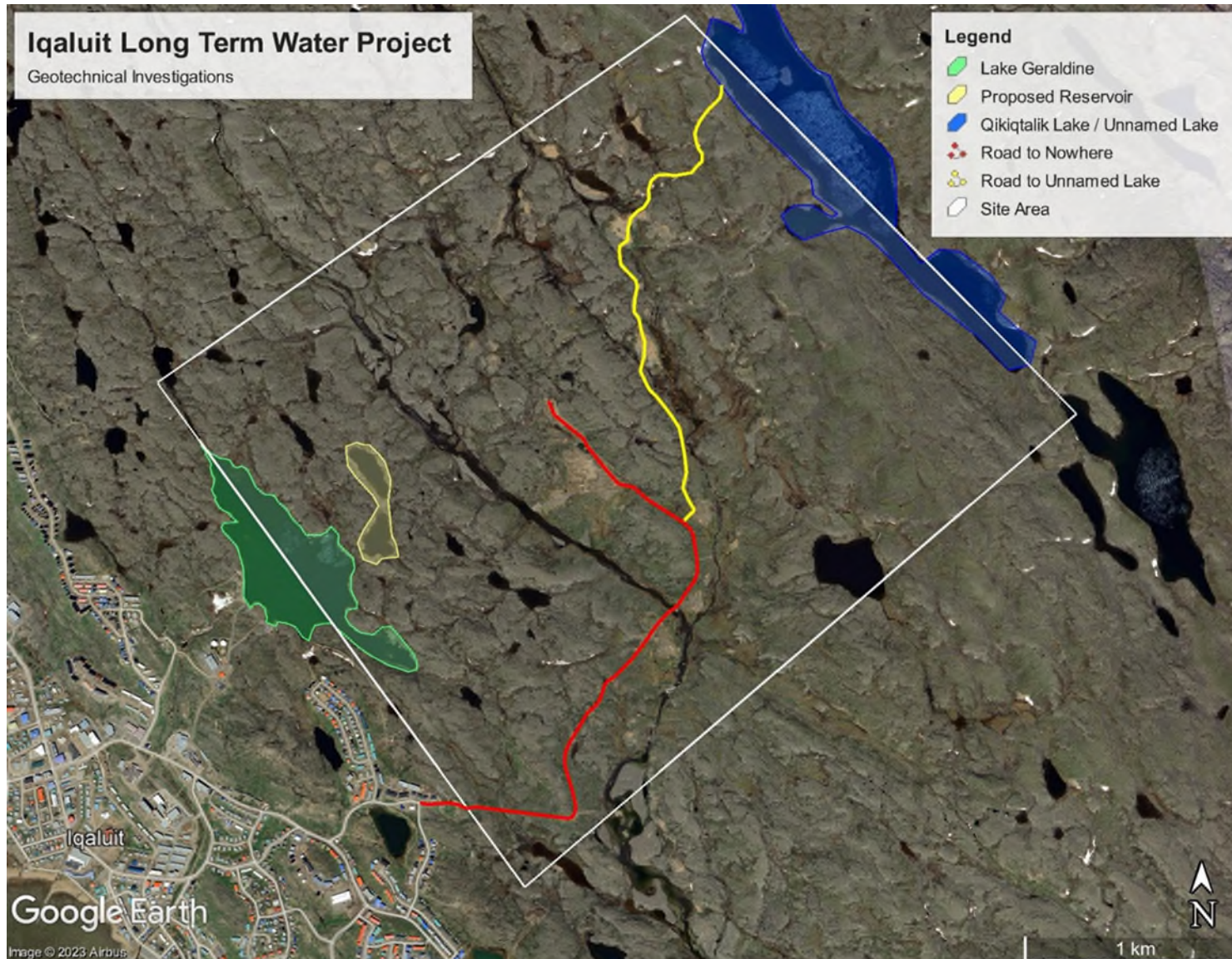


Figure 1: Site Plan

Spill Contingency Plan for Long Term Water Program - Geotechnical Investigations  
Arcadis Canada Inc.  
February 23, 2024

## **Appendix A**

### **Spill Report Form**



Canada

# NT-NU SPILL REPORT

OIL, GASOLINE, CHEMICALS AND OTHER HAZARDOUS MATERIALS

NT-NU 24-HOUR SPILL REPORT LINE

TEL: (867) 920-8130

FAX: (867) 873-6924

EMAIL: spills@gov.nt.ca

REPORT LINE USE ONLY

A	REPORT DATE: MONTH – DAY – YEAR		REPORT TIME		<input type="checkbox"/> ORIGINAL SPILL REPORT, OR <input type="checkbox"/> UPDATE # _____ TO THE ORIGINAL SPILL REPORT	<b>REPORT NUMBER</b>  _____		
	B		OCCURRENCE DATE: MONTH – DAY – YEAR				OCCURRENCE TIME	
C			LAND USE PERMIT NUMBER (IF APPLICABLE)		WATER LICENCE NUMBER (IF APPLICABLE)			
D				GEOGRAPHIC PLACE NAME OR DISTANCE AND DIRECTION FROM NAMED LOCATION		REGION <input type="checkbox"/> NWT <input type="checkbox"/> NUNAVUT <input type="checkbox"/> ADJACENT JURISDICTION OR OCEAN		
E			LATITUDE		LONGITUDE			
			DEGREES	MINUTES	SECONDS	DEGREES	MINUTES	SECONDS
F			RESPONSIBLE PARTY OR VESSEL NAME		RESPONSIBLE PARTY ADDRESS OR OFFICE LOCATION			
G			ANY CONTRACTOR INVOLVED		CONTRACTOR ADDRESS OR OFFICE LOCATION			
H			PRODUCT SPILLED		QUANTITY IN LITRES, KILOGRAMS OR CUBIC METRES	U.N. NUMBER		
			SECOND PRODUCT SPILLED (IF APPLICABLE)		QUANTITY IN LITRES, KILOGRAMS OR CUBIC METRES	U.N. NUMBER		
I			SPILL SOURCE		SPILL CAUSE		AREA OF CONTAMINATION IN SQUARE METRES	
J			FACTORS AFFECTING SPILL OR RECOVERY		DESCRIBE ANY ASSISTANCE REQUIRED		HAZARDS TO PERSONS, PROPERTY OR ENVIRONMENT	
K								
ADDITIONAL INFORMATION, COMMENTS, ACTIONS PROPOSED OR TAKEN TO CONTAIN, RECOVER OR DISPOSE OF SPILLED PRODUCT AND CONTAMINATED MATERIALS								
L		REPORTED TO SPILL LINE BY		POSITION	EMPLOYER	LOCATION CALLING FROM	TELEPHONE	
M		ANY ALTERNATE CONTACT		POSITION	EMPLOYER	ALTERNATE CONTACT LOCATION	ALTERNATE TELEPHONE	
<b>REPORT LINE USE ONLY</b>								
N		RECEIVED AT SPILL LINE BY		POSITION	EMPLOYER	LOCATION CALLED	REPORT LINE NUMBER	
				STATION OPERATOR		YELLOWKNIFE, NT	(867) 920-8130	
LEAD AGENCY <input type="checkbox"/> EC <input type="checkbox"/> CCG <input type="checkbox"/> GNWT <input type="checkbox"/> GN <input type="checkbox"/> ILA <input type="checkbox"/> INAC <input type="checkbox"/> NEB <input type="checkbox"/> TC					SIGNIFICANCE <input type="checkbox"/> MINOR <input type="checkbox"/> MAJOR <input type="checkbox"/> UNKNOWN		FILE STATUS <input type="checkbox"/> OPEN <input type="checkbox"/> CLOSED	
AGENCY		CONTACT NAME			CONTACT TIME		REMARKS	
LEAD AGENCY								
FIRST SUPPORT AGENCY								
SECOND SUPPORT AGENCY								
THIRD SUPPORT AGENCY								

# Appendix C

## C: Erosion and Sediment Control Plan

# Erosion and Sediment Control Plan



## Long Term Water Project - Geotechnical Investigations

**PREPARED FOR**  
City of Iqaluit

**DATE**  
November 9, 2023

**PREPARED BY**  
Arcadis Canada Inc. and  
Adaptive Baseline Geotechnical Ltd.

**ARCADIS REF**  
30192375

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## Introduction

This document outlines the erosion and sediment suppression measures for the geotechnical investigations that will be undertaken by Arcadis Canada Inc. (Arcadis) and Adaptive Baseline Geotechnical Ltd. (ABG) for the Long Term Water Project in Iqaluit, Nunavut. The geotechnical investigations will be conducted within the site area shown on **Figure 1**. Field work associated with these investigations will commence in fall of 2023, with completion anticipated during the summer of 2024.

## Erosion and Sediment Control Measures

The ground disturbance associated with these geotechnical investigations will be minimal given the shallow nature of the drilling and test pitting activities. Boreholes will be advanced to a maximum depth of 15 metres below ground surface (m bgs). Whereas, test pits will be terminated on bedrock or permafrost at a depth not anticipated to exceed 1.5 m bgs. All boreholes and test pits will be backfilled and compacted to closely match the grade of the surficial conditions encountered prior to the ground disturbance activities.

The following erosion and sediment control measures will be followed:

- No excavated materials will be placed directly into any watercourses or water bodies;
- Any water collecting at surface during drilling will be directed away from watercourses or water bodies by trench, berms, or other means;
- Silt fencing between areas of ground disturbance and downgradient watercourses or water bodies will be installed if run off cannot be mitigated by any other means during drilling;
- Additional silt fencing will be maintained on site to address any accidental events and/or ongoing maintenance of silt control measures; and,
- Drilling shroud and/or water will be used to capture fugitive dust should excessive amounts be generated.

## Permafrost Management

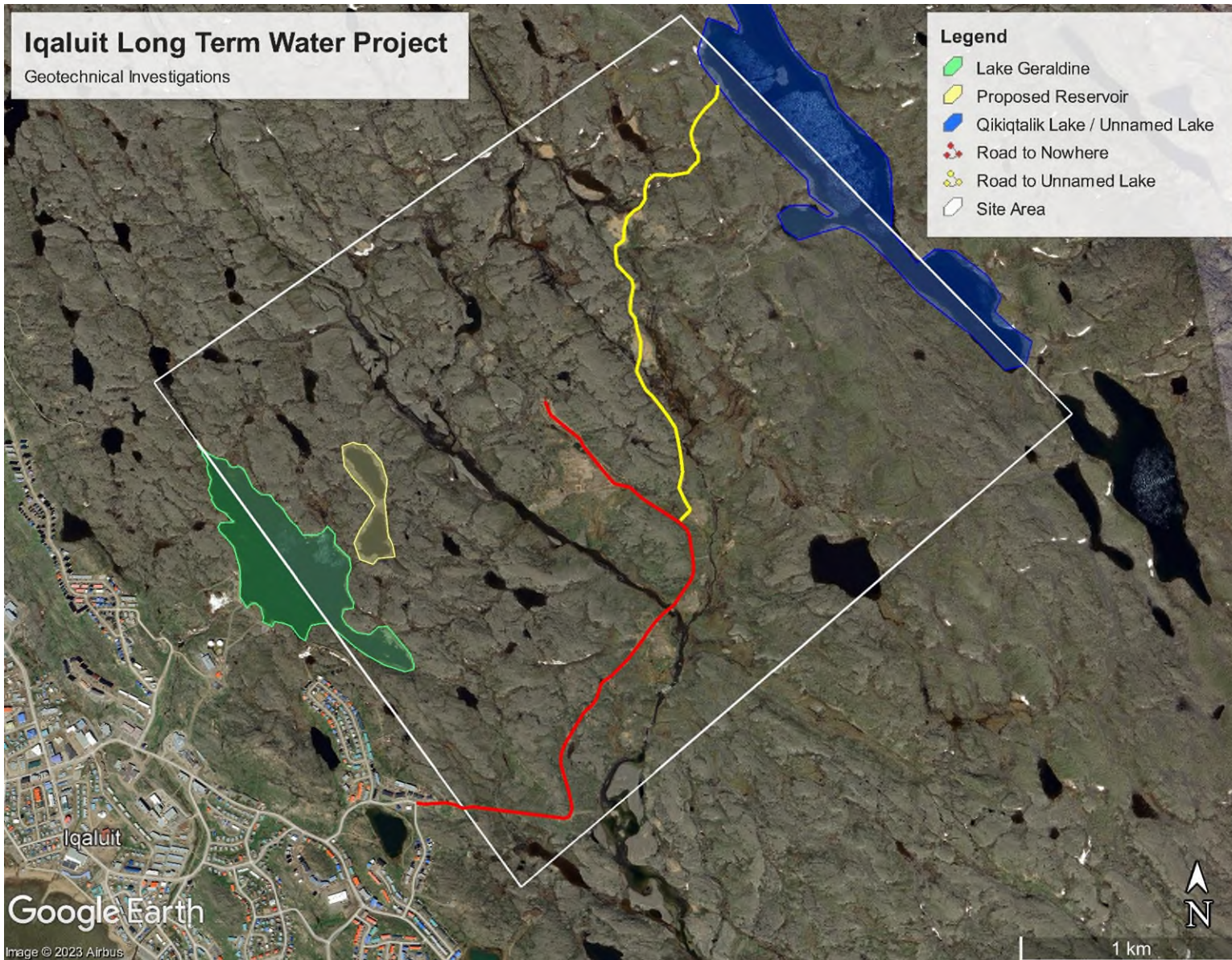
The following mitigation measures are planned to mitigate impacts from permafrost degradation:

- If snow clearing activities are required, snow cover will be carefully removed to reduce settlement of the fill during the future thaw periods.
- In areas where snow accumulation and/or drifting are an issue, ABG can implement mitigation measures such as flattening snow drifts or spreading plowed snow accumulation.
- If areas with snow drifting become a re-occurring issue, snow fencing can be installed upwind of road embankments to keep snow drifts off the road surface and away from drainage ditches.

# Erosion and Sediment Control Plan



## Long Term Water Project - Geotechnical Investigations



**Figure 1: Site Plan**

# Appendix D

**D: NIRB Screening Decision Report (No.: 23YN040)**



**SCREENING DECISION REPORT  
NIRB FILE No.: 23YN040**

NPC File No.: 150099

**November 2, 2023**

Following the Nunavut Impact Review Board’s (NIRB or Board) assessment of all materials provided, the NIRB is recommending that a review of City of Iqaluit’s (Iqaluit) “Long Term Water Project - Geotechnical Investigations” is not required pursuant to Article 12, Section 12.4.4(a) of the *Agreement between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in right of Canada (Nunavut Agreement)* and s. 92(1)(a) of the *Nunavut Planning and Project Assessment Act*, S.C. 2013, c. 14, s. 2 (*NuPPAA*).

Subject to the Proponent’s compliance with the terms and conditions as set out in below, the NIRB is of the view that the project proposal is not likely to cause significant public concerns, and it is unlikely to result in significant adverse environmental and social impacts. The NIRB therefore recommends that the responsible Minister accepts this Screening Decision Report.

**OUTLINE OF SCREENING DECISION REPORT**

<b>REGULATORY FRAMEWORK.....</b>	<b>2</b>
<b>PROJECT REFERRAL .....</b>	<b>3</b>
<b>PROJECT OVERVIEW &amp; THE NIRB ASSESSMENT PROCESS.....</b>	<b>3</b>
<b>ASSESSMENT OF THE PROJECT PROPOSAL IN ACCORDANCE WITH PART 3 OF NUPPAA.....</b>	<b>6</b>
<b>VIEWS OF THE BOARD .....</b>	<b>7</b>
<b>RECOMMENDED PROJECT-SPECIFIC TERMS AND CONDITIONS .....</b>	<b>10</b>
<b>OTHER NIRB CONCERNS AND RECOMMENDATIONS .....</b>	<b>13</b>
<b>CONCLUSION .....</b>	<b>14</b>

**APPENDICES**

APPENDIX A: SPECIES AT RISK IN NUNAVUT .....	15
APPENDIX B: ARCHAEOLOGICAL AND PALAEOLOGICAL RESOURCES TERMS AND CONDITIONS FOR LAND USE PERMIT HOLDERS .....	18

The primary objectives of the NIRB are set out in Article 12, Section 12.2.5 of the *Nunavut Agreement* and are confirmed by s. 23 of the *NuPPAA*:

*Nunavut Agreement*, Article 12, Section 12.2.5: In carrying out its functions, the primary objectives of NIRB shall be at all times to protect and promote the existing and future well-being of the residents and communities of the Nunavut Settlement Area, and to protect the ecosystemic integrity of the Nunavut Settlement Area. NIRB shall take into account the well-being of the residents of Canada outside the Nunavut Settlement Area.

The purpose of screening is provided for under Article 12, Section 12.4.1 of the *Nunavut Agreement* and s. 88 of the *NuPPAA* which states:

*NuPPAA*, s. 88: The purpose of screening a project is to determine whether the project has the potential to result in significant ecosystemic or socio-economic impacts and, accordingly, whether it requires a review by the Board...

To determine whether a review of a project is required, the NIRB is guided by the considerations as set out under Article 12, Section 12.4.2(a) and (b) of the *Nunavut Agreement* and s. 89(1) of *NuPPAA* which states:

*NuPPAA*, s. 89(1): The Board must be guided by the following considerations when it is called on to determine, on the completion of a screening, whether a review of the project is required:

- (a) a review is required if, in the Board's opinion,
  - i. the project may have significant adverse ecosystemic or socio-economic impacts or significant adverse impacts on wildlife habitat or Inuit harvest activities,
  - ii. the project will cause significant public concern, or
  - iii. the project involves technological innovations, the effects of which are unknown; and
- (b) a review is not required if, in the Board's opinion,
  - i. the project is unlikely to cause significant public concern, and
  - ii. its adverse ecosystemic and socioeconomic impacts are unlikely to be significant, or are highly predictable and can be adequately mitigated by known technologies.

It is noted that under Article 12, Section 12.4.2(c) and s. 89(2) of the *NuPPAA* provides that the considerations set out in s.89(1)(a) prevail over the considerations set out in s. 89(1)(b) of the *NuPPAA*.

As set out under Article 12, Section 12.4.4 of the *Nunavut Agreement* and s. 92(1) of the *NuPPAA*, upon conclusion of the screening process, the Board must provide its written report the Minister. The contents of the NIRB's report are specified under *NuPPAA*:

*NuPPAA*, s. 92(1): The Board must submit a written report to the responsible Minister containing a description of the project that specifies its scope and indicating that:

- (a) a review of the project is not required;
- (b) a review of the project is required; or
- (c) the project should be modified or abandoned.

Where the NIRB determines that a project may be carried out without a review, the NIRB has the discretion to recommend specific terms and conditions to be attached to any approval of the project proposal pursuant to paragraph 92(2)(a) of *NuPPAA* as follows:

*NuPPAA*, s. 92(2) In its report, the Board may also

- (a) recommend specific terms and conditions to apply in respect of a project that it determines may be carried out without a review.

## PROJECT REFERRAL

On June 23, 2023, the NIRB received a referral to screen City of Iqaluit’s (Iqaluit) “Long Term Water Project - Geotechnical Investigations” project proposal from the Nunavut Planning Commission (Commission), which noted that the project proposal is outside the area of an applicable regional land use plan.

Pursuant to Article 12, Sections 12.4.1 and 12.4.4 of the *Nunavut Agreement* and s. 87 of the *NuPPAA*, the NIRB commenced screening this project proposal and assigned it file number **23YN040**.

## PROJECT OVERVIEW & THE NIRB ASSESSMENT PROCESS

### 1. Screening Process Timelines

The following key stages were completed for the screening process:

<b>Date</b>	<b>Stage</b>
June 23, 2023	Receipt of project proposal and referral from the Commission.
June 23, 2023	Request to complete public registry online and provide information pursuant to s. 144(1) of the <i>NuPPAA</i>
August 8, 2023	Receipt of online application from Proponent
August 28, 2023	Scoping pursuant to s. 86(1) of the <i>NuPPAA</i>
August 29, 2023	Public engagement and comment request
August 30, 2023	Ministerial extension requested from the Minister Responsible for Nunavut Arctic College
September 19, 2023	Receipt of public comments
October 4, 2023	Proponent responded to comments/concerns raised by public
November 2, 2023	Issuance of Screening Decision Report

## 2. Project Scope

All documents received and pertaining to this project proposal can be accessed from the NIRB's online public registry at [www.nirb.ca/project/125845](http://www.nirb.ca/project/125845).

<b>Project:</b>	Long Term Water Project - Geotechnical Investigations
<b>Region:</b>	Qikiqtani
<b>Closest Community:</b>	Iqaluit
<b>Summary of Project Description:</b>	The Proponent intends to conduct geotechnical drilling to determine the best route for a water pipeline.
<b>Project Proposed Timeline:</b>	2023 to 2024

As required under s. 86(1) of the *NuPPAA*, the Board accepts the scope of the project as set out by City of Iqaluit in the proposal. The scope of the project proposal includes the following undertakings, works, or activities:

- Drilling of up to 24 boreholes;
- Use of
  - Borehole Drilling Machine;
  - Flatbed Truck;
  - Support Vehicle;
  - Diesel and gasoline, and
  - Anti-Freeze.

## 3. Inclusion or Exclusion to Scoping List

The NIRB has identified no additional works or activities in relation to the project proposal. As a result, the NIRB proceeded with screening the project based on the scope as described above.

## 4. Public Comments and Concerns

Notice regarding the NIRB's screening of this project proposal was distributed on August 29, 2023 to community organizations in Iqaluit, as well as to relevant federal and territorial government agencies, Inuit organizations and other parties. The NIRB requested that interested parties review the proposal and provide the Board with any comments or concerns by September 19, 2023 regarding:

- Whether the project proposal is likely to arouse significant public concern; and if so, why;
- Whether the project proposal is likely to cause significant adverse eco-systemic or socio-economic effects; and if so, why;
- Whether the project proposal is likely to cause significant adverse impacts on wildlife habitat or Inuit harvest activities; and if so, why;
- Whether the project proposal is of a type where the potential adverse effects are highly predictable and mitigable with known technology, (and providing any recommended mitigation measures); and
- Any matter of importance to the Party related to the project proposal.

On or before September 19, 2023, the NIRB received comments from the following interested parties:

- **Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC)**
  - a. *Summary of Public Comments and Concerns Received during the Public comment period of this file.*

The following provides a summary of the comments and concerns received by the NIRB:

## **CIRNAC**

- Recommends that the Proponent provide specific details of its fuel, waste, and erosion and sediment control management plans and encourages it to consider practices when implementing its project activities;
- Recommends that the Proponent provides descriptions of its drilling fluids, how gasoline will be used to support project activities, and measures it intends to implement in order to minimize chances of contamination of nearby waterbodies;
- Recommends that the Proponent clarifies which analyses will be performed on the rock samples, and whether it intends to characterize the PAG material of underlying bedrock in the study area; and
- Recommends that the Proponent continue to consult with interested parties and any other relevant interested Inuit, community members, and community organizations in Iqaluit who demonstrate an interest in the project.

### ***b. Comments and Concerns with respect to Inuit Qaujimaningit, Traditional, and Community Knowledge***

No concerns or comments were received with respect to Inuit Qaujimaningit or traditional and community knowledge in relation to the proposed project. However, Inuit Qaujimaningit and traditional and community knowledge is incorporated into the terms and conditions recommended below based on information collected from prior and similar projects, data collected and mapped by the Commission, and other available sources.

## **5. Proponent's Response to Public Comments and Concerns**

The following is a summary of the Proponent's response to concerns:

- A refueling plan will address how refueling will be done and ensure the concerns regarding distances from waterbodies;
- No fuel storage areas on site, the use of drip pans will be addressed in the refueling plan;
- There will be no sewage water generated, however some recirculation water may be used and will ensure any discharge of water to the land will be done in a manner that will not impact the local freshwater environment;
- As a general note this project will be covering the land as opposed to exposing bedrock except at the quarry and borrow locations. If during the course of the program it is identified the local bedrock beneath the proposed borrow pits is identified as being

materially different from the rock at the quarry site then samples of the bedrock could be recovered and submitted for analysis to confirm if PAG bedrock is being exposed, however, there are no plans to do this work at this time.

## 6. Time of Report Extension

As a result of the time required to allow due to the workload before the Board including several Reviews and Project Certificate reconsiderations associated with major development projects currently in progress, the NIRB was not able to provide its screening decision report to the responsible Minister within 45 days as required by Article 12, Section 12.4.5 of the *Nunavut Agreement* and s. 92(3) of the *NuPPAA*. Therefore, on August 30, 2023, the NIRB wrote to the Minister Responsible for Nunavut Arctic College, Government of Nunavut, seeking an extension to the 45-day timeline for the provision of the Board’s Report.

### ASSESSMENT OF THE PROJECT PROPOSAL IN ACCORDANCE WITH PART 3 OF *NuPPAA*

In determining whether a review of the project is required, the Board considered whether the project proposal had potential to result in significant ecosystemic or socio-economic impacts.

Accordingly, the assessment of impact significance was based on the analysis of those factors that are set out under s. 90 of the *NuPPAA*. The Board took particular care to take into account Inuit Qaujimaningit, traditional and community knowledge in carrying out its assessment and determination of the significance of impacts.

The following is a summary of the Board’s assessment of the factors that are relevant to the determination of significant impacts with respect of this project proposal:

Factor	Comment
The size of the geographic area, including the size of wildlife habitats, likely to be affected by the impacts.	<ul style="list-style-type: none"> <li>▪ The physical footprint of the proposed project components is within municipal boundaries of Iqaluit.</li> <li>▪ The proposed project would take place within habitats of far-ranging wildlife species such as migratory and non-migratory birds, arctic fox, arctic hare and Species at Risk such as Polar Bears.</li> </ul>
The ecosystemic sensitivity of that area.	<ul style="list-style-type: none"> <li>▪ No specific areas of ecosystemic sensitivity have been identified by the Proponent within the physical footprint of the proposed project.</li> </ul>
The historical, cultural and archaeological significance of that area.	<ul style="list-style-type: none"> <li>▪ No specific areas of historical, cultural and archaeological significance have been identified by the Proponent within the physical footprint of the proposed project.</li> </ul>
The size of the human and the animal populations likely to be affected by the impacts.	<ul style="list-style-type: none"> <li>▪ The proposed project is unlikely to result in impacts to local human and animal populations.</li> </ul>

Factor	Comment
The nature, magnitude and complexity of the impacts; the probability of the impacts occurring; the frequency and duration of the impacts; and the reversibility or irreversibility of the impacts.	<ul style="list-style-type: none"> <li>▪ A zone of influence of up to 20 km from the most potentially-disruptive project activities was selected for the NIRB's assessment.</li> <li>▪ With adherence to the relevant regulatory requirements and application of the mitigation measures recommended by the NIRB, no significant residual effects are expected to occur.</li> </ul>
The cumulative impacts that could result from the impacts of the project combined with those of any other project that has been carried out, is being carried out or is likely to be carried out.	<ul style="list-style-type: none"> <li>▪ The mitigation measures recommended by the NIRB have been designed with consideration for the potential for cumulative effects to result from the impacts of the project combined with other past, present and reasonably foreseeable projects.</li> </ul>
Any other factor that the Board considers relevant to the assessment of the significance of impacts.	<ul style="list-style-type: none"> <li>▪ No other relevant factors were identified.</li> </ul>

**Other past, present and reasonably foreseeable projects considered in this assessment:**

NIRB Project Number	Project Title	Project Type
<i>Proposed Developments – undergoing assessment</i>		
22MN025	Chidliak Diamond Mine	Mine Development
<i>Present Projects – approved or in operation</i>		
23YN010	Renewable Energy Microgrid Integration for Remote, Off-grid Cabins in Nunavut	Research

IEWS OF THE BOARD

In considering the factors as set out above in the screening of the project proposal, the NIRB has identified a number of issues below and respectfully provide the following views regarding whether or not the proposed project has the potential to result in significant impacts. In addition, the NIRB has proposed terms and conditions that would mitigate the potential adverse impacts identified.

The NIRB has listed specific Acts and Regulations below that may be applicable to the project proposal but this list should not be considered as a complete list and the Proponent is responsible to ensure that it follows all Acts and Regulations that may be applicable to the project proposal.

**Ecosystem, wildlife habitat and Inuit harvesting activities:**

<b>Valued Component</b>	Migratory and non-migratory birds, terrestrial and Species at Risk
-------------------------	--

<b>Potential effects:</b>	Potential adverse effects to and non-migratory birds, and their migratory routes and Species at Risk such as Ivory Gull from noise and visual disturbance generated from the transportation of personnel and equipment.
<b>Nature of Impacts:</b>	The potential for impacts is considered to be limited due to infrequent and temporary activities and any resulting impacts would be expected to be reversible
<b>Mitigating Factors:</b>	Proponent proposes to ensure camp is established with minimal impact to wildlife.
<b>Proposed Terms and Conditions:</b>	Water courses/Water bodies(including fresh and marine waters) – 6 through 8 Waste Management – 9 Fuel and Chemical Storage – 10 through 16 Wildlife – General – 17 Migratory Birds and Raptors disturbance – 18 and 19
<b>Related Acts and/or Regulations:</b>	<ol style="list-style-type: none"> <li>1. The <i>Migratory Birds Convention Act</i> and <i>Migratory Birds Regulations</i> (<a href="http://laws-lois.justice.gc.ca/eng/acts/M-7.01/">http://laws-lois.justice.gc.ca/eng/acts/M-7.01/</a>).</li> <li>2. The <i>Species at Risk Act</i> (<a href="http://laws-lois.justice.gc.ca/eng/acts/S-15.3/index.html">http://laws-lois.justice.gc.ca/eng/acts/S-15.3/index.html</a>). Attached in <b>Appendix A</b> is a list of Species at Risk in Nunavut.</li> <li>3. The <i>Wildlife Act (Nunavut)</i> and its corresponding regulations (<a href="http://www.canlii.org/en/nu/laws/stat/snu-2003-c-26/latest/snu-2003-c-26.html">http://www.canlii.org/en/nu/laws/stat/snu-2003-c-26/latest/snu-2003-c-26.html</a>).</li> </ol>

<b>Valued Component</b>	Land, terrestrial vegetation, and ground stability
<b>Potential effects:</b>	The potential for impacts is considered to be minimal due to the nature of the activities.
<b>Nature of Impacts:</b>	The potential for impacts is considered to be limited if regulations and best practices followed. The potential for disturbance due to other activities is considered to be minimal due to the localized and temporary nature of the activities.
<b>Mitigating Factors:</b>	Adhering to the NIRB's terms and conditions as well as regulations and the respective authorizations for the operation of drilling activities.
<b>Proposed Terms and Conditions:</b>	Road and Ground disturbance – 20 and 21 Drilling – General – 22 through 24 Drilling on Land – 25 through 29 Land use and Restoration of Disturbed Areas – 30 through 33
<b>Related Acts and/or Regulations:</b>	1. <i>Canadian Environmental Protection Act</i> ( <a href="http://laws-lois.justice.gc.ca/eng/acts/C-15.31/">http://laws-lois.justice.gc.ca/eng/acts/C-15.31/</a> ).

<b>Valued Component</b>	Public and Traditional land use
<b>Potential effects:</b>	No specific concerns or impacts to public and traditional land use activities in the area have been identified, however, the Board is recommending terms and conditions to ensure project activities are

	informed by available Inuit Qaujimaningit and that project activities do not interfere with Inuit wildlife harvesting or traditional land use activities.
<b>Nature of Impacts:</b>	The potential for impacts is considered to be minimal due to the nature of the activities and due care of the Proponent to avoid disturbance of Public and traditional land use.
<b>Mitigating Factors:</b>	The NIRB recommends below terms and conditions to mitigate any potential impacts to the public and traditional land use.
<b>Proposed Terms and Conditions:</b>	Heritage sites – 34 through 36 Other – 37 and 38
<b>Related Acts and/or Regulations:</b>	1. The <i>Nunavut Act</i> ( <a href="http://laws-lois.justice.gc.ca/eng/acts/N-28.6/">http://laws-lois.justice.gc.ca/eng/acts/N-28.6/</a> ).

### **Socio-economic effects on northerners:**

<b>Valued Component</b>	Local hiring, contracting and economic impacts.
<b>Potential effects:</b>	Potential positive impacts due to potential local hiring by the contracted companies and local purchasing. However, the NIRB suggests below term and condition to emphasize local hiring practices.
<b>Nature of Impacts:</b>	Positive potential impacts to the community.
<b>Proposed Terms and Conditions:</b>	Other – 39
<b>Related Acts and/or Regulations:</b>	n/a

### **Significant public concern:**

<b>Valued Component</b>	Public concern.
<b>Potential effects:</b>	No significant public concern was expressed during the public commenting period for this file.
<b>Nature of Impacts:</b>	The potential for impacts is considered to be minimal as long as the Proponent follows the recommended terms and conditions.
<b>Mitigating Factors:</b>	The Board is recommending terms and conditions to ensure project activities do not interfere with Inuit wildlife harvesting or traditional land use activities, to the extent possible hire local people and access local services where possible, and to ensure planned activities in the area utilize available Inuit Qaujimaningit.
<b>Proposed Terms and Conditions:</b>	Other – 37 and 38
<b>Related Acts and/or Regulations:</b>	n/a

### **Technological innovations for which the effects are unknown:**

No specific issues have been identified associated with this project proposal.

### **Administrative Conditions:**

Responsible authorities or Proponent shall notify the Nunavut Planning Commission and/or Parks Canada as appropriate, and the NIRB of any changes in operating plans or conditions, including phase advancement, associated with this project prior to any such change.

To encourage compliance with applicable regulatory requirements and assist the Board and responsible authorities with compliance and effects monitoring for project activities, the following project-specific terms and conditions have been recommended: 1-5.

In considering the above factors and subject to the Proponent's compliance with the terms and conditions necessary to mitigate against the potential adverse environmental and social effects, the Board is of the view that the proposed project is unlikely to cause significant public concern and its adverse ecosystemic and socioeconomic impacts are unlikely to be significant, or are highly predictable and can be adequately mitigated by known technologies.

### RECOMMENDED PROJECT-SPECIFIC TERMS AND CONDITIONS

The Board is recommending the following specific terms and conditions to apply in respect of the project:

#### **General**

1. City of Iqaluit (the Proponent) shall maintain a copy of the Project Terms and Conditions at the site of operation at all times and make it accessible to enforcement officers upon request.
2. The Proponent shall operate in accordance with all commitments stated in correspondence provided to the Nunavut Planning Commission (NPC File No.:150099) and the NIRB (Online Application Form, August 8, 2023). This information should be accessible to enforcement officers upon request.
3. The Proponent shall operate the site in accordance with all applicable Acts, Regulations and Guidelines.
4. The Proponent shall ensure that it meets the standards and/or limits as set out in the authorizing agencies' permits or licences as required for this project.
5. The Proponent shall ensure that all personnel, staff and contractors are adequately trained prior to commencement of all project activities, and shall be made aware of all operational plans, management plans, guidelines and Proponent commitments relating to the project.

#### **Water courses/Water bodies (including fresh and marine waters)**

6. The Proponent shall ensure that no disturbance of the stream bed, lakebed or the banks of any definable watercourse be permitted, except where deemed necessary for maintaining project-specific operational commitments or approved by a responsible authority in cases of spill management.
7. The Proponent shall implement erosion and sediment suppression measures on all areas during all project activities in order to prevent sediment or fugitive dust from entering any water body or surrounding environment. Erosion prevention measures may include berms or silt fences.

8. The Proponent shall not deposit, nor permit the deposit of any fuel, chemicals, wastes (including wastewater) or sediment into any water body. The Proponent should have in place an Emergency Spill Response Plan that is approved by the appropriate authorizing agency(ies).

### **Waste Management**

9. The Proponent shall manage all hazardous and non-hazardous waste including food, domestic wastes, debris and petroleum-based chemicals (e.g., greases, gasoline, glycol-based antifreeze) in such a manner to avoid release into the environment and access to wildlife at all times until disposed of appropriately or at an approved facility.

### **Fuel and Chemical Storage**

10. The Proponent shall locate all fuel and other hazardous materials a minimum distance away from the high-water mark of any water body and environmentally sensitive areas as required by the appropriate authorizing agencies. The materials shall be stored in such a manner as to prevent their release into the environment.
11. The Proponent shall use adequate secondary containment or a surface liner (e.g., self-supporting insta-berms and fold-a-tanks) when storing barreled fuel and chemicals at all locations.
12. The Proponent shall ensure that re-fuelling of all equipment occurs a minimum distance away from the high-water mark of any water body as required by the appropriate authorizing agencies.
13. The Proponent shall have a Spill Contingency Plan in place at all fuel storage or transfer locations and shall ensure that appropriate spill response equipment and clean-up materials (e.g., shovels, pumps, barrels, drip pans, and absorbents) are readily available.
14. The Proponent shall follow the authorizing agencies' direction for management and removal of hazardous materials and wastes (e.g., contaminated soils, sediment and waste oil).
15. The Proponent shall ensure that wildlife deterrent systems are utilized at the time of a spill incident in order to avoid wildlife (terrestrial or marine) and migratory birds from being contaminated.
16. The Proponent shall ensure that all spills of fuel or other deleterious materials of 100 litres or more must be reported immediately to the 24-hour Spill Line at (867) 920-8130.

### **Wildlife – General**

17. The Proponent shall not substantially alter or damage or destroy any wildlife habitat in conducting this operation unless otherwise authorized by the appropriate authorizing agencies.

### **Migratory Birds and Raptors Disturbance**

18. The Proponent shall carry out all phases of the project in a manner that protects migratory birds and avoids harming, killing or disturbing migratory birds or destroying, disturbing or taking their nests or eggs. In this regard, the Proponent shall take into account Environment and Climate Change Canada's *Avoidance Guidelines*. The Proponent's actions in applying the *Avoidance Guidelines* shall be in compliance with the *Migratory Birds Convention Act, 1994* and with the *Species at Risk Act*.

19. The Proponent shall not disturb or destroy the nests or eggs of any birds. If active nests of any birds are discovered or located (i.e., with eggs or young), the Proponent shall avoid these areas until nesting is complete and the young have naturally left the vicinity of the nest by establishing a protection buffer zone<sup>1</sup> appropriate for the species and the surrounding habitat.

### **Road and Ground Disturbance**

20. The Proponent shall not move any equipment or vehicles unless the ground surface is in a state capable of fully supporting the equipment or vehicles without rutting or gouging. Overland travel of equipment or vehicles must be suspended if rutting occurs.

21. The Proponent shall select a winter route that maximizes the use of frozen water bodies.

### **Drilling – General**

22. The Proponent shall not allow any drilling wastes to spread to the surrounding lands or water bodies.

23. The Proponent shall ensure that any deleterious substances (as defined in the *Fisheries Act*) resulting from its activities do not enter into any water bodies frequented by fish.

24. The Proponent shall ensure that all drill areas are constructed to facilitate minimizing the environmental footprint of the project area.

### **Drilling on Land**

25. The Proponent shall not conduct any land-based drilling or mechanized clearing activities a minimum distance of the normal high-water mark of any water body as required by an authorizing agency.

26. If an artesian flow is encountered, the Proponent shall ensure the drill hole is immediately plugged and permanently sealed.

27. The Proponent shall ensure that all sump/depression capacities are sufficient to accommodate the volume of wastewater and any fines that are produced. The sumps shall only be used for inert drilling fluids, and not any other materials or substances.

28. The Proponent shall not locate any sumps within a minimum distance of the normal high-water mark of any water body as required by an authorizing agency.

29. The Proponent shall ensure all drill holes are backfilled or capped prior to the end of each field season. All sumps must be backfilled and restored to original or stable profile prior to the end of each field season.

### **Land Use and Restoration of Disturbed Areas**

30. The Proponent shall use existing trails where possible during project activities on the land.

31. The Proponent shall ensure that the land use area is kept clean and tidy at all times.

32. The Proponent shall remove all garbage, fuel and equipment at the end of each field season and/or upon completion of work and/or upon abandonment.

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<sup>1</sup> Recommended setback distances to define buffer zones have been established by Environment and Climate Change Canada for different bird groups nesting in tundra habitat and can be found at [www.ec.gc.ca/paom-itmb](http://www.ec.gc.ca/paom-itmb).

33. The Proponent shall ensure that all disturbed areas are restored to a stable or pre-disturbed state using Best Available Technology Economically Achievable (BATEA) upon completion of work and/or abandonment.

### **Heritage Sites**

34. The Proponent shall ensure that archaeological and paleontological sites are not purposely or inadvertently disturbed by clients or staff as a result of project activities.
35. The Proponent shall ensure that all clients and staff are aware of the Proponent's responsibilities and requirements regarding archaeological or palaeontological sites that are encountered during land-based activities. This should include briefings explaining the prohibitions regarding removal of artifacts, and defacing or writing on rocks and infrastructure.
36. No activities shall be conducted in the vicinity (50 metres buffer zone) of any archaeological/historical sites. If archaeological sites or features are encountered, activities shall immediately be interrupted and moved away from this location. Each site encountered needs to be recorded and reported to the Government of Nunavut-Department of Culture and Heritage.

### **Other**

37. The Proponent should engage with local residents regarding planned activities in the area and should solicit available Inuit Qaujimaningit and information regarding current recreational and traditional usage of the project area which may inform project activities. Posting of translated public notices and direct engagement with potentially interested groups and individuals prior to undertaking project activities is strongly encouraged.
38. The Proponent shall ensure that project activities do not interfere with Inuit wildlife harvesting or traditional land use activities.
39. The Proponent should, to the extent possible, hire local people and access local services where possible.

## **OTHER NIRB CONCERNS AND RECOMMENDATIONS**

In addition to the project-specific terms and conditions, the Board is recommending the following:

### **Copy of licences, etc. to the Board and Commission**

1. The NIRB respectfully requests that responsible authorities submit a copy of each licence, permit or other authorization issued for the Project to the NIRB to assist in enabling possible project monitoring that may be required. Please forward a copy of the licences, permits and/or other authorizations to the NIRB directly at [info@nirb.ca](mailto:info@nirb.ca) or upload a copy to the NIRB's online registry at [www.nirb.ca](http://www.nirb.ca).

### **Use of Inuit Qaujimaningit**

2. The Proponent is encouraged to work with local communities and knowledge holders to inform project design, to carry out the project, and to confirm or validate the perspectives represented in publications, reports produced as part of the project. Care should be taken to ensure that

Inuit Qaujimaningit and local knowledge collected for the project is used with permission and is accurately represented.

## CONCLUSION

The foregoing constitutes the Board's screening decision with respect to the City of Iqaluit's (Iqaluit) "Long Term Water Project - Geotechnical Investigations". The NIRB remains available for consultation with the Minister regarding this report as necessary.

Dated November 2, 2023, at Baker Lake, NU.

  
Kaviq Kaluraq, Chairperson

Attachments: Appendix A: Species at Risk in Nunavut  
Appendix B: Archaeological and Palaeontological Resources Terms and Conditions for Land Use Permit Holders

## APPENDIX A: SPECIES AT RISK IN NUNAVUT

Due to the requirements of Section 79(2) of the Species at Risk Act (SARA), and the potential for project-specific adverse effects on listed wildlife species and its critical habitat, measures should be taken as appropriate to avoid or lessen those effects, and the effects need to be monitored. Project effects could include species disturbance, attraction to operations and destruction of habitat. This section applies to all species listed on Schedule 1 of SARA, as listed in the table below, or have been assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), which may be encountered in the project area. This list may not include all species identified as at risk by the Territorial Government. The following points provide clarification on the applicability of the species outlined in the table.

- Schedule 1 is the official legal list of Species at Risk for SARA. SARA applies to all species on Schedule 1. The term “listed” species refers to species on Schedule 1.
- Schedule 2 and 3 of SARA identify species that were designated at risk by the COSEWIC prior to October 1999 and must be reassessed using revised criteria before they can be considered for addition to Schedule 1.
- Some species identified at risk by COSEWIC are “pending” addition to Schedule 1 of SARA. These species are under consideration for addition to Schedule 1, subject to further consultation or assessment.

If species at risk are encountered or affected, the primary mitigation measure should be avoidance. The Proponent should avoid contact with or disturbance to each species, its habitat and/or its residence. All direct, indirect, and cumulative effects should be considered. Refer to species status reports and other information on the species at risk Registry at <http://www.sararegistry.gc.ca> for information on specific species.

Monitoring should be undertaken by the Proponent to determine the effectiveness of mitigation and/or identify where further mitigation is required. As a minimum, this monitoring should include recording the locations and dates of any observations of species at risk, behaviour or actions taken by the animals when project activities were encountered, and any actions taken by the proponent to avoid contact or disturbance to the species, its habitat, and/or its residence. This information should be submitted to the appropriate regulators and organizations with management responsibility for that species, as requested.

For species primarily managed by the Territorial Government, the Territorial Government should be consulted to identify other appropriate mitigation and/or monitoring measures to minimize effects to these species from the project.

Mitigation and monitoring measures must be undertaken in a way that is consistent with applicable recovery strategies and action/management plans.

Schedules of SARA are amended on a regular basis, so it is important to check the SARA registry ([www.sararegistry.gc.ca](http://www.sararegistry.gc.ca)) to get the current status of a species.

Updated: September 2019

Terrestrial Species at Risk <sup>2</sup>	COSEWIC Designation	Schedule of SARA	Government Organization with Primary Management Responsibility <sup>3</sup>
<b>Migratory Birds</b>			
Buff-breasted Sandpiper	Special Concern	Schedule 1	Environment and Climate Change Canada (ECCC)
Common Nighthawk	Threatened	Schedule 1	ECCC
Eskimo Curlew	Endangered	Schedule 1	ECCC
Harlequin Duck	Special Concern	Schedule 1	ECCC
Harris's Sparrow	Special Concern	Schedule 1	ECCC
Horned Grebe	Special Concern	Schedule 1	ECCC
Ivory Gull	Endangered	Schedule 1	ECCC
Olive-sided Flycatcher	Threatened	Schedule 1	ECCC
Peregrine Falcon	Special Concern	Schedule 1	ECCC
Red Knot Islandica Subspecies	Special Concern	Schedule 1	ECCC
Red-necked Phalarope	Special Concern	Schedule 1	ECCC
Ross's Gull	Threatened	Schedule 1	ECCC
Rusty Blackbird	Special Concern	Schedule 1	ECCC
Short-eared Owl	Special Concern	Schedule 1	ECCC
<b>Vegetation</b>			
Porsild's Bryum	Threatened	Schedule 1	Government of Nunavut (GN)
<b>Arthropods</b>			
Transverse Lady Beetle	Special Concern	No Schedule	GN
<b>Terrestrial Wildlife</b>			
Caribou (Dolphin and Union Population)	Endangered	Schedule 1	GN
Caribou (Barren-ground Population)	Threatened	No Schedule	GN
Caribou (Torngat Mountains Population)	Endangered	No Schedule	GN
Grizzly Bear (Western Population)	Special Concern	Schedule 1	ECCC
Peary Caribou	Endangered	Schedule 1	GN
Polar Bear	Special Concern	Schedule 1	ECCC
Wolverine	Special Concern	Schedule 1	GN
<b>Marine Wildlife</b>			
Atlantic Walrus (High Arctic Population)	Special Concern	No Schedule	Fisheries and Oceans Canada (DFO)
Atlantic Walrus (Central/Low Arctic Population)	Special Concern	No Schedule	DFO
Beluga Whale (Cumberland Sound Population)	Threatened	Schedule 1	DFO
Beluga Whale (Eastern Hudson Bay Population)	Endangered	No Schedule	DFO

<sup>2</sup> The Department of Fisheries and Oceans has responsibility for aquatic species.

<sup>3</sup> Environment and Climate Change Canada (ECCC) has a national role to play in the conservation and recovery of Species at Risk in Canada, as well as responsibility for management of birds described in the Migratory Birds Convention Act (MBCA). Day-to-day management of terrestrial species not covered in the MBCA is the responsibility of the Territorial Government. Populations that exist in National Parks are also managed under the authority of the Parks Canada Agency.

<b>Terrestrial Species at Risk<sup>2</sup></b>	<b>COSEWIC Designation</b>	<b>Schedule of SARA</b>	<b>Government Organization with Primary Management Responsibility<sup>3</sup></b>
Beluga Whale (Eastern High Arctic-Baffin Bay Population)	Special Concern	No Schedule	DFO
Beluga Whale (Western Hudson Bay Population)	Special Concern	No Schedule	DFO
<b>Fish</b>			
Atlantic Cod (Arctic Lakes Population)	Special Concern	No Schedule	DFO
Fourhorn Sculpin (Freshwater Form)	Data Deficient	Schedule 3	DFO
Lumpfish	Threatened	No Schedule	DFO
Thorny Skate	Special Concern	No Schedule	DFO

**APPENDIX B: ARCHAEOLOGICAL AND PALAEOLOGICAL RESOURCES TERMS AND  
CONDITIONS FOR LAND USE PERMIT HOLDERS**



**INTRODUCTION**

The Department of Culture and Heritage (CH) routinely reviews land use applications sent to the Nunavut Water Board, Nunavut Impact Review Board and the Indigenous and Northern Affairs Canada. These terms and conditions provide general direction to the permittee/proponent regarding the appropriate actions to be taken to ensure the permittee/proponent carries out its role in the protection of Nunavut’s archaeological and palaeontological resources.

**TERMS AND CONDITIONS**

- 1) The permittee/proponent shall have a professional archaeologist and/or palaeontologist perform the following **Functions** associated with the **Types of Development** listed below or similar development activities:

	<b>Types of Development</b> (See Guidelines below)	<b>Function</b> (See Guidelines below)
a)	Large scale prospecting	Archaeological/Palaeontological Overview Assessment
b)	Diamond drilling for exploration or geotechnical purpose or planning of linear disturbances	Archaeological/Palaeontological Overview Assessment and/or Inventory and Documentation and/or Mitigation
c)	Construction of linear disturbances, Extractive disturbances, Impounding disturbances and other land disturbance activities	Archaeological/Palaeontological Overview Assessment and/or Inventory and Documentation and/or Mitigation

Note that the above-mentioned functions require either a Nunavut Archaeologist Permit or a Nunavut Palaeontologist Permit. CH is authorized by way of the *Nunavut and Archaeological and Palaeontological Site Regulations*<sup>4</sup> to issue such permits.

<sup>4</sup>P.C. 2001-1111 14 June, 2001

- 2) The permittee/proponent shall not operate any vehicle over a known or suspected archaeological or palaeontological site.
- 3) The permittee/proponent shall not remove, disturb, or displace any archaeological artifact or site, or any fossil or palaeontological site.
- 4) The permittee/proponent shall immediately contact CH at (867) 934-2046 or (867) 975-5500 should an archaeological site or specimen, or a palaeontological site or fossil, be encountered or disturbed by any land use activity.
- 5) The permittee/proponent shall immediately cease any activity that disturbs an archaeological or palaeontological site encountered during the course of a land use operation until permitted to proceed with the authorization of CH.
- 6) The permittee/proponent shall follow the direction of CH in restoring disturbed archaeological or palaeontological sites to an acceptable condition. If these conditions are attached to either a Class A or B Permit under the Territorial Lands Act Indigenous and Northern Affairs Canada directions will also be followed.
- 7) The permittee/proponent shall provide all information requested by CH concerning all archaeological sites or artifacts and all palaeontological sites and fossils encountered in the course of any land use activity.
- 8) The permittee/proponent shall make best efforts to ensure that all persons working under its authority are aware of these conditions concerning archaeological sites and artifacts and palaeontological sites and fossils.
- 9) If a list of recorded archaeological and/or palaeontological sites is provided to the permittee/proponent by CH as part of the review of the land use application the permittee/proponent shall avoid the archaeological and/or palaeontological sites listed.
- 10) Should a list of recorded sites be provided to the permittee/proponent, the information is provided solely for the purpose of the proponent's land use activities as described in the land use application, and must otherwise be treated confidentially by the proponent.

## Legal Framework

As stated in Article 33 of the *Agreement between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in right of Canada (Nunavut Agreement)*:

*Where an application is made for a land use permit in the Nunavut Settlement Area, and there are reasonable grounds to believe that there could be sites of archaeological importance on the lands affected, no land use permit shall be issued without written consent of the Designated Agency. Such consent shall not be unreasonably withheld. [33.5.12]*

*Each land use permit referred to in Section 33.5.12 shall specify the plans and methods of archeological site protection and restoration to be followed by the permit holder, and any other conditions the Designated Agency may deem fit. [33.5.13]*

## Palaeontology and Archaeology

Under the *Nunavut Act*<sup>5</sup>, the federal government can make regulations for the protection, care and preservation of palaeontological and archaeological sites and specimens in Nunavut. Under the *Nunavut Archaeological and Palaeontological Sites Regulations*<sup>6</sup>, it is illegal to alter or disturb any palaeontological or archaeological site in Nunavut unless permission is first granted through the permitting process.

## Definitions

As defined in the *Nunavut Archaeological and Palaeontological Sites Regulations*, the following definitions apply:

*“archaeological site” means a place where an archaeological artifact is found.*

*“archaeological artifact” means any tangible evidence of human activity that is more than 50 years old and in respect of which an unbroken chain of possession or regular pattern of usage cannot be demonstrated, and includes a Denesuline archaeological specimen referred to in section 40.4.9 of the Agreement between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in right of Canada (Nunavut Agreement).*

*“palaeontological site” means a site where a fossil is found.*

*“fossil” includes:*

*Fossil means the hardened or preserved remains or impression of previously living organisms or vegetation and includes:*

- (a) natural casts;*
- (b) preserved tracks, coprolites and plant remains; and*
- (c) the preserved shells and exoskeletons of invertebrates and the preserved eggs, teeth and bones of vertebrates.*

## *Guidelines for Developers for the Protection of Archaeological Resources in the Nunavut Territory*

(Note: Partial document only, complete document at: [www.ch.gov.nu.ca/en/Archaeology.aspx](http://www.ch.gov.nu.ca/en/Archaeology.aspx))

## Introduction

The following guidelines have been formulated to ensure that the impacts of proposed developments upon heritage resources are assessed and mitigated before ground surface altering activities occur. Heritage resources are defined as, but not limited to, archaeological and historical sites, burial grounds, palaeontological sites, historic buildings and cairns. Effective collaboration between the developer, the Department of Culture, and Heritage (CH), and the contract archaeologist(s) will ensure proper preservation of heritage resources in the Nunavut Territory. The roles of each are briefly described.

CH is the Nunavut Government agency which oversees the protection and management of heritage resources in Nunavut, in partnership with land claim authorities, regulatory agencies, and

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<sup>5</sup> s. 51(1)

<sup>6</sup> P.C. 2001-1111 14 June, 2001

the federal government. Its role in mitigating impacts of developments on heritage resources is as follows: to identify the need for an impact assessment and make recommendations to the appropriate regulatory agency; set the terms of reference for the study depending upon the scope of the development; suggest the names of qualified individuals prepared to undertake the study to the developer; issue an archaeologist or palaeontologist permit authorizing field work; assess the completeness of the study and its recommendations; and ensure that the developer complies with the recommendations.

The primary regulatory agencies that CH provides information and assistance to are the Nunavut Impact Review Board, for development activities proposed for Inuit Owned Lands (as defined in Section 1.1.1 of the *Agreement between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in right of Canada (Nunavut Agreement)*), and the Indigenous and Northern Affairs Canada, for development activities proposed for federal Crown Lands.

A developer is the initiator of a land use activity. It is the obligation of the developer to ensure that a qualified archaeologist or palaeontologist is hired to perform the required study and that provisions of the contract with the archaeologist or palaeontologist allow permit requirements to be met; i.e. fieldwork, collections management, artifact and specimen conservation, and report preparation. On the recommendation of the contract archaeologist or palaeontologist in the field and the Government of Nunavut, the developer shall implement avoidance or mitigative measures to protect heritage resources or to salvage the information they contain through excavation, analysis, and report writing. The developer assumes all costs associated with the study in its entirety.

Through his or her active participation and supervision of the study, the contract archaeologist or palaeontologist is accountable for the quality of work undertaken and the quality of the report produced. Facilities to conduct fieldwork, analysis, and report preparation should be available to this individual through institutional, agency, or company affiliations. Responsibility for the curation of objects recovered during field work while under study and for documents generated in the course of the study as well as remittance of artifacts, specimens and documents to the repository specified on the permit accrue to the contract archaeologist or palaeontologist. This individual is also bound by the legal requirements of the *Nunavut Archaeological and Palaeontological Sites Regulations*.

### **Types of Development**

In general, those developments that cause concern for the safety of heritage resources will include one or more of the following kinds of surface disturbances. These categories, in combination, are comprehensive of the major kinds of developments commonly proposed in Nunavut. For any single development proposal, several kinds of these disturbances may be involved.

- *Linear disturbances: including the construction of highways, roads, winter roads, transmission lines, and pipelines;*
- *Extractive disturbances: including mining, gravel removal, quarrying, and land filling;*
- *Impoundment disturbances: including dams, reservoirs, and tailings ponds;*

- *Intensive land use disturbances: including industrial, residential, commercial, recreational, and land reclamation work, and use of heritage resources as tourist developments.*
- *Mineral, oil and gas exploration: establishment of camps, temporary airstrips, access routes, well sites, or quarries all have potential for impacting heritage resources.*

### **Types of Studies Undertaken to Preserve Heritage Resources**

**Overview:** An overview study of heritage resources should be conducted at the same time as the development project is being designed or its feasibility addressed. They usually lack specificity with regard to the exact location(s) and form(s) of impact and involve limited, if any, field surveys. Their main aim is to accumulate, evaluate, and synthesize the existing knowledge of the heritage of the known area of impact. The overview study provides managers with baseline data from which recommendations for future research and forecasts of potential impacts can be made. A Class I Permit is required for this type of study if field surveys are undertaken.

**Reconnaissance:** This is done to provide a judgmental appraisal of a region sufficient to provide the developer, the consultant, and government managers with recommendations for further development planning. This study may be implemented as a preliminary step to inventory and assessment investigations except in cases where a reconnaissance may indicate a very low or negligible heritage resource potential. Alternately, in the case of small-scale or linear developments, an inventory study may be recommended and obviate the need for a reconnaissance.

The main goal of a reconnaissance study is to provide baseline data for the verification of the presence of potential heritage resources, the determination of impacts to these resources, the generation of terms of reference for further studies and, if required, the advancement of preliminary mitigative and compensatory plans. The results of reconnaissance studies are primarily useful for the selection of alternatives and secondarily as a means of identifying impacts that must be mitigated after the final siting and design of the development project. Depending on the scope of the study, a Class 1 or Class 2 Permit is required for this type of investigation.

**Inventory:** A resource inventory is generally conducted at that stage in a project's development at which the geographical area(s) likely to sustain direct, indirect, and perceived impacts can be well defined. This requires systematic and intensive fieldwork to ascertain the effects of all possible and alternate construction components on heritage resources. All heritage sites must be recorded on Government of Nunavut Site Survey forms. Sufficient information must be amassed from field, library and archival components of the study to generate a predictive model of the heritage resource base that will:

- allow the identification of research and conservation opportunities;
- enable the developer to make planning decisions and recognize their likely effects on the known or predicted resources; and
- make the developer aware of the expenditures, which may be required for subsequent studies and mitigation. A Class 1 or 2 permit is required.

**Assessment:** At this stage, sufficient information concerning the numbers and locations of heritage resources will be available, as well as data to predict the forms and magnitude of impacts. Assessments provide information on the size, volume, complexity and content of a heritage resource, which is used to rank the values of different sites or site types given current archaeological knowledge. As this information will shape subsequent mitigation program(s), great care is necessary during this phase.

**Mitigation:** This refers to the amelioration of adverse impacts to heritage resources and involves the avoidance of impact through the redesign or relocation of a development or its components; the protection of the resource by constructing physical facilities; or the scientific investigation and recovery of information from the resource by excavation or other method. The type(s) of appropriate mitigative measures are dictated by their viability in the context of the development project. Mitigation strategies must be developed in consultation with, and approved by, the Department of Culture and Heritage. It is important to note that mitigation activities should be initiated as far in advance of the construction of the development as possible.

**Surveillance and monitoring:** These may be required as part of the mitigation program.

*Surveillance* may be conducted during the construction phase of a project to ensure that the developer has complied with the recommendations.

*Monitoring* involves identification and inspection of residual and long-term impacts of a development (i.e. shoreline stability of a reservoir); or the use of impacts to disclose the presence of heritage resources, for example, the uncovering of buried sites during the construction of a pipeline.

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