

NPC 151201: Arctic Water Solutions: Harnessing Native Northern Plants for Nature-Based Wastewater Treatment in Canada's Arctic

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Proposal Status: Conformity Determination Issued

[Overview Documents](#)

[Project Overview](#)

Type of application: New

Proponent name:

Wenxi Liao

Proponent company:

University of Guelph

Project Description:

Northern communities across Canada's Arctic rely heavily on simple sewage lagoons that have limited wastewater treatment capacity. Conventional wastewater treatment plants are often impractical in these regions due to high operating and maintenance costs, substantial energy demands, and reduced treatment efficiency under extreme cold conditions. Nature-based green infrastructure, such as biofilters, have demonstrated effective removal of nutrients, pathogens, and emerging contaminants in cold regions such as Norway, Finland, and Sweden. However, there is a critical knowledge and technology gap in adapting these systems using native plant species and engineered biofilter media to develop wastewater treatment solutions that are environmentally compatible, culturally appropriate, and resilient to Canada's Arctic conditions. This project will develop and optimize low-cost, scalable, and climate-adapted biofilters for wastewater treatment in Canada's Arctic, while protecting native plant species and enhancing ecosystem services. Through laboratory and field experiments, we will strategically select native Arctic plants and optimize engineered biofilter media to identify system designs that effectively remove pathogens, nutrients, and other contaminants from wastewater, while supporting ecosystem services and long-term system resilience. Low-cost, smart sensors and Internet of Things (IoT)-enabled data platforms will be developed to monitor water flow and water quality. The most promising system configurations will be deployed at a field demonstration site at the Canadian High Arctic Research Station (CHARS) and monitored through on-site sampling and measurements, as well as IoT-enabled sensing and data platforms. Monitoring will span across full Arctic seasonal cycles to assess treatment

performance, plant health, and system resilience. Through close partnerships with Northern and Indigenous communities, this project will co-develop effective, climate-adapted, and culturally appropriate wastewater treatment solutions for Canada's Arctic and other cold-climate regions while supporting knowledge and technology mobilization and community engagement.

[Project Schedule](#)

Start Date:

2027-01-01

End Date:

2028-06-01

[Project Map](#)

List of project geometries:

Id

Geometry

Location Name

[22303](#)

polygon

Canadian High Arctic Research Station (CHARS) in Cambridge Bay

NPC Planning regions:

No Approved Plan

[Project Land Use and Authorizations](#)

Project Land Use:

Scientific Research

Scientific Research

Licensing Agencies:

Nunavut Research Institute

Government of Nunavut - Department of Environment

Material Use

Equipment:

Type

Quantity

Type

Use

No data found

Fuel Use:

Type

Container

Capacity

Use

No data found

Hazardous Material and Chemical Use:

Type

Container

Capacity

Use

No data found

Water Consumption:

Daily Amount (m²)

Retrieval Method

Retrieval Location

0

Waste and Impacts

Environmental Impacts:

This project is funded through Polar Knowledge Canada (POLAR). As described in the project summary, the proposed research aims to evaluate the wastewater treatment performance of vegetated biofilter systems. A defined volume of locally sourced wastewater will be applied to the biofilters, and effluent will be collected for treatment performance assessment. A portion of the treated effluent will be transported to the University of Guelph for laboratory analysis. Any treated effluent exceeding analytical requirements will be returned to the originating wastewater treatment facility or an approved local wastewater disposal location, in accordance with local guidelines, facility requirements, and applicable regulations. The proposed work is expected to pose minimal environmental risk. Wastewater samples will be handled, stored, and transported using appropriate containment and biosafety procedures to minimize the risk of spills, releases, or exposure. Only the volume of wastewater necessary for experimental application and analysis will be used. Any excess treated or untreated wastewater will be returned to the originating wastewater treatment facility or other approved local disposal locations in accordance with local guidelines and operational requirements. These measures will minimize environmental impacts while ensuring safe and responsible handling of wastewater throughout the project. We consulted the Nunavut Water Board and were informed that no permits or licences are required from the NWB for the proposed project.

Waste Management:

Waste Type

Quantity Generated

Treatment Method

Disposal Method

No data found