

Nunavut Research Institute

License Holder Reporting requirements

*For research undertaken in the 2025 calendar year
(commencing January 01, 2025 and ending December 31, 2025)*

Project Title:

Permafrost dynamics and landscape evolution on southern Victoria Island, Nunavut.

Project Leader(s):

*Full name, affiliation, and contact information (address, phone number, email) of each project leader
(principle investigator and co-PIs)*

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Project Team:

Full name, affiliation, and address (name of city/community and province/territory/state) of each member of the project team

Full name	Affiliation	Role
Stéphanie Coulombe	Polar Knowledge Canada, Cambridge Bay, NU	Research Scientist
David Didier	UQAR, Rimouski, QC	Professor, PI
Barett Kurylyk	Dalhousie U., Dalhousie, NS	Professor, PI
Daniel Fortier	U of Montreal, Montreal, QC	Professor, PI
Eric Bottos	Thompson Rivers U	Professor, PI
Chloe MacLean	Thompson Rivers U	MSc student
Samuel Gagnon	UQAR, Rimouski, QC	Research Scientist
Yohan Quénet	UQAR, Rimouski, QC	PhD student
Bay Berry	Dalhousie U., Dalhousie, NS	PhD student
Summer Montoya	Dalhousie U., Dalhousie, NS	MSc student
Carole-Anne Guay	UQAR-ISMER, Rimouski, QC	MSc student
Emma Renaudie	UQAR-ISMER, Rimouski, QC	PhD student
Loek Pascaud	U. of Sherbrooke, Sherbrooke, QC	MSc student
Gabriel Ferland	Vivitem, Cambridge Bay, NU	Field technician
Layla Arnaquq	Polar Knowledge Canada, Cambridge Bay, NU	Field technician
Shannon Evetalegak	Polar Knowledge Canada, Cambridge Bay, NU	Field technician
Jasmine Tiktalek	Polar Knowledge Canada, Cambridge Bay, NU	Field technician
Marc-Olivier Dubois Chevalier	UQAR, Rimouski, QC	Field assistant
Théau Leclerck	UQAR, Rimouski, QC	PhD Student
Ross Lieblappen	Vermont State University, Montpelier, VT, USA	Professor
Eliza Goodell	Vermont State University, Montpelier, VT, USA	MSc student
Andy Vermilyea	Vermont State University, Montpelier, VT, USA	Research Scientist
Dominic Mazzilli	Vermont State University, Montpelier, VT, USA	Undergraduate Student
Oliva Rutkowski	Vermont State University, Montpelier, VT, USA	Undergraduate Student

Abstract:

*A concise summary of what was done, found, and concluded to date, and how the results/information will be used. This summary must be translated into the appropriate dialect of Inuktitut. Suggested length: 250-300 words. *This section will be published in the NRI's annual compendium of licensed research*

This project examines permafrost and related aquatic and coastal ecosystems in and around Cambridge Bay, as well as nearby areas of southern Victoria Island. Since 2017, the research team has been monitoring environmental changes to better understand their effects on the landscape, ecosystems, and local communities. Community collaboration remains a key part of the project. Local participants helped with fieldwork, assisted with lake and seafloor mapping, and shared valuable knowledge about observed environmental changes. Fieldwork for the 2025 season occurred from May to October and involved government scientists, academic researchers, students, and local community members. Two new permafrost monitoring stations were installed near Cambridge Bay to record ground temperatures throughout the year and evaluate the impact of a warming Arctic climate on permafrost. Studies on rivers and lakes examined how thawing ground affects water flow, sediment transport, and chemistry. Coastal monitoring at two sites included drone mapping, bathymetric surveys, and sensors to observe erosion, waves, currents, and water temperature, as well as chemical processes along the shoreline. New high-resolution seafloor maps will soon be accessible to local residents for safer travel and fishing. This year's work continues the long-term monitoring program, and data analysis from the 2025 field season is ongoing. The results, expected later this winter and spring, will enhance understanding of how permafrost thaw and coastal change influence Arctic ecosystems and support community adaptation and future planning in the region.

Key messages:

Concise, plain language summary of key take-away messages of work to date, findings and conclusions. Preferably 3-5 points, in bullet form.

- This project continues long-term monitoring of permafrost, coasts, rivers, and lakes near Cambridge Bay, with a focus on how these systems interact and respond together to environmental change.
- In 2025, two new permafrost monitoring stations were installed, providing year-round ground temperature data. One extends 27 metres deep, improving understanding of how climate change affects permafrost in the region.
- High-resolution bathymetric maps are being developed for local coastal and lake areas and will be shared with the community to support safer travel, fishing, and coastal planning.

Objectives:

Project objectives, preferably in bullet form.

This research program aims to document and monitor environmental changes related to permafrost in and around Cambridge Bay and nearby regions of southern Victoria Island. The specific objectives are to:

1. Characterize the permafrost thermal regime and physical properties.
2. Monitor landscape evolution over time, with a particular emphasis on coastal permafrost dynamics.

3. Assess the impacts of permafrost disturbances on aquatic ecosystems, including hydrology and water quality.
4. Investigate the morphological and limnological properties of lakes, as well as their long-term evolution.
5. Quantify the role of newly mobilized organic matter from thawing coastal permafrost in the production of inorganic carbon and CO₂ degassing.
6. Measure suprapermafrost groundwater discharge to the coastal ocean and associated biogeochemical fluxes.
7. Examine shifts in tundra microbiome community structure and function using advanced DNA sequencing techniques.

Annual activities:

A description of activities and methods carried out during the current reporting period. This section should answer the questions: What? Where? When? Who? How? Include dates team members conducted research at remote field sites or collected data (including interviews) in communities; append a map with locations and/or coordinates of remote field sites, if applicable.

Fieldwork took place from May to November, with additional visits by local collaborators throughout the summer and fall. The multidisciplinary team (25 person) included researchers, students, and community members. Two local field technicians and community partners provided essential support, especially during bathymetric surveys. Research activities focused on Cambridge Bay and nearby areas.

A new 27-m-deep permafrost monitoring station was installed near the old town site as part of a broader network tracking permafrost, snow, and climate conditions. Along the Kitigaq River, permafrost degradation and hydrological processes were examined through sediment sampling, temperature monitoring, weather and turbidity sensors, and drone mapping of thaw-affected zones. We also continued research at smaller lakes west of Lake Kitigaq, targeting recently formed or expanding basins. The team measured water depth, collected chemical and physical samples, and conducted repeated drone flights to monitor shoreline and permafrost dynamics.

Coastal research at Augustus Hill and Long Point continued long-term monitoring of coastal permafrost. Instruments, such as wave buoys, pressure sensors, ADCPs, and turbidity loggers recorded nearshore dynamics. Weekly GPS-RTK surveys, bathymetry and drone imaging documented coastal erosion, sediment transport, and beach morphology. Additional sensors measured ground moisture and temperature, as well as groundwater levels. Geophysical surveys and sediment and water sampling provided data on subsurface permafrost and biogeochemical fluxes. Time-lapse and video monitoring further complemented these measurements by capturing shoreline and ice dynamics.

Table 1 Coordinates of field sites

Sites	Latitude	Longitude
Augustus Hills	69.166°	-105.634°
Long Point	69.095°	-105.441°
Lakes to the west of Kitigak Lake	69.237°	-105.909°
Kitigak River	69.287°	-106.093°

Results and Achievements:

Findings and results to date of the above activities, highlighting any key research achievements (see guide below for formatting tips regarding tables and figures).

Because this report is being submitted earlier than in previous years to allow for licence renewal ahead of planned winter fieldwork, most data processing and laboratory analyses are still in progress. Several key instruments were only retrieved in October, and their datasets will be analysed over the fall and winter. A more comprehensive set of scientific results will be presented in next year's report.

- Using very high-resolution satellite images (2010–2023) and bathymetric data, team members documented active and spatially variable thermokarst change, including the formation and growth of small lakes, ongoing shoreline erosion, and the shrinking or drying of others (Pascaud et al., in preparation).
- Other team members (Machemin et al., in revision) adapted the RUSLE model for tundra landscapes. The modified framework effectively captures catchment-scale erosion in the Cambridge Bay area and provides a promising tool for identifying areas prone to soil loss in continuous permafrost environments.
- Other work (Gagnon et al., 2025) examined coastal gully formation, where groundwater flow creates subsurface tunnels (pipes) that later collapse and trigger gully development. This study improves understanding of piping and gullying in periglacial environments and will explore how these processes interact with groundwater fluxes and coastal erosion to shape Arctic coastal landscapes.

Challenges/Obstacles

In this section, please comment on any challenges/obstacles (if any) that you experienced during this project year. If there were any actions to mitigate or resolve these challenges, please list them here. Were any concerns raised regarding the conduct of research team members or the impacts of the project?

During this project year, we did not face any major challenges. As in 2024, the main limitation was the underutilization of our allocated helicopter time due to technical issues with the aircraft. This required some adjustments to our field schedule and caused minor delays in accessing certain remote sites. Nonetheless, we were able to adapt by prioritizing alternative transportation methods and redirecting efforts toward more accessible locations.

Expected Project Completion Date:

Provide month and year of expected completion date of the project.

This project is partially supported by CIRNAC's CCPN program, with funding secured until March 2027. In addition, it is supported through internal research funding from Polar Knowledge Canada, in-kind logistics from PCSP, and research grants held by the co-PIs. Given the strong long-term monitoring component, our intention is to continue this project well beyond 2027, pending feasibility and future funding opportunities.

Project website (if applicable):

If your project has a presence on the internet, including a website and/or social media page, please provide the link and/or account handle.

Currently, there is no dedicated project website, but one is in the planning stages. Updates will be provided once the website is live.

POLICY RELEVANCE

Does this research support policy development or decision-making in Nunavut? If yes, please describe.

The project's focus on permafrost dynamics, coastal erosion, and climate change impacts directly supports Nunavut's long-term environmental and infrastructure planning. By documenting how thawing permafrost and shoreline retreat affect ecosystems, infrastructure, and communities, the research provides a foundation for climate adaptation and land-use planning. Data on coastal erosion rates and permafrost conditions offer valuable evidence for policies related to infrastructure, land reclamation, and resource management. Close collaboration with local communities ensures the work reflects their needs and priorities, including protecting cultural sites, enhancing resilience, and building local monitoring capacity. The team maintains regular communication with the Nunavut Climate Change Secretariat to share progress and align research objectives. By providing science-based information on environmental change, the project helps inform decision-making and climate adaptation strategies at both community and territorial levels.

Did your project develop a communications plan? Please describe communications/reporting tools used, and list the target audience for each and/or who requested which.

No specific communications plan has been developed yet. However, reporting has been conducted through individual requests and as project needs arise. We plan to share results and gather community input. For instance, we are organizing a second permafrost workshop in February 2026 and will participate in a science fair in Cambridge Bay hosted by Polar Knowledge Canada (CHARS) to present several sub-projects.

How were Nunavummiut credited and/or acknowledged in all project outputs, such as co-authorship, participant biographies, article acknowledgements, etc.

Active and recurring local partners have been included as co-authors on peer-reviewed publications and other project outputs. Nunavummiut collaborators are also acknowledged in reports, presentations, and outreach materials.

RESEARCH OUTCOMES: BENEFITS

Community engagement:

Briefly list and describe any community consultation, engagement, collaboration and outreach activities that you have undertaken for the project; describe the role(s) that community members and/or specific organizations have played in research co-design and activities.

We continue to maintain strong engagement with the Iqaluktuuttiaq community throughout the project to ensure that research activities remain relevant and collaborative. Key actions undertaken this year include:

- Local boat operators supported bathymetric surveys, and the northern-based company Vivitem provided on-the-land field assistance.
- In February 2025, we presented preliminary results to the Hunters and Trappers Organization (HTO) and hosted a public community night at the Elders Palace. Discussions focused on permafrost degradation and its impacts on freshwater ecosystems, as well as future research directions and other sites that community members suggested for investigation. The event

featured traditional food (caribou stew, char chowder), baked goods, hot beverages, and door prizes, and it was well attended by Elders and local residents.

- Based on positive response, we plan to host a follow-up session in February/March 2026 to share updated findings and gather community input on how research outcomes can further support local priorities.

Youth engagement:

Briefly list and describe any outreach, school or classroom activities that you have undertaken for the project; describe the role(s) that youth have played in your research activities.

No dedicated youth activities were conducted during this project year. We had planned to collaborate with another university team to support a summer field camp for local youth, but funding for that initiative did not materialize. We intend to revisit this opportunity and explore alternative formats for youth engagement in summer 2026.

Training and Employment:

How many Nunavummiut received training from team members? Please describe training and/or compensation provided.

During the reporting period, three Nunavummiut were hired to support bathymetric surveys, primarily as boat operators. They were contracted through Viventem, a local field support company, as the HTO was not operating at full capacity due to staffing transitions. Community members were compensated according to local wage standards for their time in the field, including assistance with equipment deployment and retrieval.

How many team members received training from Nunavummiut?

Please describe training received and/or what knowledge sharing and/or skills exchange took place.

This year, no team members received training from Nunavummiut.

How many Nunavummiut received employment?

Please describe employment type and length, role(s) and responsibilities, and compensation provided.

During the reporting period, three Nunavummiut were hired to support bathymetric surveys as boat operators. Their personal boats were also rented for field use. Community members were compensated according to local wage standards for both their time in the field and the use of their vessels, including assistance with equipment deployment and retrieval.

How many Nunavummiut received honoraria as research participants?

Please describe method of participation (interview, observation, sample, survey, etc.), including compensation provided.

No Nunavummiut received honoraria as research participants during this reporting period, as no interviews, surveys, or other participant-based activities were planned or conducted in 2025.

Please explain how the project directly benefited Nunavut organizations and/or businesses (e.g., through contract services, local purchases, equipment donations, etc.)

The project delivered economic benefits to Nunavut-based businesses through local purchasing and contracts. Viventem managed field logistics and hired community members, while Aurora Energy Solutions drilled a permafrost monitoring borehole under a contract with Nunavut Arctic Services. These partnerships created local employment, strengthened capacity, and ensured project spending remained within the community.

OPTIONAL: Nunavut Team Members, hires, and/or trainees (excluding research participants, e.g., interviewees)

The NRI is creating an inventory of Nunavummiut who are skilled and/or interested in research. The information provided below will not be shared publicly but will support long-term capacity sharing by connecting local and visiting researchers with research talent in each community.

NA

Academic Mobility

If you are affiliated with an academic institution, please answer the following question: For which Level of Project(s) will the data be used? (Check all that may apply)

- ☒ Research
- ☐ Post-Doctoral Research
- ☒ PhD Thesis
- ☐ Masters (Major Research Paper)
- ☒ Masters (Thesis)
- ☐ Graduate Course Project
- ☒ Staff/Administration Research
- ☐ Undergraduate Honours Thesis

BUDGET

Please complete the table below to detail your projected and actual research expenditures during the reporting period.

Category	Planned/Approved Expenditure	Actual Expenditure
Travel and accommodation		~ \$270,000
Equipment, material and supplies		~ \$26,000
Salaries/Wages for Nunavut Resident		~ \$24,000
Salaries/Wages for non-Nunavut resident researchers		~ \$10,000
Professional fees and services in Nunavut		~ \$20,000
Professional fees and services in Nunavut		0

List the total \$ amount of funding from each funding source for your full research program, including in-kind support.

CHARS in-kind (accommodation and vehicles) \$140k

CHARS internal research budget: \$55k

NSERC discovery grant & Discovery Grant NRSP: \$32k

CIRNAC: \$75k

NSERC Northern supplement & NSERC-FRQNT grant: \$25k

NSTP: \$18k

GRIL for collaborative projects: \$5k

RESEARCH OUTPUTS / REPORTING TOOLS

What research outputs were generated? Please list below and append copies of each. Specify which outputs (if any) may be made public on the NRI research licensing database.

The research generated datasets, conference posters, peer-reviewed publications, and a comic strip, all appended below, with some outputs potentially suitable for public release on the NRI research licensing database upon request.

Have peer-reviewed manuscripts been published as a result of your project? If Yes, complete the following table:

Full citation of publications submitted in 2024 and 2025	Publicly available/ Free to access (Y/N)	Link (if available) and DOI (if available)
Emergent thermokarst lakes as sentinels of permafrost thaw in a High Arctic landscape. IPA–IAL 2025: 3rd International Paleolimnology and Limnogeology Symposium, Aix-les-Bains, France.	N	NA
Pascaud, L., Bouchard, F., Rautio, M., & Coulombe, S. Lakes as sentinels of permafrost thaw: Investigating thermokarst evolution near Cambridge Bay, Nunavut. 46th Canadian Symposium on Remote Sensing, University of Lethbridge, Lethbridge, Alberta, Canada.	N	NA
Pascaud, L., Bouchard, F., Rautio, M., & Coulombe, S. Permafrost degradation in the Canadian Arctic: Is there climate resilience in Ikaluktutiak (Cambridge Bay, NU)? Arctic Change 2024, Ottawa, Ontario, Canada.	N	NA
Leclercq, T. et al. 2025. Collaborative Approaches in Hydrography and Oceanography to the Study of Coastal Morphodynamics in Nunavut. ArcticNet's Annual Scientific Meeting 2025, Calgary, Canada.	N	https://event.fourwaves.com/asm2025/abstracts/44c21696-de77-46e4-b99f-339f085f197c
Gagnon, S., Coulombe, S., Didier, D., Binette, S., Chaillou, G., Kurylyk, B., Maksagak, I. and Evetalegak, J. 2025. Coastal gullies formed by piping on a permafrost marine terrace near Iqaluktuuttiaq (Cambridge Bay), Nunavut, Canada. Geomorphology, 486, p. 109905.	Y	https://doi.org/10.1016/j.geomorph.2025.109905
Renaudie et al. 2025. Quantifying groundwater discharge using radioactive tracers along the permafrost-ocean continuum. ArcticNet's Annual Scientific Meeting 2025, Calgary, Canada.	N	https://event.fourwaves.com/asm2025/abstracts/14aceb08-8186-424e-9881-5845c8108cae
Dubois-Chevalier et al. 2025. Integrated Monitoring of Arctic Coastal Morphodynamics and Erosion in the Canadian Arctic Archipelago. ArcticNet's Annual Scientific Meeting 2025, Calgary, Canada.	N	https://event.fourwaves.com/asm2025/abstracts/bef8b1eb-e18a-

		460a-9d2f-92e7ada1dc98
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If No, do you intend to submit a manuscript (or manuscripts) for peer reviewed publication?

Yes, several manuscripts are currently being prepared by different team members and will be submitted for peer-reviewed publication.

Were non-peer reviewed materials produced to either communicate or synthesize results to the public?

Examples of these materials include (but are not limited to): websites, reports, brochures, podcasts, webinars, presentations, non-peer reviewed publications, etc.

Title	Description of materials	Link (if available)	DOI (if available)
Emergent thermokarst lakes as sentinels of permafrost thaw in a High Arctic landscape.	<i>Presentation at the IPA-IAL 2025: 3rd International Paleolimnology and Limnogeology Symposium, Aix-les-Bains, France.</i>	NA	NA
Lakes as sentinels of permafrost thaw: Investigating thermokarst evolution near Cambridge Bay, Nunavut.	<i>Presentation at the 46th Canadian Symposium on Remote Sensing, University of Lethbridge, Lethbridge, Alberta, Canada.</i>	NA	
Collaborative Approaches in Hydrography and Oceanography to the Study of Coastal Morphodynamics in Nunavut.	Presentation ArcticNet's Annual Scientific Meeting 2025, Calgary, Canada.	https://event.fourwaves.com/as m2025/abstract s/44c21696-de77-46e4-b99f-339f085f197c	
Quantifying groundwater discharge using radioactive tracers along the permafrost-ocean continuum.	Presentation ArcticNet's Annual Scientific Meeting 2025, Calgary, Canada.	https://event.fourwaves.com/as m2025/abstract s/14aceb08-8186-424e-9881-5845c8108cae	
Integrated Monitoring of Arctic Coastal Morphodynamics and Erosion in the Canadian Arctic Archipelago.	Presentation ArcticNet's Annual Scientific Meeting 2025, Calgary, Canada.	https://event.fourwaves.com/as m2025/abstract s/bef8b1eb-e18a-460a-9d2f-92e7ada1dc98	

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How were Nunavummiut credited and/or acknowledged in all project outputs, such as co-authorship, participant biographies, article acknowledgements, etc.

Active and recurrent local partners were credited as co-authors on conference presentations, contributing their expertise and local knowledge. Community members and collaborators were acknowledged in the articles for their support in the field and valuable contributions to the project.

DATA AND INTELLECTUAL PROPERTY

Did you enter into a research agreement, data-sharing agreement and/or intellectual property rights agreement with a community and/or designated Inuit organization (DIO)? If yes, please explain.

No

Do intellectual property rights apply to your research? If yes, please explain.

Not applicable.

Who owns the data? Has the raw data been shared with the appropriate community and/or DIO? If yes, how? How is data security and storage handled by community-based co-owners?

The data are currently owned by the individual researchers leading each research component. No requests for raw data have been received from the community or from Nunavut organizations to date, but all data can be shared upon request. The data we have collected has not raised any security concerns, and there are no sensitive or private data elements requiring special security protocols.

Where is the data stored and will the data be destroyed within a set timeframe?

The data are currently stored on internal servers at the respective universities and partner organizations. Some datasets have already been published and are publicly available. The data will not be destroyed within a set timeframe and will be retained for future research purposes, following the best practices for data preservation and security.

Is the data trackable and/or available in a public data repository? If yes, please provide the appropriate information and/or link to ensure the findability and accessibility of the data.

Yes, some of the data are already trackable and available in public data repositories, and additional datasets will be published as the project progresses. Several datasets are currently being prepared and will be submitted to recognized, publicly accessible repositories. Once finalized, links to all datasets will be shared to ensure their findability and accessibility for the broader community and researchers.

CLIMATE CHANGE

Is your research about climate change (causes, impacts, mitigation, adaptation, etc.)? If yes, explain.

Our research examines the impacts of climate change, particularly permafrost thaw, coastal erosion in the Arctic, and changes to aquatic ecosystems. Accelerated Arctic warming drives significant changes through interconnected processes, such as the loss of sea ice and shorter sea ice seasons, which expose coastlines to increased wave action and storm surges, accelerating erosion. Warmer sea temperatures further destabilize coastal permafrost, while more frequent and severe storms worsen erosion and coastal flooding. These changes, along with permafrost thaw, release sediments and organic material into aquatic systems, affecting nutrient cycles and contributing to greenhouse gases such as CO₂ and methane. Our research aims to understand how these processes interact to influence permafrost degradation, coastal retreat, and aquatic ecosystem dynamics. By documenting and analysing these changes, we aim to provide vital data to support adaptation strategies for Arctic communities, especially those dependent on stable coastlines and aquatic resources. Although the data and knowledge collected to date do not directly influence policies, they have the potential to inform policy development or decision-making in the near future, addressing the long-term environmental and socio-economic impacts of climate change in the region.

PHOTOGRAPHS

If possible, please provide high-resolution photos of licensed research activities that NRI may use in communication materials, organizational reporting, and other promotional purposes. The photographer and all recognizable people in each photo must sign the attached Photo and Video Release form. Please also complete the table below for each photo provided and submit to NRI along with all required NRI photo release forms. The photographer/owner will be credited in all uses of the photograph(s).

File Name	Location	Description	Subjects	Photographer/Owner	Date