

Project Dashboard

Talik mapping and conceptual models of subpermafrost groundwater-surface water connectivity to support decision making regarding mining development facilities (149754)
Proposal Status: Conformity Determination Issued

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Project Overview

Type of application: **New**

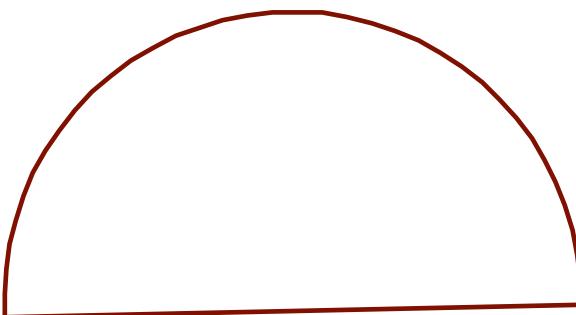
Proponent name: Anne-Marie LeBLanc
Company: Natural Resources Canada

Schedule:

Start Date: 2023-04-01
End Date: 2025-03-31
Operation Type: Annual

Project Description:

In the continuous permafrost zone, the presence of unfrozen ground (i.e., talik) is mainly found below lakes and rivers. If the water bodies are large and deep enough to not freeze to their bottom in winter, open taliks can form connecting surface waters to the deep regional groundwater system below the base of permafrost. Although open taliks have been recognized as possible groundwater pathways, little is known about these open talik systems in terms of their level of hydraulic connectivity and the complex groundwater processes taking place. With increasing mining activity in northern Canada, the identification of lakes potentially underlain by open taliks and characterisation of their subpermafrost groundwater-surface water connectivity is critical to assess effects on mining operations (i.e., water inflows; quantity and/or salinity). It is also important to assess if mining projects intersecting with open taliks can potentially lead to adverse effects on groundwater and surface water systems connected by these open taliks. The proposed activity would 1) provide new methods and refine existing ones for mapping and detecting open taliks below lakes in the Rankin Inlet area, Nunavut, 2) provide information on water origin in lakes, and 3) refine existing conceptual models of sub-permafrost groundwater flow and interactions with surface water in continuous permafrost, reflecting the mining operation within or close to an open talik (e.g., at Meliadine Mine). The activity would provide new knowledge on permafrost-groundwater-surface water interactions to decision makers, on mining operation and water management strategies. Associated findings would inform on environmental impact, cumulative effects, and climate change assessments. We are proposing field operations to be conducted in and around Rankin Inlet on the western coast of Hudson Bay, Nunavut. Our field operations would include: 1) lake water sampling (bottom of water column) to assess lake water chemistry including lowering down instruments into the water column (either via holes drilled through their ice cover or via drones or zodiacs during the summer); 2) short (e.g., few hours) and long term (e.g., one year) installation of devices and sensors in lake and lake bottom (spring or summer); 3) shallow permafrost ($\sim <3m$) sampling in various surficial geology units (summer); 4) and acquisition of ground-based geophysical data to determine if unfrozen ground (i.e., open talik) underlies lakes of interest (spring). The research is aimed at better understanding the various sources of water origin in lakes (e.g., near-surface or deep groundwater), thermal and physicochemical conditions of lakes, and presence of talik below lakes. Derived data would be used to constrain thermal, hydrogeochemical and hydrogeological models. We would also take the opportunity during community consultations and field campaigns to advance collaboration with stakeholders (such as by working with community members and Meliadine mine employees to select lakes of interest). Follow up visits to some of the sites of interests would be required, for instruments and data retrieval, and



for further sampling after the analysis of first year results.
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Project Map

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