



Waste Management Plan: (Attachment 2)
Liard River Basin Groundwater Monitoring Project
 October 16, 2018

Contents

1. Introduction..... 2

 1.1 Company Contacts..... 2

 1.2 Effective Date of the Waste Management Plan 3

 1.3 Waste Management Goals 3

2. Identification of Waste Types..... 4

3. Management of Waste Types 5

4 Infrastructure Required for Waste Management 5



1. Introduction

The G³⁶⁰ Institute for Groundwater Research at the University of Guelph and the Department of Environment and Natural Resources (ENR) with the Government of the Northwest Territories (GNWT) has developed this Waste Management Plan for the proposed research project, 'Groundwater Monitoring and Aquifer Characterization in the Liard River Basin', commencing in spring 2019. The study site will be located approximately 30 km radially from the Hamlet of Fort Liard, between latitude's 60°00'00"N and 60°40'00"N and longitudes 122°40'00"W and 124°20'00"W. A complete project description is outlined in Attachment 1, Project Description.

1.1 Company Contacts

The research project is a collaboration between the G³⁶⁰ Institute for Groundwater Research at the University of Guelph, Department of Environment and Natural Resources (ENR) with the Government of the Northwest Territories (GNWT), and the University of Calgary¹.

G360 Institute for Groundwater Research

Amanda Pierce

Senior Hydrogeology Research Associate, G³⁶⁰ Institute for Groundwater Research
apierce@g360group.org | 519-824-4120 x 56486

(Operational contact for G³⁶⁰ Institute)

Dr. Beth L. Parker, Ph.D., L.E.L.

Professor, School of Engineering
NSERC Industrial Research Chair
Director, G360 Institute for Groundwater Research
bparker@uoguelph.ca | 519-824-4120 x 53642

(Principle Investigator for G³⁶⁰ Institute)

Dr. John A. Cherry, Ph.D, FRSC, P.Eng.

Adjunct Professor, University of Guelph
Distinguished Emeritus Professor, University of Waterloo
Director of University Consortium Field-Focused Groundwater Research, University of Guelph
cherryj@g360group.org

(Principle Investigator for G³⁶⁰ Institute)

Government of Northwest Territories: Company Contact

Isabelle de Grandpre, M.Sc

Hydrogeologist, Water Resources Division
Environment and Natural Resources, Government of the Northwest Territories
Isabelle_de-Grandpre@gov.nt.ca | 867-767-9234 x 53123

¹ The University of Calgary is a partner in the project for laboratory analyses and is not involve in the field component of the research. Thus, there were not involved in the development of this waste management plan and are not listed as contacts.

1.2 Effective Date of the Waste Management Plan

This Waste Management Plan will be effective from the initial onset of the project (spring 2019) to the completion of the project in 2023 with the option of extended the Land Use Permit for 2 years (until 2025).

1.3 Waste Management Goals

The goal of this Waste Management Plan will be to document a strategy for disposal of all generated waste so that it has minimal impact to the natural environment and, therefore, does not negatively impact land, water, air, wildlife, fish and vegetation. The central principles of the proposed Waste Management Plan, which will meet the goals for successful waste management, include:

1. A waste reduction and recovery approach will be taken for the project. This approach involves making all possible attempts to reduce waste and dispose of any generated waste in appropriate facilities.
2. All recyclable materials will be disposed of at the temporary satellite processing center in Fort Liard, or, if required, transported to appropriate recycling centers in Fort Nelson, B.C. Every effort will be made to coordinate with the mobile recycling depot (Tri R Recycling) in Fort Liard.
3. Attempts were made to get a letter from the Fort Liard Landfill given the authorization to dispose domestic waste in the Fort Liard Landfill Facility. As the response was negative, non-hazardous and domestic waste will be taken care of by the contractors and disposed in an approved facility near Fort Nelson (Tervita, Mile 285 Alaska Highway, 250-774-3027), or a third party such as KBL Environmental will be contracted to dispose it to an approved facility.
4. Borehole drilling will be done using either air rotary or with fresh water. We don't anticipate to use any fluid additive. If a drilling fluid is used, it will be analyzed for total dissolved solids (TDS) in the field. If TDS is <2500 mg/L, it will be disposed of to the ground, a minimum of 100 m away from the borehole and 100 m away from any natural freshwater source. If TDS is >2500 mg/L, the drilling fluid will be collected in tanks and removed off-site for disposal at an appropriate wastewater facility. This approach will include a plan to allow solids to settle, reducing the turbidity of the fluid to be disposed.
5. Drill cuttings and rock waste will be contained at the borehole drilling area and disposed in an appropriate low-lying gully at least 100 m from a freshwater receptor and without disruption to any natural waterways.
6. Every effort will be made to minimize disturbance to flora and fauna and preserve the natural landscape. This includes removal of all waste material, disposing of drilling fluid and cuttings well away from natural waterways or areas of drainage.
7. To minimize the spreading of invasive species identified in Region 1 and Region 3, all drilling equipment will be decontaminated between drill sites and decon fluid will be collected and disposed as described above.

2. Identification of Waste Types

The following types of waste are expected to be generated as a result of this project:

1. **Drill Cuttings and Rock Waste.** Inert ground/geological material obtained from borehole drilling and brought to surface. Part of this material, including rock core and some cuttings, will be removed from site for laboratory analysis, the remaining drill cuttings and rock chips will be disposed in low-lying holes at least 100 m away from a water source or taken off-site and disposed.
2. **Excess Borehole Drilling Wastewater.** Fresh water might be used as a lubricant for drilling. Less than 44 m³/day of water will be required (only one drill used). Returns of excess drilling fluid will be tested for total dissolved solids (TDS) to ensure the returning fluid does not exceed 2500 mg/L. If the TDS of the drilling fluids is in excess of 2500 mg/L, the fluid will be stored in tanks and transported off-site for disposal at an approved facility in B.C.
3. **Domestic Non-hazardous Waste.** Field operations are expected to generate some inert, household and domestic waste, such as rags, packaging, food containers and other standard domestic waste. This will be collected and taken to an approved facility for proper disposal. All domestic waste will be collected in portable tamper-resistant containers and emptied and cleaned at the end of each day.
4. **Recycling Waste.** Plastic sample bottles, household jugs, glass containers, and cardboard will be removed from site and disposed in an appropriate recycling facility.
5. **Toilet Waste.** Field operations and drilling on-site will be limited to 8-12-hour days, with no on-site camp. As a result, this waste will be minimal. Field crews will be returning to accommodations in Fort Liard each day. If deemed necessary, a portable toilet will be brought to location.

3. Management of Waste Types

Table 1, below, summarizes the management strategy for each waste type.

Table 1: Waste Management Plan

Waste Type	Approximate Amount	Description	Management Plan
Drill cuttings	Expected ~1.25 m ³ per site Borehole 1 ~ 0.86 m ³ Borehole 2 ~ 0.39 m ³	Geological material from the boreholes that will not be used for analysis	Disposed in either in a low-lying gully without disruption to natural water sources, or removed from site and disposed in an approved facility
Excess Drill Water	Expected to use no more than 44 m ³ in a 24-hour period.	Water used for drill fluid, returns from the borehole.	Drill fluids will be recycled to reduce fresh water requirements, upon drilling program completion, water will be tested. If the TDS exceeds 2500 mg/L, the fluids will be removed and disposed at an approved facility.
Domestic waste	1-2 domestic garbage bags per day of fieldwork	Inert domestic waste, rags, household consumables	To be disposed to an approved landfill facility
Recycling Waste	~ 1 standard bag per day during sampling fieldwork only	Plastic sample bottles, glass containers, jugs.	To be disposed in the mobile satellite recycling facility in Fort Liard, or transported to a Fort Nelson recycling facility

4 Infrastructure Required for Waste Management

Domestic and recycling waste generated on-site will be removed using crew trucks and a trailer.

If excess drilling fluid is tested and exceeds a TDS of 2500 mg/L, the fluid will be stored in intermediate bulk container (ICB) tanks. These tanks would be stored on site for the duration of the field operations, and then removed to an appropriate disposal facility.