


# Pan-Territorial Information Notes

**MOVING FORWARD TOGETHER ON CLIMATE CHANGE  
ADAPTATION IN CANADA'S NORTH**







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# Foreword

Communities across Canada's North are working to adapt to our changing climate. While there are some significant similarities in how northern communities in Yukon, the Northwest Territories, and Nunavut are experiencing climate change, our approaches in dealing with climate impacts are often diverse and creative.

The information notes found in this compendium's second edition show the continuing commitment from the territorial governments to share information on adaptation work underway in each jurisdiction. Through the compendium project, government and community decision-makers, research agencies, community groups and community members can benefit from new ideas relevant to northern communities and environments to strengthen adaptation efforts in all arenas.

The research projects in this compendium support the goals set out in the Pan-Territorial Adaptation Strategy released in 2011. The strategy acknowledges that the North needs to build on climate change adaptation knowledge and harness more effective adaptation strategies for immediate and long-term solutions.

# The Nunavut Permafrost Databank

Developing a centralized databank for Nunavut permafrost data

## CONTEXT

The Government of Nunavut's Climate Change Section works with partners to identify impacts of climate change in Nunavut and ways that we can adapt to these changes. Warming temperatures associated with climate change affects the stability of permafrost (ground that has been frozen for more than two years).



Photo: Government of Nunavut

Shifting permafrost is impacting Nunavut's built infrastructure by creating instability in buildings, roads, airstrips, and other structures. As more permafrost data is shared, Nunavummiut can be better prepared to deal with these changes.

## OBJECTIVE

Much work is being done in Nunavut on permafrost mapping and characterization; however, the results of this research are difficult to access and are spread across different locations. This results in no clear centralized location for permafrost data in

Nunavut. Due to this, there is a high risk of data loss and inaccessibility when it is most needed by northern decision-makers.

## APPROACH

The Nunavut Permafrost Databank will house permafrost data for Nunavut in one central, user-friendly location. The databank will serve to make data more accessible. It will be used by researchers, government staff, sector-specific groups, as well as the general public. This project is not intended to duplicate existing work or databases, but rather to centralize these sources into one location.

## EXPECTED RESULTS

Due to the different formats and sources of data, the databank is being developed as a geo-referenced map, linking to other online forums that contain key permafrost data, publications, or references. It will also have raw data currently not available through any other public forum. The databank will be hosted on the Nunavut Climate Change Centre website: [www.climatechangenunavut.ca](http://www.climatechangenunavut.ca)

The Government of Nunavut is still in the development phase of this project and welcomes feedback on its design and data sources before the Nunavut Permafrost Databank is released in 2016.

## Significance

*The Nunavut Permafrost Databank will provide decision-makers with access to information that can improve how they plan and support infrastructure development in the territory.*

## Partners

- Centre d'études nordiques, Université Laval
- Geological Survey of Canada
- Canada-Nunavut Geoscience Office
- Aboriginal Affairs and Northern Development Canada

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# Climate Change Training Course

## Climate Change Adaptation for Northern Decision-Makers Course

### CONTEXT

Nunavut is experiencing impacts from climate change that can have both negative and positive impacts on Nunavummiut. We must understand these changes and find ways to better prepare and adapt in all areas of our lives and work. If people understand how climate change is affecting their daily lives and the work they do, they can take action to make sure they are prepared to deal with and take advantage of these changes.



Photo: The Government of Nunavut

### OBJECTIVE

The Government of Nunavut has developed a training course for Nunavut decision-makers to help them understand how climate change impacts their work, and how they can include measures in their daily decisions to adapt.

The course includes two main components. The first is a two-day in-class session on a variety of climate change topics, including climate change science, impacts of climate change on Nunavut, Inuit Qaujimajatuqangit

and climate change, and how to include climate change considerations into decision-making.

The second component is the development of sector specific resource guides. These guides provide additional information to specific sectors and help northerners apply climate change adaptation measures to their specific areas of work.

### APPROACH

The course was offered as a pilot in Iqaluit in November 2014. Course participants included representatives from different sectors including: health, environment, emergency services, built infrastructure, energy, tourism, and resource development.

The course was developed as part of a series of territorial climate change training courses with the Government of Yukon. It was also developed with feedback from an advisory committee made up of Government of Nunavut staff from various departments.

### RESULTS

The pilot is being evaluated by team members and course participants, and revisions are being made to improve the course. The course will continue to be offered in the future to ensure that more Nunavut decision-makers can benefit from understanding climate change impacts and adaptation options. Materials from the course are available at:

[www.climatechangenunavut.ca](http://www.climatechangenunavut.ca).

### Significance

*This course informs government staff of climate change impacts and how to incorporate climate change into decision-making across all government sectors.*

### Partners

- Yukon Government
- Government of Nunavut Departments and Crown Corporations
- Aboriginal Affairs and Northern Development Canada
- Northern Climate ExChange

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# Climate Change Outreach in Arviat

The Government of Nunavut met with the community of Arviat to examine how shifting permafrost is affecting infrastructure and how to minimize the impacts

## CONTEXT

Community engagement activities were held in Arviat in August, 2014 to gather and share information on how climate change is impacting the community. Discussions focused on how infrastructure is affected by shifting permafrost and how these changes influence current and future development in the community.

These sessions were part of a larger ongoing Government of Nunavut-led project to map the suitability of land for future development in seven Nunavut communities. These maps will allow community planners and others involved in infrastructure development to gain knowledge about the site conditions of land chosen for future development.



Photo: Government of Nunavut

## OBJECTIVE

The overall goal of this project was to discuss how shifting permafrost is affecting Arviat's infrastructure and how to deal with these impacts. More specifically, objectives included:

- Sharing initial results of the land suitability map for Arviat;

- Identifying additional hazards based on local knowledge and incorporating this information into current maps; and
- Discussing methods already being used for dealing with risks associated with permafrost shift and brainstorming new strategies for adaptation.

## APPROACH

Meetings occurred with local businesses, the Hamlet, and the housing sector. Discussion topics focused on ensuring that climate change was being considered in all aspects of the design, construction and maintenance of infrastructure development.

Other stakeholder groups included students, elders and the general community. Students from a variety of age groups participated in hands-on activities related to permafrost thaw. A session with elders provided context on how the landscape in and around Arviat has drastically changed over time. A public information session was also hosted in order to promote the project to the broader community. Other community-wide engagement methods included hosting a radio call-in show and delivering a permafrost knowledge survey.

## RESULTS

This project showed that it is important to consider shifting permafrost when building in Nunavut communities. It also showed the need for continued partnership-building in the community planning and infrastructure development sector.

## Significance

*Meeting with community members about shifting permafrost can provide valuable insight into community-specific issues, and can bring about stronger adaptation measures that are tailored for each community.*

## Partners

- Government of Nunavut, Department of Community and Government Services
- ArcticNet
- Nunavut Tunngavik Incorporated
- Arviat Wellness Centre

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# A Homeowner's Guide to Permafrost

Providing Nunavut homeowners with the necessary resources to keep their houses on solid ground

## CONTEXT

Changes to permafrost is one of the more significant climate change impacts communities are experiencing in Nunavut. Infrastructure is being (and will continue to be) severely compromised because of rapid changes in the terrain that can have serious effects on Nunavummiut (people of Nunavut).

In the past, Nunavut homeowners have not always had access to some of the necessary resources on permafrost and how it is a critical component of their home structures. Homeowners need relevant information on permafrost if they are to adapt to changes and protect their homes.



Photo: Government of Nunavut

## OBJECTIVE

The Government of Nunavut's Department of Environment has created *A Homeowner's Guide to Permafrost in Nunavut*. The objective is to provide homeowners in Nunavut with the knowledge and resources to make simple changes around their home to help the permafrost stay frozen beneath it. The guide also helps local decision-makers

take on adaptation actions that are relevant to the communities they serve. The guide was developed as part of a series with the Government of Northwest Territories' *A Homeowner's Guide to Permafrost in the Northwest Territories*.

The Nunavut guide explains what permafrost is, how climate change is affecting it, the impacts to houses from thawing permafrost, and the importance of preventing thaw. It also explains how wind, snow, water, and the seasons affect permafrost, and how skirting, snow build-up, water build-up and other practices can all lead to permafrost degradation.

## APPROACH

The guide was written in a non-technical, plain language format for the average homeowner. The text is broken up with informative illustrations, check-lists, and useful photos displaying good and bad practices of home foundation management. A picture says a thousand words, and this philosophy is used to keep the guide user-friendly.

## EXPECTED RESULTS

Building degradation from permafrost thaw can be costly to not only homeowners, but also to government and private construction companies. By promoting good building maintenance practices and providing education and outreach around the importance of permafrost to buildings, it is expected that some of these costs might be reduced or delayed. This will lead to significant future cost savings. In using this guide, homeowners will be better equipped to make decisions about the construction and upkeep of their homes.

## Significance

*The Homeowner's Guide to Permafrost in Nunavut is the first of its kind to provide education about the effects of permafrost thaw on homes and adaptation strategies for Nunavummiut to keep a strong foundation.*

## Partners

- Nunavut Housing Corporation
- Government of Northwest Territories
- Centre d'études nordiques, Université Laval
- Natural Resources Canada
- Aboriginal Affairs and Northern Development Canada

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# The Nunavut Climate Change Centre (NC<sup>3</sup>)

Creating the Nunavut Climate Change Centre (NC<sup>3</sup>) online resource centre as a tool for centralizing climate change resources in Nunavut

## CONTEXT

The Government of Nunavut's Department of Environment established the NC<sup>3</sup> website ([www.climatechangenunavut.ca](http://www.climatechangenunavut.ca)) in 2012 to create a larger climate change resource site with a more interactive layout. There are many groups developing tools and community resources for climate change adaptation and research in Nunavut. Incorporating these resources into one, centralized location will help share and spread climate change knowledge in Nunavut.



Photo: Nunavut Climate Change Centre

## OBJECTIVE

The NC<sup>3</sup> website provides a broad overview of climate change in Nunavut including: current climate change projects, news and activities happening in Nunavut, educational resources, adaptation toolkits, research tools, and an Inuit Qaujimajatuqangit (traditional knowledge). On a broader scale, the NC<sup>3</sup> serves to increase national and global awareness of climate change and its impacts on Nunavut.

## APPROACH

The NC<sup>3</sup> website is designed around individual Nunavut communities, so that information relevant to specific communities can be easily accessed and understood in both plain language and the four official languages of Nunavut. It provides a venue for researchers to report on relevant climate change projects and to share their findings with the general public. It also aims to connect communities with researchers and allows information (i.e. research results) to be shared back to communities that participated in these research activities.

Aside from receiving information from the NC<sup>3</sup> website, community members can also interact by posting questions, photos, and stories related to climate change in their communities. This lets people shape the content of the website and contribute to reducing the impacts of climate change on Nunavut.

## EXPECTED RESULTS

It is expected that communities will use the NC<sup>3</sup> website to participate in climate change initiatives across the territory and initiate more adaptation awareness activities in their own communities.

There is a lot of potential for the development and promotion of community-based and youth engagement initiatives in Nunavut. The NC<sup>3</sup> site can be the central meeting place for these interactions to happen. By working together, we can help our communities adapt and prepare for the environmental changes Nunavummiut (people of Nunavut) are experiencing, and will continue to experience. Together, we can promote happier and healthier communities.

## Significance

*The NC<sup>3</sup> website serves as a portal to SHARE information on how Nunavut is affected by climate change, what our elders are saying, and how individuals can TAKE ACTION to adapt to our changing climate.*

## Partners

- Nunavut Research Institute
- ArcticNet
- Natural Resources Canada

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# Terrain Analysis in Nunavut

Using radar satellite images to assess climate change risks inherent with land development in Nunavut communities

## CONTEXT

Permafrost is ground that has been frozen for more than two years. In Nunavut, permafrost is under all of the land. The warming temperatures associated with climate change will affect the stability of the permafrost and therefore affect infrastructure in Nunavut. Currently, there are few resources available to assist developers building on unstable permafrost. This project enables the Government of Nunavut's Department of Community and Government Services and the Hamlets of Nunavut to acquire knowledge about site conditions of lands chosen for future development by conducting a terrain analysis in six communities.

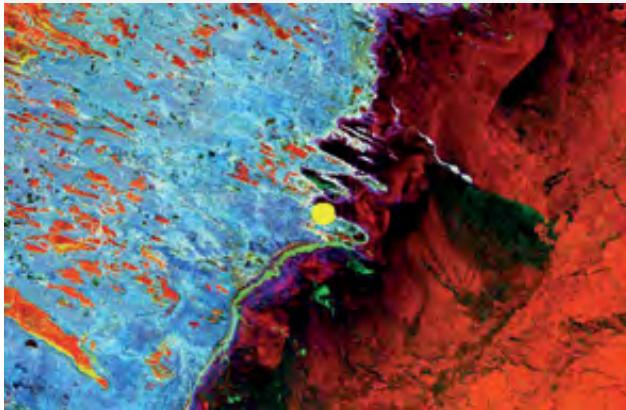


Photo: 3V Geomatics Arviat (yellow dot) is imaged as ice forms during the fall and early winter. Blue is from the bright ground during September. Green or yellow show areas where ice is beginning to form on Hudson Bay and lakes in October. Red areas show ice formed in December.

## OBJECTIVE

Information from this project will be used by planners and engineers to assist the selected communities in the decision-making process of selecting lands for future development. Community members are encouraged to

participate in the planning process by contributing their knowledge towards the development of their community's plans. By identifying and distinguishing lands that are more susceptible to the negative impacts of climate change (flooding, landslides and the shifting of land), communities will be better equipped to minimize the costs associated with the failure of foundations of buildings and infrastructure.

## APPROACH

This project monitors the shifting of permafrost by assessing the soil, permafrost and drainage conditions of the selected lands. The following monitoring methods are being used: radar satellite images, digital elevation models, optical images, site visits and local knowledge. Based on the data and information obtained, the studied terrains are ranked based on their suitability for future development. The communities of Arviat, Baker Lake, Kimmirut, Gjoa Haven, Cape Dorset and Kugluktuk were chosen based on their need for this information as well as the ability to build off previous work.

## EXPECTED RESULTS

This project will provide communities with tools and policies to assist in better land management. Information will be integrated into the municipal community plans.

The results from this project will aid in reducing the costs, damages, and losses associated with the failure of foundations of buildings and infrastructure in Nunavut. Aside from the communities benefiting, the territorial and federal governments, which have made considerable investments in the communities, will also benefit financially.

## Significance

*Terrain analysis provides information that enables communities to make better adaptation decisions when planning for new infrastructure developments in permafrost regions.*

## Partners

- Community and Government Services, Government of Nunavut
- Hamlets of Arviat, Baker Lake, Kimmirut, Gjoa Haven, Cape Dorset and Kugluktuk
- Aboriginal Affairs and Northern Development Canada

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# Hazardous Waste Inventory and Risk Assessment

Assessing climate change risk to municipal hazardous waste disposal sites in eight northern NWT communities

## CONTEXT

Northern regions in the NWT are experiencing the most rapid climate warming in Canada, resulting in thawing permafrost, slumping, and coastal erosion. These landscape changes can result in storage locations of hazardous waste (used oil, fuel, batteries, paint, and mercury) becoming unsafe and increasing the likelihood of having them released into the environment. Having a complete inventory of hazardous waste and assessment of their potential risk is important to protect communities from potential environmental threats that could arise with consistently warmer temperatures.



Photo: Government of the Northwest Territories

## OBJECTIVE

Inventory stockpiles of hazardous waste owned by community governments in the Inuvik region, including a cost estimate for their transportation and disposal. Create a climate change risk assessment using the inventory results to prioritize management and removal options.

## APPROACH

A qualified professional has visited six of eight communities in the Inuvik region to collect hazardous waste inventories from municipalities. Existing information has already been used to create a draft risk assessment that interprets the results of the inventory and identifies any additional risks that climate change impacts will directly and indirectly have on the hazardous waste stockpile in those regions.

## EXPECTED RESULTS

A complete inventory of hazardous waste will be created for: Aklavik, Inuvik, Fort McPherson, Paulatuk, Sachs Harbour, Tsiigehtchich, Tuktoyaktuk, and Ulukhaktok, as will a risk assessment that considers the vulnerability of the individual sites to hazardous waste contamination brought on by climate change.

This project benefits communities by creating inventories that can be used to plan budgets for transportation and disposal of hazardous waste, provide opportunities for communities to develop best practices for waste disposal and learn the risks and liabilities of hazardous waste management, and advise communities on how to coordinate the transportation and disposal of current hazardous waste from sites considered most at risk due to climate change.

## Significance

*Climate change increases the risk of municipal hazardous waste being released into the environment. The Beaufort Delta and High Arctic are experiencing rapid climate warming resulting in thawing permafrost, slumping, and coastal erosion.*

## Partners

- Community governments
- Aboriginal Affairs and Northern Development Canada
- NWT Association of Communities
- Northwest Territories Water Board
- Gwich'in Land and Water Board
- Government of the NWT, Municipal and Community Affairs
- Government of the NWT, Environment and Natural Resources

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# Permafrost Hazard Mapping

Facilitating the application and further development of techniques and methods to monitor and predict the effects of permafrost subsidence and upheaval as a tool for climate change adaptation planning

## CONTEXT

Rapid warming in the Northwest Territories is resulting in the degradation and thawing of permafrost. Understanding past changes and the current status of permafrost throughout the NWT will support climate change adaptation and decision-making with regards to permafrost. The approaches and methodologies that have been successfully demonstrated by other recent projects will be applied to this project. Multi temporal RADAR and complimentary (in situ) data sources to measure vertical and horizontal surficial displacement in particular, will be used to understand the level of impact that climate change is having on permafrost.



Photo: Government of the Northwest Territories

## OBJECTIVE

The objective of this project is to monitor and predict the effects of permafrost subsidence and upheaval using satellite mapping known as DInSAR (Differential Interferometric Synthetic Aperture Radar) and remote predictive mapping techniques, and to provide better informed decisions in the

selection of sites for future development. The project has two complimentary goals: to produce community permafrost subsidence hazard maps to support climate change adaptation and decision-making, and to develop a governance document outlining best practices for DInSAR permafrost hazard mapping.

## APPROACH

The Government of the Northwest Territories (GNWT) Department of Environment and Natural Resources (ENR) contracted a third party to supply RADARSAT-2 imagery. The project has benefited from an agreement between the Government of Canada and MacDonald Dettwiler and Associates with free RADARSAT-2 imagery.

## EXPECTED RESULTS

Results so far include:

1. Working with 3V Geomatics to acquire relevant data and imagery – RADARSAT-2, and processing.
2. Processing RADARSAT-2 C-Band SLC temporal image stacks.
3. Presentations on the project were held with GNWT transportation and the NWT Association of Communities.

## Significance

*Creating an inventory of permafrost maps in the NWT will allow a better understanding of areas being impacted by permafrost thaw, allowing increased adaptation resource efficiency, community planning and the filling of research gaps.*

## Partners

- Aboriginal Affairs and Northern Development Canada (AANDC)
- TRACS : Transportation Risk in the Arctic to Climatic Sensitivity
- CCAPT: Climate Change Adaptation for Permafrost Terrain.

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# Assessing Building Vulnerability

The Government of the Northwest Territories is developing tools for evaluating the effects of climate change on buildings and other infrastructure assets

## CONTEXT

The Government of the Northwest Territories (GNWT) maintains more than 750 public buildings including schools, hospitals, offices, correctional facilities and many other community assets. Climate change has serious impacts on building foundations: increased temperatures result in permafrost thaw, which can compromise building foundations. Also, changes in snow patterns may result in increased snow on buildings, possibly resulting in damage or collapse.



Photo: Pan-Territorial Adaptation Partnership

## OBJECTIVE

To create a tool to assess infrastructure, in particular buildings, for their capacity to withstand changes in climate, focusing on snow loads and permafrost degradation. The tool should:

- Provide accurate assessment information on the likely capacity of a building to withstand adverse changes in climate.
- Provide an assessment score that can be used to make building remediation, management, and maintenance decision.
- Be easy to use.

- Provide results that can be stored electronically so past results can be accessed and likely trends in capacity identified.

## APPROACH

GNWT Department of Public Works and Services (PWS) is leading a team of consultants to develop the tools needed to evaluate buildings. The team is assessing building assets, inspecting buildings, completing a risk assessment and analysis, developing recommendations, and updating the status of knowledge.

Initial tools for the risk assessment and evaluation have been, and will continue to be, plotted on GNWT building assets. The final year of funding will include the development of the software tool, any associated instructions-for-use/training for operators, and ratings for each building assessed throughout the project.

## EXPECTED RESULTS

Data from the climate change evaluation of buildings gathered during this four-year project will be integrated into the GNWT maintenance database. This data will allow for facility condition indices (FCI) to be calculated for buildings. The FCI will be used to determine if it is cost effective to invest in repairs or if the GNWT should instead consider building new structures.

This project will help adaptation and capital planning within the GNWT by completing a risk evaluation of public buildings in many NWT communities. Buildings in need of maintenance, or those with an FCI score suggesting replacement is necessary, will be identified and addressed based on the project results.

## Significance

*Permafrost that supports building foundations and snow loads on roofs are changing with a warming northern climate. Buildings designed for different climatic conditions could now be at risk.*

## Partners

- GNWT Environment and Natural Resources, Public Works and Services
- Aboriginal Affairs and Northern Development Canada
- Associated Engineering
- Risk Sciences International
- EBA Engineering
- Wayne Guy Architects

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# Mountain Pine Beetle Vulnerability

Determining the risk and management options for invasive mountain pine beetle in Northwest Territories pine forests

## CONTEXT

Mountain Pine Beetle (MPB) has historically been found in the pine forests of British Columbia (BC), and after a recent epidemic in BC the beetle crossed into Alberta (AB). In the fall of 2012, MPB was detected at sites along the Northwest Territories/AB border. A March 2013 survey found beetles had survived the winter in the NWT for the first time. The movement of MPB further north is being aided by warmer winter temperatures, the result of climate change.



Photo: Aerial Forest Health Survey Flight Paths – FMD

MPB's spread blue stain fungus that, combined with larval feeding, can kill pine trees by blocking their conductive tissue. MPB attacks both pine species found in the NWT, jack pine and lodgepole pine. While the potential impact of MPB in the NWT is unknown, it has impacted the wood supply for forest harvesting, wildlife habitat and hydrology in BC. Healthy Forests and Landscapes are integral to maintaining safe and sustainable communities. No mountain pine beetle activity was found in the NWT in 2014, but monitoring is still important for making informed management decisions in case the beetles return.

## OBJECTIVE

To determine the current status and risk of MPB to NWT forests, investigate management options to mitigate and minimize negative impacts, and to communicate current and predicted status of MPB to communities and affected stakeholders.

## APPROACH

Current activities focus on aerial surveys of the most susceptible pine stands in southern NWT combined with the pheromone baiting program near NWT/AB border. This includes monitoring overwinter survival rates between April and June each year if any beetles are confirmed.

The Government of the Northwest Territories (GNWT) Forest Management Division (FMD) has been actively participating in the National Forest Pest Strategy meetings on slowing the spread of MPB across Canada to expand their understanding of the beetle and its activity in other regions.

## EXPECTED RESULTS

This project will produce maps of pine forests in the NWT vulnerable to MPB and assist in sustainable forest management decision-making. A pest risk analysis has been completed, which includes a risk assessment and the determination of potential risk response options for a management strategy. It identifies future information needs and potential management strategies. One of them will be developing a five year MPB monitoring plan for the NWT.

## Significance

*Climatic conditions now allow Mountain Pine Beetle to survive in the NWT. Pine forests and values depending on them may be at risk.*

## Partners

- GNWT Environmental and Natural Resources, Forest Management Branch
- Aboriginal and Northern Development Canada
- Natural Resources Canada
- University of British Columbia
- Alberta Environment and Sustainable Development
- JCH Forest Management

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# Permafrost Homeowner's Guide

The Government of the Northwest Territories (GNWT) has created a *Homeowner's Guide to Permafrost*, designed to assist residents of the Northwest Territories (NWT) with understanding and mitigating permafrost impacts on their homes

## CONTEXT

Climate change in the NWT is beginning to thaw and degrade the permafrost that has traditionally acted as a solid foundation for buildings and homes. Infrastructure built on permafrost that was once stable, is beginning to succumb to structural issues due to this weakening of the permafrost that underlies them. This degradation, caused by increased surface air temperatures, is unlikely to slow, making adaptation essential to avoiding costly damage to houses. Educating NWT residents on how to prevent negative impacts on permafrost is an excellent means to avoid unnecessary permafrost degradation and teach them what they can do to encourage permafrost to remain frozen even as air temperatures increase.



Photo: Government of the Northwest Territories

## OBJECTIVE

The GNWT's Climate Change Unit aimed to develop a plain language guide that can be used by homeowners within the NWT to take action in preventing permafrost degradation

around their homes. This guide provides simple solutions that can help mitigate and even reverse the damages caused to permafrost by increased air temperatures.

## APPROACH

A contractor was contacted to develop an approachable, plain language document that would be released to communities and residents. This guide is comprehensive, yet simple and concise, allowing easy pickup and use.

The document helps homeowners identify if their household is susceptible to permafrost damage and ways to prevent damage to the home resulting from permafrost heave and subsidence. The document also provides advice to mitigate permafrost thaw beneath structures and even restore permafrost that has begun to thaw and degrade.

## RESULTS

The *Homeowner's Guide to Permafrost* is now complete and available both as a hardcopy print at various locations throughout the NWT and as an online file. The document was distributed to communities by working with the Northwest Territories Association of Communities. The distribution of this guide will increase the resilience of residents of the NWT in the face of climate change impacts on infrastructure.

## Significance

*The degradation of permafrost, from climate change as well as indirect human actions, can be prevented by changing certain behaviours. This guide helps to identify and explain how homeowners can avoid damaging permafrost under their homes.*

## Partners

- Environment and Natural Resources
- Northwest Territories Association of Communities
- CS Environmental
- Soaring Tortoise Design
- Natural Resources Canada
- Government of Nunavut, Department of Environment

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# NWT Emergency Planning

Update on an after-action review of territorial and regional civil emergency response efforts during the 2014 fire season and preparations to update the Northwest Territories' (NWT) emergency plan

## CONTEXT

With an expected increase in the severity and number of natural disasters occurring due to increasing global temperatures, there is a need for an improved and up-to-date territorial emergency management regime. Potential disaster related impacts resulting from climate change include an increase in the frequency and severity of flooding, an increase in the number and intensity of wildfires, and an increase in permafrost thaw slumps (landslides). This work will help improve emergency response capacity as well as identify risk reduction measures designed to reduce the climate change vulnerability of populations at risk.



Photo: Government of the Northwest Territories

## OBJECTIVE

To understand changing response requirements and improve and update the NWT Emergency Plan with best practices to ensure effective emergency response to more severe and frequent natural disasters identified in the NWT Hazard Identification Risk Assessment. It will also be informed by an after-action review (AAR) of the 2014 summer wildfires.

## APPROACH

The Department of Municipal and Community Affairs (MACA) coordinated the AAR, which included an evaluation of territorial and regional civil emergency response efforts during the 2014 wildfire season, as well as research theory, best practices, and comparative models on key emergency response topics.

This work focused on control and coordination, emergency communications, risk assessments and civil emergency response activities.

Research on best practice in emergency management and recommendations from the AAR will form the basis of the update to the NWT Emergency Plan.

## EXPECTED RESULTS

This project is expected to produce a thorough and complete after-action review of the civil emergency response during the summer 2014 wildfires. The after-action review will utilize its results to the development of a best practices research document. These two documents will be available to guide future updates to the NWT emergency plan.

These resources – the after-action review, best practices research document and the updated NWT Emergency plan – will increase the understanding and preparedness of northerners to emergency situations. The incorporation of climate change considerations into these documents will enable them to remain relevant despite the changing climate of the NWT.

## Significance

*Global temperatures are expected to increase further during the 21<sup>st</sup> century and are expected to be substantially greater than the global average. This is expected to have a significant influence on the severity and number of natural disasters.*

## Partners

- GNWT Department of Municipal and Community Affairs
- Aboriginal Affairs and Northern Development Canada
- GNWT Department of Environment and Natural Resources
- Territorial Emergency Response Committee
- Northwest Territories Association of Communities

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# Cultural Vulnerability Site Mapping

Creating a vulnerability index tool for climate change induced threats to archaeological sites and traditional land use areas within the Gwich'in Settlement Area

## CONTEXT

Climate change is increasing permafrost thaw in the NWT, and causing cultural, structural and economic damage to the North. The thaw of ice-rich permafrost can result in landscape changes, such as thaw slumps, which can expose preserved archaeological remains and alter traditional land use. In order to assess the vulnerability of these sites, the GNWT is collaborating with the Prince of Wales Northern Heritage Centre and researchers from the University of Victoria to create a vulnerability index tool. This tool will map and predict areas susceptible to alterations in landscape due to the changing climate of the Northwest Territories.

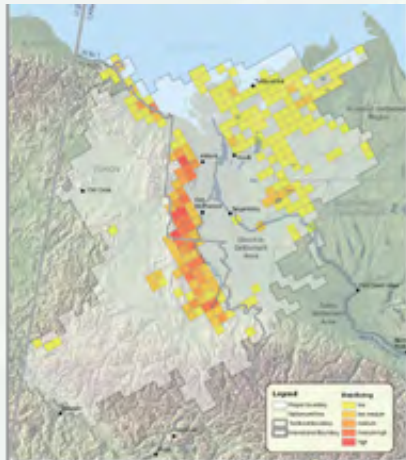


Figure: Government of the Northwest Territories

## OBJECTIVE

This project is developing a vulnerability index tool for climate change induced threats to archaeological sites in the Gwich'in Settlement Area (GSA). The project is building a GIS-based predictive model that uses spatial data on active thaw slumps,

archaeological sites, Gwich'in traditional land use sites, and other landscape variables. The current year of the project has been dedicated to acquiring analysis software (PCI Geomatica), in conjunction with the Department of Lands, Centre for Geomatics, to analyze data in areas at high risk of impact from thaw slump activity.

## APPROACH

In the first and second years of the project an inventory of growing thaw slumps was created, which examined over 5,000, 225 km<sup>2</sup> grid cells, to identify, record and characterize thaw slumps in the GSA.

Secondly, compilations of Gwich'in traditional land use data and known archaeological sites were utilized to develop a map of current and traditional land use. This map was overlain with water features, geological features and other environmental information.

The analysis software has been purchased and will aid with next year's goals by automating the process of isolating slump and archaeological features, and the process of change detection in thaw slumping activity.

## RESULTS

The results of this year's funding include the submission for publication of a paper on permafrost thaw and aboriginal cultural landscapes to a journal. A risk map was created for this paper and includes information relevant to this project.

PCI Geomatica will facilitate detailed mapping of interactions between thaw slumps and cultural resources, which will enable the project leads to fine tune the overall risk map.

## Significance

*Understanding how traditional lands have been used and how they are currently being used, as well as threatened, helps to save information about the NWT, before this information is lost due to climate change impacts.*

## Partners

- Prince of Wales Northern Heritage Centre
- University of Victoria
- NWT Geoscience Office
- GNWT Environment and Natural Resources, Environment Division
- Aboriginal Affairs and Northern Development Canada
- The Gwich'in Social and Cultural Institute

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# Climate Change Curriculum

A climate change course aimed at equipping community government decision-makers and employees with the knowledge necessary to adapt to climate change impacts being felt by northern communities

## CONTEXT

The School of Community Government (SCG) of the Department of Municipal and Community Affairs (MACA) with the Government of the Northwest Territories (GNWT) provides training to community governments and their staff, and organizations that support community governments. The SCG consists of a number of training program areas. Climate change training was identified as a gap in the programs they currently offer.

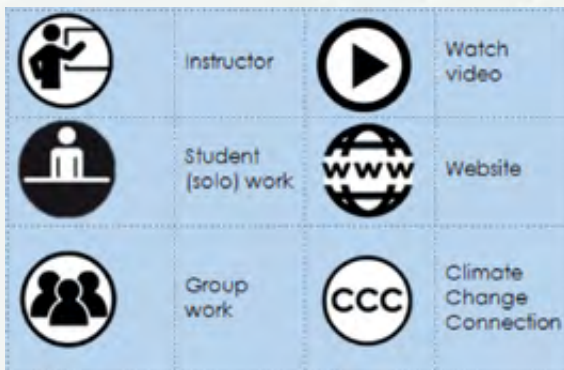


Figure: Government of the Northwest Territories

## OBJECTIVE

The objective of this project was to design and develop a course of study in "Climate Change and its Impact on Community Governments" to present to NWT community councils and government staff wanting to increase their understanding of climate change in the NWT and its effects. This curriculum will allow communities with limited resources to build capacity within their organization.

## APPROACH

The course was created with the help of a contractor, Ecology North (EN). The Northwest Territories Association of Communities (NWTAC), Environment and Natural Resources (ENR) and MACA worked with EN to ensure that the curriculum included traditional knowledge examples, experiences and adaptation techniques when possible.

A final draft of the two-part (instructor and student manuals) curriculum was created February 2015. It includes learning objectives, assignments, and exercises for a three day workshop. The goal is to provide an understanding of climate change and what communities can do to mitigate and adapt to it in areas like infrastructure development, community planning, and emergency response.

## EXPECTED RESULTS

MACA and the NWTAC led a focus group delivery during the initial stages of the workshop (pilot phase). Overall, participants found the workshop informative. Ecology North will revise content and adapt facilitation using the feedback from the pilot delivery to update both manuals. The course will also be able to adapt to delivery through distance education as a self-study and an online course.

There is a workshop scheduled for delivery in 2015/16. The NWTAC will support staff and council from community governments to attend.

## Significance

*Understanding climate change is essential for communities to be able to adapt, and in order to understand it there needs to be a way to convey that information.*

## Partners

- Aboriginal Affairs and Northern Development Canada
- GNWT Municipal and Community Affairs, School of Community Government
- Ecology North
- Northwest Territories Association of Communities

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# Arctic Adaptation Exchange Web Portal

Sharing knowledge to help communities enhance their ability to adapt to climate change

## CONTEXT

The Arctic Adaptation Exchange website ([www.arcticadaptationexchange.com](http://www.arcticadaptationexchange.com)) facilitates the exchange of climate change adaptation knowledge in the circumpolar north. Communities, researchers, and decision-makers in the public and private sectors can use this information hub to enhance their ability to understand and plan effectively for climate change in the North.



Photo: Government of Yukon

The Arctic Adaptation Exchange is an Arctic Council initiative co-led by Canada (supported by Natural Resources Canada and the Government of Yukon), the U.S. (supported by the U.S. Department of State and the University of Alaska Fairbanks), Aleut International Association and Gwich'in Council International.

## OBJECTIVE

To improve dialogue and knowledge exchange on climate change impacts and adaptation in the Arctic. To enhance adaptive capacity and foster innovation, learning-by-doing and the development of best practices.

## APPROACH

Ways of responding to climate change impacts differ between regions and communities. There is a growing body of research and practical experience which can be learned from and used to enhance how northerners respond to changes in our climate. Arctic Adaptation Exchange users can download and upload information, connect with others with an interest in climate change, and discover new tools and practical innovations to help them better adapt to climate change impacts.

## RESULTS

Information sharing will enhance adaptation planning and implementing adaptation actions. Practical experience gained through this project will facilitate innovation across the circumpolar Arctic. The Arctic Adaptation Exchange website may be used to increase, encourage and streamline communication between participants to enable the development of creative solutions to the challenges of climate change.

## Significance

*Knowledge sharing strengthens the ability of Arctic communities to respond and adapt effectively to climate change and builds a foundation for adopting innovative approaches.*

## Partners

- Government of Canada (Government of Yukon, Natural Resources Canada)
- U.S. State Department
- University of Alaska Fairbanks
- Aleut International Association
- Gwich'in Council International

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# Mainstreaming Climate Change

Integrating climate change considerations into decision-making in Yukon

## CONTEXT

'Mainstreaming' means making something part of the norm. The Climate Change Information and Mainstreaming Program (CCIMP) works to incorporate climate change considerations into the decision-making of governments and organizations. The program was established in 2010 and is a partnership between the Northern Climate ExChange of the Yukon Research Centre and the Yukon government's (YG) Climate Change Secretariat. CCIMP helps YG departments blend climate change considerations into projects, planning and decision-making.



Photo: Government of Yukon

## OBJECTIVE

To provide support and expertise to decision and policy makers in governments and organizations to help reduce emissions and adapt to climate change.

## APPROACH

The Climate Change Information and Mainstreaming Program offers: technical expertise, including climate change science, impacts and adaptation information and project-specific recommendations; Yukon climate trends, projections and scenarios; presentations, and workshops. CCIMP accomplishes this through strong relationships and a course providing an overview of climate change science and policy.

## RESULTS

Since its inception in 2010, more than 100 government employees across eight departments have participated in the "Decision-Making for Climate Change" course. The CCIMP program has also responded to numerous requests from government departments and non-government organizations who have taken advantage of climate change project support.

This project and partnership is leading the way in normalizing climate change considerations throughout government departments and other organizations' decision-making.

## Significance

*The Climate Change Information and Mainstreaming Program supports integration of climate change considerations into government and organization planning and decision-making.*

## Partners

- Northern Climate ExChange, Yukon Research Centre, Yukon College
- Climate Change Secretariat, Department of Environment, Government of Yukon

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# Mapping Landscape Hazards

Using geoscience mapping to identify hazard risks in a changing climate

## CONTEXT

Climate change is affecting Yukon communities. It alters the permafrost on which they are built, affects flood patterns, and alters landscape stability. Communities are seeking information that will help them increase local resilience and adapt to change. Landscape hazard maps are one tool communities can use to prepare for ongoing environmental change and subsequent impacts on infrastructure.



Photo: Yukon College and Yukon Geological Survey

## OBJECTIVES

This project investigates current landscape hazards related to permafrost, surficial geology and hydrology in Yukon communities. It creates easy-to-interpret maps showing ranked hazard risk that can be integrated in decision-making processes.

## APPROACH

To identify existing hazards, researchers gathered and mapped geoscience information such as surficial geology, permafrost and water data. Projections of future climate variability and permafrost distribution were then used to identify potential hazard risks. Integrating the results allowed the research team to rank the risks of current and future hazards in each study community.

## RESULTS

Landscape hazard maps have been completed for Mayo, Pelly Crossing, Burwash Landing and Destruction Bay, Ross River, Faro and Dawson City. Hazard maps for Old Crow will be available in March 2016.

For each community, hazard risks were ranked by severity (low, moderate, high) and represented graphically on a community-scale map. In most mapped communities, high hazard risk was associated with active or likely permafrost degradation, thaw settlement, landslides, erosion, thermokarst, and active floodplains. Areas with low risk typically had no or very limited permafrost degradation, flooding or geological hazards.

Hazard maps from this project have been used to identify areas for future development, tailor infrastructure to site conditions, assess land use suitability, and inform community-based decision-making.

## Significance

*Landscape hazard maps help Yukon communities understand how their area will respond to environmental change and allow them to adapt effectively to these impacts.*

## Partners

- Northern Climate ExChange, Yukon Research Centre, Yukon College
- Government of Yukon, Yukon Geological Survey
- Universities of Montreal, Ottawa, Laval and Alberta
- First Nations in study communities
- Municipalities of study communities
- Aboriginal Affairs and Northern Development Canada

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# Climate Change & Public Health

Advancing Yukon's understanding of health implications associated with climate change

## CONTEXT

Climate change can affect human health. Extreme weather events, environmental changes, new diseases and unpredictable weather patterns can impact the overall health and well-being of individuals and communities. Impacts can range from immediate and severe to slow and cumulative. They can be physical, emotional or psychological.

Climate change can affect social and environmental influences on human health and, therefore, the well-being of our communities. Taking stock of what we know



Photo: Government of Yukon

about the relationship between climate change and human health in Yukon can help us better understand existing gaps in knowledge and resources. This is particularly noticeable in areas like food security, shelter, traditional knowledge and culture, which have been the focus of much of the research and analysis undertaken on this issue.

## OBJECTIVE

Identifying current and future health impacts caused by climate change in Yukon and drawing on existing knowledge and experience in this area to help address gaps in our knowledge and resources that inform future planning and action.

## APPROACH

In 2014, the Yukon government, in partnership with the Northern Climate ExChange and the Council of Yukon First Nations, led a research project exploring the relationship between climate change and public health in Yukon.

## RESULTS

The final report helped establish an understanding of past and current activity exploring the relationship between climate change and health in Yukon. Future projects addressing the impacts of climate change on the health of Yukoners may build on these results. Future projects addressing the impacts of climate change on the health of Yukoners may continue to build on these results.

## Significance

*Climate change may affect the health of Yukoners in unique ways. Increasing our knowledge of the relationship between climate change and health will help communities to respond appropriately and to build resiliency.*

## Partners

- Council of Yukon First Nations
- Northern Climate ExChange, Yukon Research Centre, Yukon College
- Arctic Athabaskan Council

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# Energy Sector Case Studies

Evaluating opportunities to integrate adaptation and mitigation programs into the energy sector

## CONTEXT

The energy sector is one of the largest contributors to greenhouse gas (GHG) emissions in Canada. While all economic sectors will be affected by climate change, the energy sector will need to adapt significantly to the anticipated shift in demand coupled with stresses on generating infrastructure. Integrating adaptation and mitigation can increase resilience in the energy sector while decreasing GHG emissions. The conservation of resources, including cost savings, is also possible.



Photo: Government of Yukon

## OBJECTIVE

To investigate and demonstrate the benefits resulting from synergies between mitigation and adaptation in Canada's energy sector.

## APPROACH

Investigate and compile case studies that illustrate the opportunities and benefits derived from combining activities that reduce greenhouse gas emissions and actions that help adapt to the impacts of climate change. The project highlighted key lessons from provincial programs in Ontario, Saskatchewan, Alberta, British Columbia, Newfoundland and Yukon. International case studies were used to supplement the Canadian studies.

## RESULTS

The case studies successfully identified four co-benefits that can be derived from the integration of adaptation and mitigation:

- Reduced competition for resources both within the sector and with other land-users;
- Reduced influence of uncertainty on policy development and project design;
- Increased harmonization of project outcomes that achieves multiple objectives; and
- Improved social license for energy project implementation.

By demonstrating the benefits of integration in energy policies and in the early stages of energy project development, this analysis provides useful guidance for energy sector agencies seeking to achieve improved resource conservation, cost savings, and reduced opposition to energy projects.

## Significance

*Promoting integration of adaptation and mitigation will contribute to the ability of Canada's energy sector to take meaningful action towards enhancing effectiveness and cost efficiency.*

## Project Leads

- Energy Solutions Centre, Government of Yukon
- Ontario Centre for Climate Impacts and Adaptation Resources

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# Highways, Hydrology & Climate Change

Assessing the water-related effects of climate change on Yukon's northern highways

## CONTEXT

The climate of northern regions has become warmer and wetter over the last three decades resulting in degrading permafrost and changing vegetation. In addition, a warming climate has already altered the hydrology – the distribution, movement, and quality of water – of Yukon, resulting in more frequent and intense flooding that has negative and expensive impacts on transportation infrastructure.



Photo: Government of Yukon

## OBJECTIVE

To better understand how Yukon's water cycles (precipitation, evaporation, runoff, etc.) are changing, and to use computer-generated models of past and future climate changes to develop better ways to respond to these changes along the Dempster Highway.

## APPROACH

Sensitivity to water changes and associated permafrost thawing will be assessed along the Dempster Highway Corridor. Using a range of climate change planning scenarios, assessments will be carried out within the eight distinct ecological regions that the Dempster Highway traverses. Weather stations have been installed along the highway where they do not already exist in order to supplement data collected at existing stations.

## EXPECTED RESULTS

This initiative will generate a summary of projected hydrological changes that may result from climate change along the Dempster Highway. It will also develop flood frequency projections based on annual peak flows for Dempster Highway stream crossings. These products will allow for the development of adaptation strategies and options, which may include infrastructure design modifications.

## Significance

*Developing hydrological response projections will assist in adaptation planning and may reduce negative impacts of climate change on northern transportation infrastructure.*

## Partners

- Highways & Public Works, Government of Yukon
- Water Resources, Government of Yukon

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# Thawing Permafrost and Highway Integrity

Determining the vulnerability of the North Alaska Highway to permafrost thaw

## CONTEXT

This project will examine the potential effects of climate change on permafrost along the northern 200 km of the Alaska Highway in Yukon, where permafrost is relatively warm and often ice-rich. This stretch falls within the Traditional Territories of the White River and Kluane First Nations, and passes through the communities of Destruction Bay, Burwash Landing and Beaver Creek. The highway is critical for distributing food, supplies and medical necessities to these communities as well as to interior Alaska.



Photo: Government of Yukon

Government of Yukon's Highways and Public Works is partnering with the Northern Climate ExChange (NCE), part of the Yukon Research Centre at Yukon College, to map permafrost characteristics in the area.

## OBJECTIVE

This project identifies and characterizes permafrost underneath the Alaska Highway, establishes future climate scenarios for the region, and evaluates the potential effects of climate change on the area's permafrost.

## APPROACH

This project uses environmental data, engineering reports, Highways and Public Works maintenance records, air photos and field investigations, including permafrost drilling and geophysics, to identify thaw-sensitive areas under the highway. This information will be combined with future climate scenarios to inform decision-making.

## RESULTS

Developing an understanding of the impacts of climate change on highway infrastructure is critical for the continued maintenance of the North Alaska Highway into the future. Information gained from this study is already:

- Helping to develop specific, efficient and effective policies, highway engineering designs and highway maintenance plans;
- Providing transportation security for Yukon communities, visitors and Alaskans to the region; and
- Serving as a model for future studies in other regions of Yukon and the North.

## Significance

*Exploring how permafrost thaw impacts the North Alaska Highway corridor will impact transportation security in Yukon.*

## Partners

- Highways and Public Works, Government of Yukon
- Northern Climate ExChange, Yukon Research Centre, Yukon College
- Climate Change Secretariat, Government of Yukon
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# Permafrost Monitoring and Transportation Infrastructure

Assessing the effects of permafrost response to climate warming on transportation infrastructure in Yukon and the Northwest Territories

## CONTEXT

Permafrost is widespread in many parts of central Yukon and NWT and extensive and continuous in the north of both territories. Their transportation networks traverse permafrost that is sensitive to climate warming. Little is known of current conditions in this remote terrain or how the ground has responded to recent increases in air temperature. Warming and thawing of permafrost due to climate change results in terrain instability and has already begun to affect the integrity of transportation infrastructure components in some locations.



Photo: Government of Yukon

In response to demand from the public and the mining industry, the NWT and Yukon governments are exploring ways to improve and upgrade roads. Research is required to supply data on permafrost conditions adjacent to and beneath transportation infrastructure and to estimate the vulnerability of permafrost to climate warming at these sites.

## OBJECTIVE

To conduct a baseline regional assessment of permafrost thermal regime, vulnerability of transportation infrastructure to changing permafrost conditions and a time frame for permafrost degradation affecting highway embankments.

## APPROACH

Six to nine sites along the Dempster Highway, at the Mayo Airport and on the North Canol road will be monitored for deep and near-surface permafrost condition and ground temperature. Additional weather data collected by Yukon Department of Highways and Public Works (HPW) personnel will support the permafrost data collected during the study. Data compilation and management will be done by the Yukon Research Centre's Cold Climate Innovation Program and analysed by Carleton University. The data will be used as a planning tool by HPW and shared with the Government of NWT.

## EXPECTED RESULTS

The data collected will determine the predicted effect of climate change over the next 50 years on permafrost conditions at the monitored sites. The results may inform future transportation infrastructure planning, including the development of best practices. The data will be available for use by other researchers.

## Significance

*Key step in developing a territory-wide program to monitor ground temperatures and climate conditions in those areas where transportation infrastructure is vulnerable to climate change.*

## Partners

- Highways & Public Works, Government of Yukon
- Government of Northwest Territories

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# Infrastructure and Permafrost Thaw

Conducting a risk assessment to understand how thawing permafrost will impact key buildings in Ross River, Yukon

## CONTEXT

Northern Canada is at the forefront of climate change impacts, especially in the discontinuous permafrost zone. Permafrost thaw may affect the stability of existing and proposed community infrastructure. By identifying the risks and developing adaptation and management plans, northern communities will be more prepared for a changing permafrost landscape.



Photo: archbould.com

## OBJECTIVE

To conduct a risk assessment of public buildings and develop customized best management practices for operating and maintaining buildings on permafrost. The project will focus on infrastructure of critical importance for Ross River, Yukon, such as the school, community and recreation centre, and daycare facility.

## APPROACH

For the risk assessment, researchers identify critical infrastructure affected by permafrost degradation, and use geophysical surveys and the analysis of permafrost core samples to characterize and assess the permafrost that surrounds sensitive buildings. These results are then integrated to determine permafrost distribution and characteristics, and assess thaw sensitivity and potential impacts on infrastructure.

## EXPECTED RESULTS

This project will support Property Management Division's maintenance and construction staff by improving our collective understanding of permafrost under key building stock. Best management practices developed through this project will inform ongoing maintenance and monitoring operations, and will help ensure the integrity of local infrastructure. Results will also be valuable for other northern communities experiencing changing permafrost regimes.

## Significance

*Risk assessments can help northern communities develop best practices for maintaining buildings on degrading permafrost*

## Partners

- Property Management Division, Highways and Public Works, Government of Yukon
- Natural Resources Canada
- Northern Climate ExChange, Yukon Research Centre

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# Cost of Adaptation for a Winter Road

Economic implications of climate change adaptation for mine access roads

## CONTEXT

Northern ice roads provide vital access to businesses and communities. They are essential for continued northern development and prosperity. The focus of this study is the Tibbitt to Contwoyto winter road, which provides access to three active mines in the Northwest Territories. This road was chosen due to its sensitivity to climate change, the availability of past research and analysis and its regional economic importance. It is the busiest heavy-haul ice road in the world and the viability of the road into the future is a key concern for existing and potential mines along the route.



Economic Implications of Climate Change  
Adaptations for Mine Access Roads in Northern Canada



Photo: Northern Climate ExChange

The approximately 600 km ice road is constructed on a yearly basis and allows the transportation of goods, materials and personnel to the mines. The road is open for several months every winter and is the sole overland access to the mines. Studying the costs of responding to climate change on northern ice roads can inform current

projects and continued northern development in the NWT, Nunavut, Yukon and other circumpolar jurisdictions.

## OBJECTIVE

This project developed a cost-benefit analysis to assess climate change adaptation options for a major northern mine access road.

## APPROACH

A multi-disciplinary team worked together to identify the adaptation costs for a mine access road. Team members brought expertise in northern climate change impacts, adaptation, vulnerability assessments, adaptation economics and climate analytics.

Researchers analyzed key climate change vulnerabilities associated with the ice road, and potential adaptations that could be used to modify the road. They then conducted an analysis of the financial costs and benefits associated with those vulnerabilities and adaptations, and the distribution of those costs and benefits.

## EXPECTED RESULTS

Understanding the costs associated with adapting to climate change is critical for the current and future prosperity of the transportation and mining industries. The results of this study:

- Provide decision-makers with information and tools, including the cost of implementing adaptations, to help them with future decisions about transportation in a changing climate;
- Inform how adaptation cost-benefit analyses might be usefully conducted in other regions and on other types of infrastructure.

## Significance

*Conducting a cost-benefit analysis for a range of adaptation options for a major northern mine winter access road will help to better inform future decisions about transportation infrastructure in a changing climate.*

## Partners

- Northern Climate ExChange, Yukon Research Centre, Yukon College
- International Institute of Sustainable Development
- Risk Sciences International
- Nodelcorp Consulting Inc.
- EnviroEconomics
- Natural Resources Canada
- Pan-territorial Adaptation Partnership (Governments of Yukon, NWT, and Nunavut)

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# Temperature Trends and Energy Demand

Evaluating the influence of climate change on energy demand to assess future strategies for energy market transformation

## CONTEXT

Climate change has significant potential to affect how Yukon manages its energy resources. Changing temperatures and precipitation patterns may have multiple effects on energy demand. Changing market dynamics, including growing demand in Yukon's residential sector, is also leading to a transition period in how electricity is generated.



Photo: Government of Yukon

## OBJECTIVE

To help inform energy resource planning by identifying potential risks and opportunities for the Yukon energy sector resulting from climate changes that affect supply and demand.

## APPROACH

This project compiles a forecast of energy demand in Yukon that includes the influence of climate change. The Yukon government's Energy Solutions Centre and Yukon Energy Corporation then worked to analyze the impacts of the projected changes on the territory's heating and electricity sectors.

## RESULTS

The energy forecast showed that climate change is expected to lessen the amount of energy required for residential heat in Yukon. Daily energy consumption may fall by 10 to 137 GWh/year over the short term (2011 to 2014) – the equivalent of annual electricity and heating for 381 to 5520 Yukon homes.

If Yukon is successful in limiting the growth of energy consumption as its population grows, reduced consumption could result in many benefits – including reductions in electrical infrastructure costs, reduced resource pressures, and new economic opportunities. Such benefits will ultimately lower household energy expenses and greenhouse gas emissions.

## Significance

*Understanding how electricity demands will be influenced by temperature trends will contribute to more effective and comprehensive energy demand and resource planning.*

## Partners

- Energy Solutions Centre, Government of Yukon
- Natural Resources Canada (Adaptation and Impacts Division)
- Yukon Energy Corporation

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# Northern Adaptation Website

Pan-territorial climate change adaptation information now available in a centralized location

## CONTEXT

The Pan-Territorial Adaptation Partnership (PTAP), a collaboration between the Governments of Yukon, the Northwest Territories and Nunavut, works on climate change adaptation projects across Northern Canada. Since 2010, PTAP has been working to support communities and decision-makers and establish partnerships with researchers and funding agencies.

## APPROACH

The website is accessible in a variety of different ways to a variety of different users. The site is searchable and also allows visitors to access information through various jump-off points.

## CONTENT

The Northern Adaptation Website features:

- Information on PTAP
- Materials from the 2013 Pan-Territorial Permafrost Workshop
- Youtube channel and Flickr photos from various PTAP events
- An Information Notes database, which allows visitors to search and filter through non-technical summaries of climate change adaptation projects
- New content and resources developed by PTAP

## EXPECTED RESULTS

The website is intended to help with the development and promotion of pan-territorial adaptation work. By working together, PTAP helps our communities adapt and prepare for the environmental changes Northerners are experiencing, and will continue to experience.

As PTAP continues to grow and expand as a partnership, so too will this website, as a forum for providing information, training, and tools to support pan-territorial adaptation efforts by individuals, communities, and government.

## Significance

*This website provides information on current northern adaptation activities, updates on pan-territorial adaptation events, news, and other adaptation resources.*

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Photo: Pan-Territorial Adaptation Partnership

## OBJECTIVE

The Northern Adaptation website was launched in 2014 as a central location to showcase adaptation work being done pan-territorially.

The material on the website is not available anywhere else online, making the website the only online location for PTAP materials. The website is not meant to duplicate any of the climate change information on individual territories' climate change websites, but rather to highlight the projects PTAP has completed together.









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