

# ABANDONMENT AND RESTORATION PLAN

## BAKER LAKE GEOTHERMAL PROJECT

Hamlet of Baker Lake, NU

Prepared for:



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## 1 Introduction

This Abandonment and Restoration Plan (ARP) has been developed on behalf of Qulliq Energy Corporation (QEC or the Company) in accordance with applicable legislation, guidelines and best practices. This ARP applies to the activities associated with the investigation for potential geothermal energy at the Baker Lake Geothermal Project (the Project), Nunavut, Canada.

The ARP will come into effect as soon as all permits, licences and authorizations have been obtained for the Project. Copies and updates to this plan may be obtained via the Company or APEX Geoscience Ltd. (APEX). This ARP will be replaced, upon approval, if there are any significant changes to the activities outlined in the existing permits which warrant changes to this ARP. Minor changes will be submitted as an addendum to this ARP and submitted to the distribution list as required.

### 1.1 Contact Details

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Edmonton, AB T5M 3Y7  
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### 1.2 Purpose and Scope

The purpose of the Baker Lake Geothermal Project ARP is to provide guidelines to follow during the shutdown and final abandonment of the Project, in order to return the site to as near as possible to natural conditions.

### 1.3 Other Plans

The ARP should be considered as a part of the project-wide management system. Other management plans in place at the Baker Lake Geothermal Project include:

- Emergency Response Plan (ERP)
- Environmental Management Plan (EMP)
- Spill Contingency and Fuel Management Plan (SCFMP)
- Waste Management Plan (WMP)

### 1.4 Project Description

QEC is a 100% Government of NU owned corporation that is the sole provider of electrical power in the Territory. QEC currently provides power to all 25 communities in NU by operating stand-alone diesel power plants in each, which means that it is dependent upon fossil fuels. However, QEC is actively searching for new and renewable energy resources.

QEC commissioned a Nunavut Geothermal Feasibility Study, completed by RESPEC, with guidelines set by the Canadian Geothermal Energy Association (CanGEA) for the Canadian National Geothermal Database (CNGD), published in June 2018. Baker Lake

has been selected as a test site for investigating the geothermal potential in the Canadian Shield.

The Project will consist of the completion of a small diameter, temperature gradient hole in which geothermal properties will be studied. Should this work yield positive results, further investigations, will be conducted that might ultimately lead to the construction of a geothermal heat and power facility that would help reduce, if not eliminate, the hamlet's dependence on fossil fuels.

The Project will commence in the late summer or fall and will comprise the drilling of a single, approximately 800-metre deep, vertical core hole at a target location within Lot 447 of the hamlet of Baker Lake. A small volume of fuel (less than 4,000 L) will be required to power the drill during the program and will be appropriately permitted and managed. A camp will not be required for the exploration program, as the project is within the municipal boundaries of the hamlet of Baker Lake.

A Community Consultation visit to Baker Lake to discuss the QEC Baker Lake Geothermal Project is planned prior to the commencement of the program.

All drilling will be confined to Lot 447 of Baker Lake as seen in Figure 2 of Appendix 1.

## 2 Project Equipment

Due to the project being within the hamlet of Baker Lake, no camp will be constructed. The core will be processed in a rented, heated facility in Baker Lake. Below is a list of equipment and vehicles that may be present at the proposed drill site.

### 2.1 Ground Transportation

- Pickup Truck x 2
- Water Truck if water source too far to pump

### 2.2 Drilling Equipment

- Zinex A5 (or similar) diamond drill complete with motor, gear box, drill head, tower, overshot, skids, and housing
- Water pump
- Water Tank
- Mix tank with pressure pump
- Generator
- Coil heater
- Fuel Tank
- Utility basket for drill equipment, spares, supplies, etc.
- 3 metre NQ drill rods x 400
- NQ casing (various sizes) x 50
- 100' hose line with fish screens x 150

### 2.3 Fuel

- 205 L Drums diesel x 5

- 205 L Drums gasoline x 1
- 100 lbs propane tanks x 2

### 3 Progressive Reclamation

From the *Guidelines for the Closure and Reclamation Cost Estimate for Mines in the Northwest Territories*, prepared by Mackenzie Valley Land and Water Board and Aboriginal Affairs and Northern Development Canada, November 2013:

*“Progressive reclamation takes place prior to permanent closure to reclaim components and/or decommission facilities that no longer serve a purpose. These activities can be completed during operations with the available resources to reduce future reclamation costs, minimize the duration of environmental exposure, and enhance environmental protection. Progressive reclamation may shorten the time for achieving closure objectives and may provide valuable experience on the effectiveness of certain measures that might be implemented during permanent closure.”*

Progressive reclamation will be continually carried out at the Baker Lake Geothermal Project. The progressive reclamation activities will include, but not be limited to:

- Photos will be taken at the drill site before, during and after drilling operations.
- Fuel and any other hazardous materials will be kept within secondary containment and appropriate precautions will be taken when refuelling or topping up other fluids/chemicals, but in the event of a spill it will be treated immediately as per the “Baker Lake Geothermal Project Spill Contingency and Fuel Management Plan.”
- Proper training and waste receptacles will be provided to ensure waste is separated appropriately and can be easily disposed of as required.
- Waste receptacles will be appropriately protected from the environment (e.g. wind) to ensure garbage is not allowed to spread to the environment. If in the event waste material is spilled or released to environment it will be immediately cleaned up.
- Waste material will be properly disposed of in the Hamlet Baker Lake or will be transported south to an accredited facility.
- Drilling will utilize recirculation and filtration systems to minimize loss of water and drill additives and nonhazardous and bio-degradable drilling fluids will be used at all times wherever possible to ensure greywater placed in sumps is as clean as possible.
- If any artesian water flow is detected, the hole will be plugged and cemented in bedrock to prevent continued flow.

### 4 Schedule

The drilling program is anticipated to be completed in the summer and will take approximately 6 weeks to complete.

Once the potential of geothermal utilization has been established for the Baker Lake area, a possible follow-up hole might be drilled to install such a generation system.

Final abandonment and restoration will commence as soon as the single hole has been completed and is deemed to no longer be required for further work.

All abandonment and restoration work will be completed prior to the date of expiry of any existing or future applicable land use permits and water licenses.

### Seasonal Shutdowns

No seasonal shutdown will take place since a single hole is going to be drilled and after completion, all waste, fuel, equipment and vehicles will be removed.

## 5 Final Abandonment and Restoration

### 5.1 Inspection and Documentation

Prior to abandoning the drill site, a complete inspection of all areas will be conducted. Photographs will be taken to document the conditions prior to leaving the site and will be archived along with any photos taken before or during drilling. Copies of these photos will be included as part of the Baker Lake Geothermal Project Annual Report.

### 5.2 Buildings, Equipment and Fuel

No buildings are going to be constructed during drilling as the project will occur within Baker Lake where accommodation is available.

The drill and drilling equipment will be dismantled, packaged, secured, and shipped off site as per the drill contract. All drill casing will be removed from the ground or if removal is not possible, cut down to ground level or below and capped.

All remaining fuel and empty drums will be removed from site. The soil under and surrounding any area where fuel was stored will be thoroughly inspected for any contamination and photographs will be taken.

### 5.3 Waste

All waste will be disposed of in accordance with the Baker Lake Geothermal Project WMP and any contamination will be treated as per the SCFMP. Sumps will be inspected to ensure there is no leaching or run-off. Back filling and levelling will be employed as necessary.

All waste will be separated into combustible, non-combustible inert, recyclable or hazardous waste. All waste that can be accepted at the Baker Lake waste facility will be disposed of there and anything that cannot (e.g. hazardous waste) will be backhauled for recycling or proper disposal.

#### *5.3.1 Non-Hazardous Combustible Waste*

No incinerator will be on site so all combustible waste will be disposed of at the Baker Lake waste facility.

#### *5.3.2 Non-Combustible, Recyclable and Hazardous Waste*

All non-combustible, recyclable and hazardous wastes, including lubricating oils, hydraulic fluids, petroleum-based solvents, batteries, aerosol cans and fluorescent light bulbs will be sealed in appropriate containers and shipped south for proper disposal at an accredited facility.

#### *5.3.3 Drill Waste*

Drill water will be released into a properly constructed sump, positioned a minimum of 31 m from the normal high-water mark of any waterbody, within the QEC property, to allow for slow infiltration into the soil. If available, coarse gravel will be placed in the bottom of the sump to provide filtration and supports will be built on the sides to prevent slumping. When full, sumps will be covered with enough material to allow for future ground settlement.

#### *5.3.4 Contaminated soils/snow*

Any contaminated soil, snow, or ice will be cleaned up immediately in accordance with the Baker Lake Geothermal Project SCFMP. All contaminated soil, snow, and ice will be sealed in 205 L steel drums and stored in the hazardous waste storage area to await backhaul to a registered hazardous waste receiver.

#### *5.3.5 Empty fuel drums*

Empty drums will be backhauled south for proper disposal at an accredited facility.

For more information on waste generation and management see the Baker Lake Geothermal Project WMP.

#### *5.3.6 Sewage*

A porta-potty, pacto toilet, or similar system will be utilized at the drillsite. Contents will be regularly emptied either via vacuum truck (for the porta-potty) or transported to the Baker Lake waste facility.

### **5.4 Restoration**

Any contaminated areas around the drill site or small fuel cache will be treated in accordance with the Baker Lake Geothermal Project SCFMP. Any washed-out areas will be filled and re-contoured to natural levels. Any areas of disturbed vegetation, including drill site or fuel cache will be photographed and managed as per recommendation of the landowner (QEC) and/or hamlet of Baker Lake. Remediation procedures might include fertilization to encourage re-growth.

## 6 Post-Closure Site Monitoring

After reclamation is complete, if required, annual monitoring may take place. The monitoring may consist of soil and water testing, measuring and documenting plant re-growth, examining potential run-off and erosion problems, and checking the stability and condition of the core boxes. Reports, including photographs, will be submitted to the appropriate regulatory bodies. The monitoring will continue as long as the regulating bodies deem it necessary.



## Appendix 1: Figures

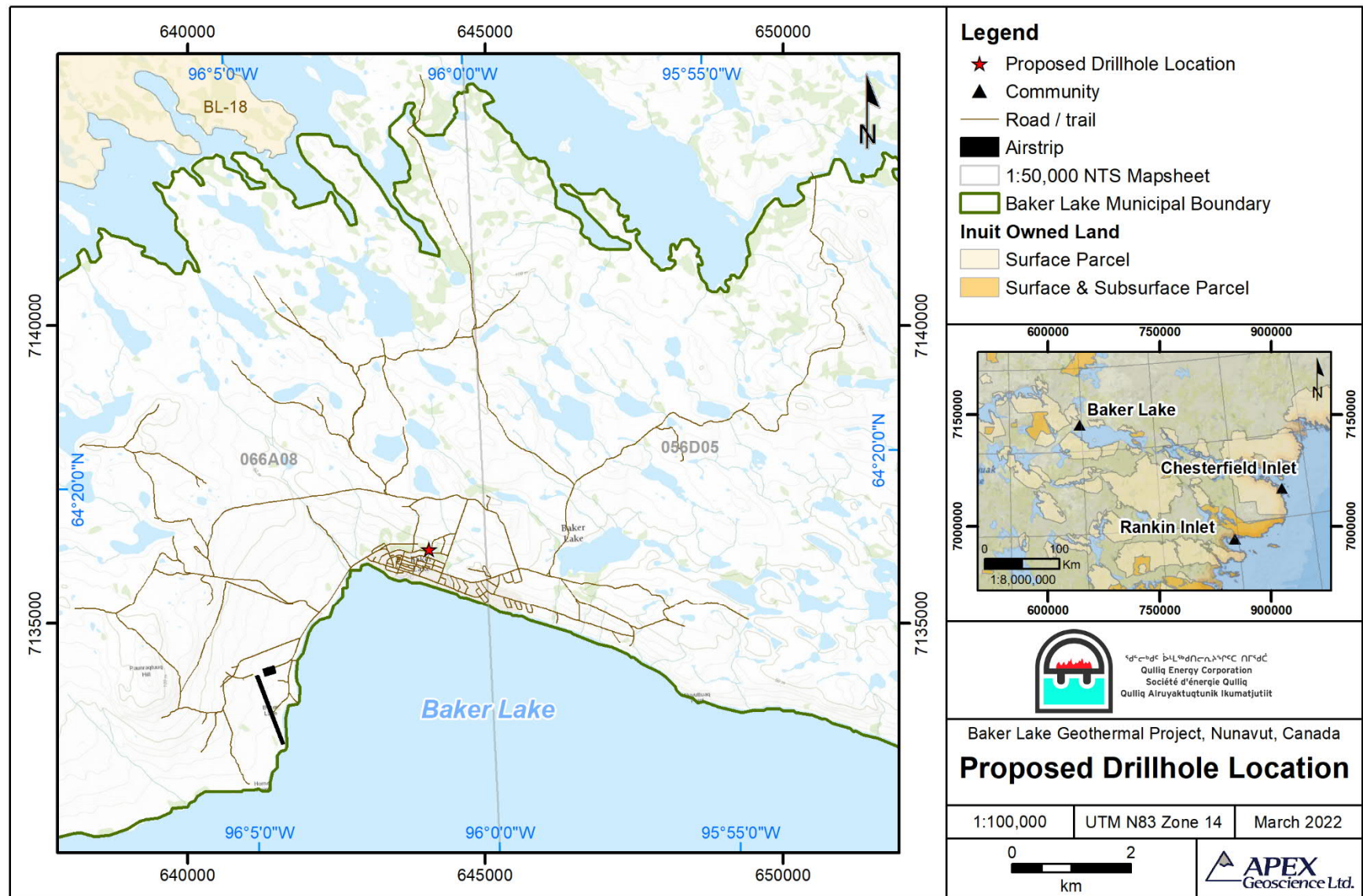


Figure 1 Baker Lake Geothermal Project Location

# Baker Lake Geothermal Project Abandonment and Restoration Plan

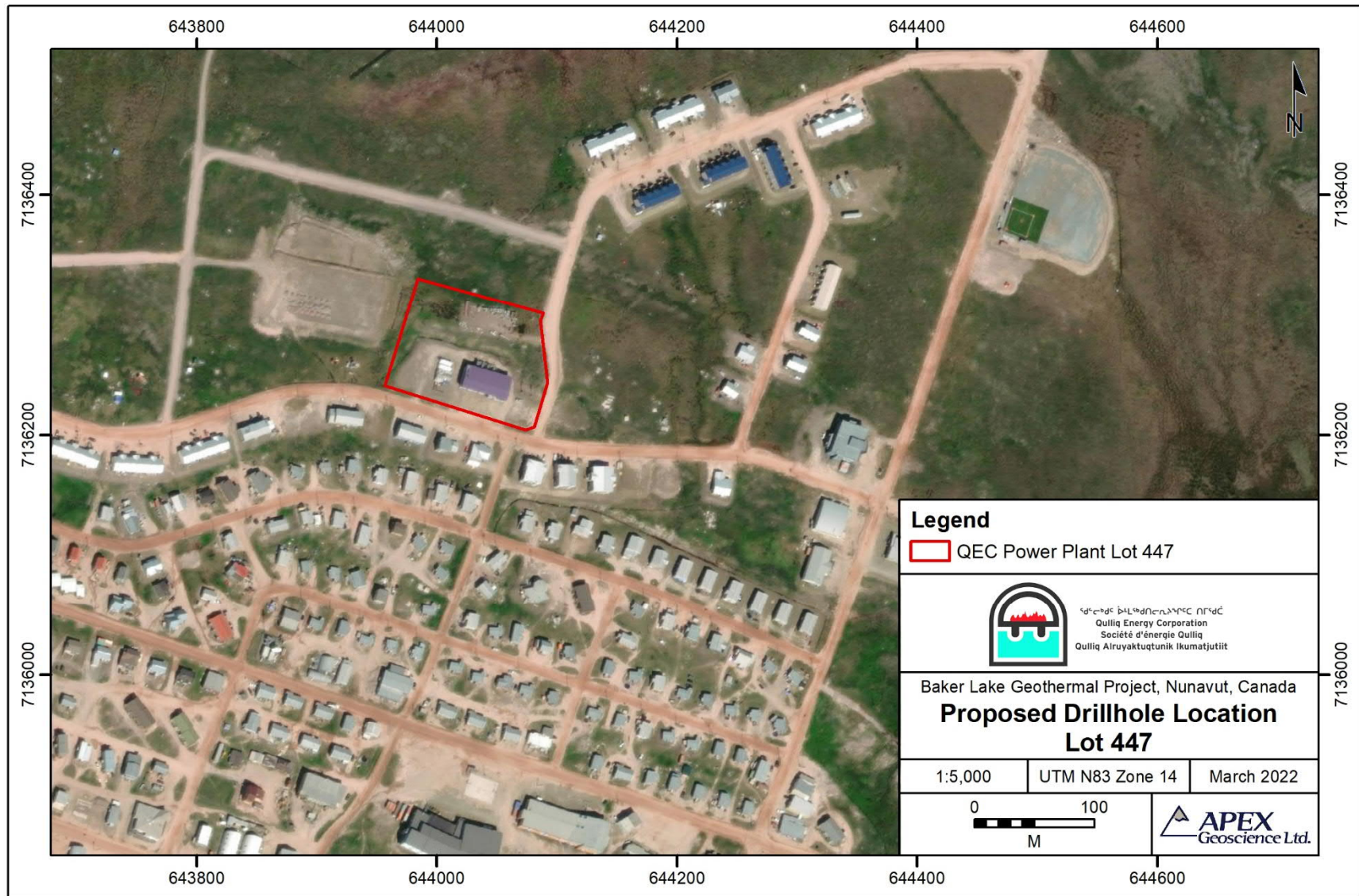


Figure 2 Baker Lake Geothermal Project Location Close-Up