



NWT Water Stewardship Strategy

IMPLEMENTATION WORKSHOP

Northern Waters in a Changing Climate

October 22-23, 2019

Dettah, NT

Summary Report

Stratégie sur la gestion des eaux des Territoires du Nord-Ouest

ATELIER DE MISE EN ŒUVRE

Les eaux du Nord dans un climat en évolution

Les 22 et 23 octobre 2019

À Dettah, aux TNO

Rapport sommaire

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Executive Summary

Water partners joined the Government of the Northwest Territories' (GNWT) Department of Environment and Natural Resources' (ENR) Water Management and Monitoring Division in Dettah from October 22-23, 2019, for the 10th annual NWT Water Stewardship Strategy (WSS) Implementation Workshop. Approximately 90 water partners attended the workshop, including representatives from Indigenous governments and organizations, territorial and federal departments, non-governmental organizations, academic institutions, regulatory and renewable resource boards and community representatives. Members of the Water Strategy Aboriginal Steering Committee also participated in the workshop, representing their respective Indigenous governments.

Working with the theme “Northern Waters in a Changing Climate”, participants acknowledged the need to work together strategically to achieve the vision of the WSS, sharing knowledge, building relationships and identifying new opportunities for collaboration in water stewardship. Discussions focused on:

- Linkages between the NWT Water Stewardship Strategy and the NWT Climate Change Strategic Framework.
- The importance of meaningful youth engagement.
- Opportunities to strengthen monitoring of climate change impacts on NWT waters, including community-based water monitoring.
- Adaptation to water-related climate change impacts.
- Accounting for climate change in transboundary water management agreements.

Previous workshop reports and resources related to the Water Strategy can be accessed on the [NWT Water Stewardship website](#).

Sommaire

La Division de la gestion et de la surveillance des eaux du ministère de l'Environnement et des Ressources naturelles du gouvernement des Territoires du Nord-Ouest s'est réunie avec ses partenaires du domaine de l'eau à Dettah les 22 et 23 octobre 2019 à l'occasion du 10^e atelier annuel de mise en œuvre de la Stratégie sur la gestion des eaux des TNO. Environ 90 partenaires du domaine de l'eau ont participé à l'atelier, y compris des représentants de gouvernements et d'organisations autochtones, de ministères territoriaux et fédéraux, d'organisations non gouvernementales, d'universités, d'offices de réglementation et des ressources renouvelables ainsi que de représentants des collectivités. Des membres du Comité directeur autochtone de la Stratégie sur la gestion des eaux ont également participé à l'atelier où ils ont représenté leurs gouvernements autochtones respectifs.

Sous le thème « Les eaux du Nord dans un climat en évolution », les participants ont partagé leurs connaissances, établi des relations et déterminé de nouvelles possibilités de collaboration en gestion des eaux. Les discussions ont porté sur les sujets suivants :

- Les liens entre la Stratégie sur la gestion des eaux des TNO et le Cadre stratégique sur le changement climatique des TNO.
- L'importance d'un engagement significatif des jeunes.
- Les façons de renforcer la surveillance des répercussions des changements climatiques sur les eaux des TNO, notamment au moyen de projets communautaires de surveillance de l'eau.
- L'adaptation aux effets du changement climatique liés à l'eau.
- La prise en compte des changements climatiques dans les accords de gestion des eaux transfrontalières.

Vous trouverez les rapports sur les ateliers précédents et les ressources liées à la Stratégie sur la gestion des eaux sur le [site Web consacré à la gestion des eaux des TNO](#).

1. Introduction

Environment and Natural Resources brought together water partners, including Northerners from more than 13 communities, for the 10th annual NWT Water Stewardship Strategy Implementation Workshop in Dettah on October 22-23, 2019. Under the theme of “Northern Waters in a Changing Climate”, the workshop focused on the intersections between climate change and water.

The annual workshop brings water partners together to review the implementation progress of the *Northern Voices, Northern Waters: NWT Water Stewardship Strategy* (Water Strategy) and the *NWT Water Stewardship Strategy: Action Plan 2016-2020* (Action Plan). The workshop is an opportunity for water partners to share information, knowledge and perspectives on water stewardship in the Northwest Territories (NWT).

1.1 Workshop Objectives

The objectives of the workshop were to:

- Emphasize the importance of our individual and collective responsibilities to ensure the waters of the NWT remain clean, abundant and productive for all time.
- Increase awareness of water partners’ implementation initiatives towards water stewardship in the NWT, emphasizing those that link with climate change.
- Provide opportunities for meaningful discussion, knowledge sharing and relationship-building among water partners.
- Identify new opportunities for collaboration or partnerships towards water stewardship in the NWT.

1.2 Workshop Participants

Approximately 90 water partners attended the workshop, including representatives from Indigenous governments and organizations, territorial and federal departments, non-governmental organizations, academic institutions, regulatory and renewable resource boards and community representatives. Members of the Water Strategy Aboriginal Steering Committee also participated in the workshop, representing their respective Indigenous governments. See Appendix A for the full list of workshop participants.

2. Day 1 Workshop Summary

Day 1 opened with a performance by the Yellowknives Dene Drummers and an opening prayer by Dettah elder, Peter Sangris. This welcome was followed by opening remarks from ENR Deputy Minister, Joe Dragon.



2.1 Water Strategy Update and Workshop Purpose and Objectives

Tyler Farrow of ENR provided an overview of the Water Strategy and an update on implementation of the 2016-2020 Action Plan.

The Water Strategy was released in 2010. It was developed collaboratively with input from Indigenous governments and organizations, regulatory and resource boards, communities, environmental organizations, industry, researchers and territorial and federal governments. The Water Strategy lays out a path to bring all levels of government, other agencies and the public together to maintain the health of waters in the NWT.

ENR's Water Management and Monitoring Division coordinates implementation and communication of the Water Strategy, but it is delivered through collective implementation activities by all water partners. The Water Strategy is guided by the Water Strategy Aboriginal Steering Committee, which was formed in 2009 to ensure that the Water Strategy, Action Plans and associated activities meet the needs and values of Indigenous governments and people.

Implementation of the Water Strategy is guided by an Action Plan that water partners helped to develop. The current Action Plan for 2016-2020 lays out a list of actions with timelines and specifies the water partners tasked to complete them during the implementation period. Water Strategy activities are organized into four main components: Work Together; Know and Plan; Use Responsibly; and Check our Progress.

Conducting regular reviews of implementation progress is a part of the Check Our Progress component of the Water Strategy. Highlights were shared from the 2018-19 Progress Review, the third review to be completed under the 2016-2020 Action Plan. The Action Plan also calls for an independent evaluation to be conducted at the end of the five-year implementation period. Recommendations from the independent evaluation will inform the development of a new Action Plan for 2021-2025.

Under the theme of *Northern Waters in a Changing Climate*, the purpose of the 10th annual workshop was to focus on the intersections between climate change and water resources within the broader context of the Water Strategy and Action Plan. The workshop was also intended to foster the exchange of ideas, stories, and research findings to facilitate collaboration, relationship-building and shared learning among water partners.

2.2 Aboriginal Steering Committee Panel

Members of the Aboriginal Steering Committee introduced themselves and provided an overview of their work on the committee. They also gave updates on the water stewardship activities in which the committee and their respective organizations have recently been involved. They also shared their perspectives and experiences related to northern waters and climate change. Members of the Aboriginal Steering Committee panel included:

- Patrick Riley, Kát’odeeche First Nation (KFN)
- Brooke Barber, Acho Dene Koe First Nation (ADKFN)
- Phoebe Rabesca, Tłı̄cho Government (TG)
- Tim Heron, Northwest Territory Métis Nation (NWTMN)

Committee members emphasized the importance of transboundary water management agreements and monitoring, incorporating scientific and traditional knowledge in decision-making, and engaging youth on water and climate issues. When asked to summarize their main message in one or two words, committee members responded: get involved; listen; protect and improve; and observe and record.



2.3 Northern waters in a changing climate: Mapping change

During this session, participants worked in breakout groups to explore the changes being observed in NWT waters and the linkages to climate change. Participants circulated between thematic tables chaired by subject leads, sharing experiences and observations and placing them on maps of the NWT. The thematic tables were as follows:

- Water quality – chaired by Andrea Czarnecki (ENR)
- Water quantity – chaired by Ryan Connon (ENR)
- Permafrost – chaired by Ashley Rudy (NWT Geological Services, Industry, Tourism and Investment) and Tristan Gingras-Hill (Wilfred Laurier University)
- Snow and ice – chaired by Isabelle de-Grandpre (ENR)
- Aquatic life – chaired by Annie Levasseur (ENR)

The findings from the mapping session are summarized in Tables 1-5 below:

Table 1: Water quality	
•	Increased nutrient levels – Slave River, Peace River.
•	More algal blooms, which could be due to increased nutrient inputs from municipalities and increasing temperatures – Peel River, Hay River, and Great Slave Lake.

<ul style="list-style-type: none"> • Increasing levels of total suspended solids in water.
<ul style="list-style-type: none"> • Orange masses observed on rivers - Inuvialuit and Gwich'in areas.
<ul style="list-style-type: none"> • Increasing levels of ions in the water, which could be linked to landslides.
<ul style="list-style-type: none"> • Elders won't drink the water in the lakes anymore – Smith's Landing First Nation.
<ul style="list-style-type: none"> • Warmer water and occurrence of algal blooms and fish kills – Hay River.
<ul style="list-style-type: none"> • Low dissolved oxygen levels – Deschaine Lake.
<ul style="list-style-type: none"> • Increased turbidity – Peel River.
<ul style="list-style-type: none"> • Increased sediment loads in water affecting fish populations – Aklavik.
<ul style="list-style-type: none"> • There is a need for studies and improved monitoring to understand the limnology of lakes.
<ul style="list-style-type: none"> • There is a need to better utilize traditional knowledge to support western science in water quality monitoring programs. However, this must be approached carefully to avoid tokenism and the capture of traditional knowledge to support development.
<ul style="list-style-type: none"> • There is a need to develop and utilize traditional knowledge indicators. For instance, clams and plants could be useful indicators for water quality and climate change because they are filter feeders. The safety and acceptability of water to drink could be a good indicator of water quality.

Table 2: Water quantity
<ul style="list-style-type: none"> • Lower water levels in general are being observed across the territory.
<ul style="list-style-type: none"> • Increased beaver population is having an impact on water levels upstream and downstream of beaver dams, especially up north.
<ul style="list-style-type: none"> • Reduced water levels are having an impact on canoe routes – Mackenzie River, Marian River.
<ul style="list-style-type: none"> • Waters above two-year high mark in October, making some areas inaccessible for benthic sampling.
<ul style="list-style-type: none"> • Water levels are fluctuating more than usual and tributaries are drying up – Slave River.
<ul style="list-style-type: none"> • Low water levels in rivers – Whitesand River, Nelson River and Beaver River.
<ul style="list-style-type: none"> • Sandbars are changing and islands are disappearing due to erosion – Nelson River and Liard River.
<ul style="list-style-type: none"> • Low water levels everywhere so it's possible to walk across creeks – Łutsel K'e area.
<ul style="list-style-type: none"> • Water levels are very low after dry years – Trapper Creek and Trapper Lake.
<ul style="list-style-type: none"> • Drop in water levels on Great Slave Lake – Łutsel K'e.
<ul style="list-style-type: none"> • Lower water levels on lakes – Yellowknife.
<ul style="list-style-type: none"> • Mackenzie River levels are down – Fort Providence.
<ul style="list-style-type: none"> • Big log jams – Tourangeau Creek.
<ul style="list-style-type: none"> • There is a need to do a better job of mapping traditional knowledge observations of water levels to help understand how water levels and flow affect land users.
<ul style="list-style-type: none"> • There is concern that traditional knowledge is not being adequately considered and integrated into water and climate monitoring, and a demand for meaningful reconciliation as it relates to natural resource management and monitoring.
<ul style="list-style-type: none"> • There is a need to consult people who use the river to understand how monitoring information reflects the state of the river basin.

Table 3: Permafrost
<ul style="list-style-type: none"> • There is concern that thawing permafrost could put traditional burial sites in the Shoddy Lake area at risk. The edges of permafrost plateaus are degrading and slumping is becoming more common resulting in the cribbing at the burial sites becoming exposed or very close to the water - Marian Watershed.
<ul style="list-style-type: none"> • The risk of permafrost thaw to archaeological sites is immense - High Arctic, Mackenzie Delta, and Sahtu, Dehcho, Tłı̄cho and Akaitcho regions.
<ul style="list-style-type: none"> • Massive thaw slumps depositing sediment into rivers and affecting fishing – Aklavik.

• There are water-logged landscapes impacting access to harvesting sites – Hay River area.
• Permafrost changes and slumping are reorganizing the environment – Łutsel K'e.
• More slumps and sinkholes in the karst beyond the shield. The No Name River near the Fortune Minerals development is changing – west of Behchokò.
• Increased amount of marshland due to permafrost thaw – Buffalo River.
• Permafrost is at about 0 degrees and any changes can lead it to thaw – Fort Simpson area.
• Landscape changes due to permafrost thaw are affecting water flow pathways – river channels and water levels have changed. This affects travel on watercourses.
• Permafrost is thawing and adding water to ecosystems, while peatlands are releasing methane. There is connectivity between permafrost and groundwater regimes, although it is poorly understood.
• Draining lakes and ponds due to permafrost thaw.
• Ground warming has led to an increase in invasive plant species, which may affect native species.

Table 4: Snow and ice

• There is an overall declining trend in the quantity of snowfall in the territory.
• Snow surveys, designed to record maximum snow levels, are now conducted in March rather than April.
• Snow drifts are different now than 10-20 years ago; they are much smaller, shaped differently and build up in different places. The snow is wetter now and there are more south winds – Gameti.
• Changes in the structure of snowflakes / drier snow – Łutsel K'e area.
• Increased snowfall, and change in type to 'fluffy snow'. The snowpack is having an impact on the delta and wildlife such as muskrat – Inuvik.
• Changing snow conditions affect winter travel and the ability of harvesters to reach certain areas.
• Snowpack and ice conditions are having an impact on caribou and waterfowl migrations.
• Less snow on the ground except in the Delta. Snow is falling earlier and insulating the water.
• Elders and land users are concerned about going out on to the land due to reduced ice thickness and instability – Dehcho.
• Significant changes to sea ice on the Arctic Ocean, which impacts wildlife and travel. Inuvialuit can no longer travel by snowmobile to Hershel Island – Mackenzie Delta.
• Thinner ice and infrequent recharge of riparian habitat. The ground isn't freezing as well and the ice doesn't form properly, which impacts wildlife and travel by land users – Slave River.
• Onset of cold weather, including snow fall and freeze up, is increasingly delayed – Yellowknife.
• Changing snow and ice conditions influencing the population and location of fish – Yellowknife.
• Ice thickness seems to be decreasing – Łutsel K'e, Aklavik.
• Ice conditions are more unpredictable, there is a lot more melting and freezing.
• Early snow and weak ice conditions, which impact land use and harvesting activities – Horn River / Fort Providence.
• Spring thaw is coming early – Marian Lake, Enterprise, Yellowknife, Wood Buffalo National Park.
• No ice jam – Fort Smith.

Table 5: Aquatic life

• Increasing numbers of salmon, of multiple species, are being found and there is concern about what is going to happen to native predatory fish (dolly varden, char) - Mackenzie Delta, Slave River and Great Slave Lake.
• Fluctuations in benthic communities, possibly related to climate change or fracking activity in the Liard – Petitot River.
• Inconnu and grayling populations seem to be decreasing and the flesh and taste of fish has changed - Kakisa.
• Increase in chum salmon, some with diseases – Liard River.

- **Fish are smaller, flesh is less firm and taste has changed – Marian Lake.**
- **The taste of muskrats and beaver has changed – Marian Lake.**
- **Beavers increasingly being found in new locations, especially up north.**
- **Beaver activity is having an impact on fish populations – Salt River.**
- **Changes in poplar – Liard region and along the Nelson River.**
- **Emergence of chum salmon – Fort Resolution.**
- **Fish kills from changes in water levels and/or temperature, and algal blooms – Hay River.**
- **Increase in flocks of pelicans and decrease in gulls – Buffalo Lake, Kakisa, Hay River.**
- **Increase in swans – Marian Lake, Buffalo Lake.**
- **Decrease in inconnu population – Buffalo River.**
- **Mosquitoes increasing, potentially due to permafrost slumping.**



2.4 Water and climate change: Perspectives from Traditional Knowledge holders

In this session facilitated by Frank McKay (ENR), traditional knowledge holders Joseph Judas and Michel Rabesca (Tłı̄cho Government), and Jessi Pascal (Ehdiitat Renewable Resource Council), shared personal perspectives and experiences related to water and climate change. Frank McKay opened the session by providing an overview of the GNWT’s Traditional Knowledge Policy, how traditional knowledge is being used in GNWT programming and the ongoing development of an action plan to guide the incorporation of traditional knowledge into decision-making. The incorporation of traditional knowledge and western science needs to be handled carefully, as it has implications for how decisions are made.

Joseph Judas explained the gradual impacts of climate change that he has witnessed over the past 25-30 years in Wekweètì. The patterns and behavior of wildlife are changing – porcupines are being spotted in new places, bears are attacking people more often, and moose have been moving to the barren lands and to the north but still below the tree line. Muskrat and beaver are also moving to the north. The weather is getting warmer every year, which impacts life on the land in many ways. Water levels and the timing of freeze up and thaw are changing, as well as the movement patterns of animals. All of these factors have an impact on hunting, trapping and traditional livelihoods, which are no longer as viable as

they used to be. It is important that students be taught about the impacts of climate change so that they can be properly prepared.

Jessie Pascal shared her experiences as a young land user in Aklavik, a multicultural community of Inuvialuit and Gwich'in. She is currently working on a film project which aims to capture the experiences and perspectives of elders on changes to the environment. Through her experiences as a land user, and by listening to elders, Jessi has gained significant insight into changes being experienced on the land. The Porcupine Caribou, which migrate between NWT, Yukon and Alaska, no longer come close to Aklavik like they used to. This makes hunting more challenging. Since travelling is more difficult, it is more costly and time consuming for people to go out on the land to harvest. Beavers are also causing issues in the region, as their population has grown significantly. In the last few years, hundreds of beavers have been caught through an Inuvialuit-Gwich'in initiative. At Shingle Point, icebergs have vanished and fishermen have begun catching salmon where they never used to find them. The Peel River is very important to the people of Aklavik and it is imperative to keep that water clean for future generations. There is a need to get youth more involved on these issues and to ensure that they have a voice.

Michael Rabesca recounted the changes he has observed as a land user in Behchokò. Lots of changes have occurred since he was a 12-year-old boy in 1956, learning about being in the bush from his father and uncle. The land has gotten drier and bodies of water have gotten warmer. Birds and berries in the area are disappearing and fish and meat taste differently. The people on the land are more diverse, and more people are experiencing sickness. Michael wonders if there is any link between climate change and disease and death in the area.

2.5 Fireside Chats: Monitoring Water-Related Climate Change Impacts

The afternoon of Day 1 featured two sessions happening at the same time related to monitoring water-related climate change impacts in the NWT: *Monitoring changes in stream flow, snow conditions and permafrost landscapes*, and *using earth observation and open access data to understand water quality changes over time*.

Monitoring changes in stream flow, snow conditions and permafrost landscapes

Ryan Connon (ENR), Ashley Rudy of the Northwest Territories Geological Survey and Tristan Gingras-Hill of Wilfrid Laurier University) delivered talks about monitoring changes in stream flow, snow conditions and permafrost landscapes in the NWT.

Changing streamflow conditions in the NWT

Ryan Connon spoke about the changes being observed in streamflow conditions in the NWT, and why these changes are occurring. Trends in streamflow conditions were assessed through the analysis of data from the Water Survey of Canada (WSC). WSC is the national authority responsible for the collection, interpretation and dissemination of standardized hydrometric data in Canada.

The hydrometric monitoring network in the NWT is relatively sparse for such a large area, and not all stations have consistent, long-term records which are needed to assess trends. When trends are observed in large rivers it's hard to determine why, as there are many different components of a water balance that could contribute to a change. The NWT has five distinct ecoregions which have different hydrological processes.

In order to understand large river basins, it is important to first understand the smaller basins within them. In terms of the large rivers of the NWT, no significant changes are being observed in the annual flows of either the Mackenzie or Liard rivers. An increase in the amount of water moving underneath river ice in the winter has been observed. However, it is difficult to explain why this is happening.

In the Taiga Shield, runoff is generated through a fill and spill process, whereby many lakes need to have their storage capacity filled before generating stream flow downstream. Both Baker Creek and Cameron River are characteristic of the Taiga Shield in the sense that streamflow is strongly dependent on existing water levels. When trying to understand how a basin is responding to climate change, it is important to consider how natural variability between wet and dry years can impact water levels.

The Taiga Plains in the south of the NWT are characterized by sporadic-discontinuous permafrost which affects basin hydrology. The basin is comprised of large wetland systems with thick peat and muskeg deposits at the headwaters. The permafrost which underlies the peatlands is thawing and changing how the water is routed and stored. Frozen permafrost acts as a dam that blocks and redirects the flow of water, but as permafrost thaws it allows bodies of water to become better connected. Essentially, the southern Taiga Plains are becoming more connected hydrologically, meaning that more precipitation that falls in these regions will be conveyed to the river network. As examples, in both the Jean Marie River and the Birch River within the Taiga Plains, the annual runoff and the volume of the snow melt runoff are increasing. Without an increase in precipitation, this change is attributed to the greater interconnectivity of wetlands that has been observed. For these reasons, a warming climate has the potential to fundamentally alter the way runoff is stored in this region.

Further north, the Taiga Plains are underlain by continuous permafrost. In these regions, permafrost underlies at least 90% of the landscape, and it is thicker and colder than in the southern Taiga Plains. Permafrost thaw in these regions is much slower and occurs through vertical degradation. Thawing permafrost does change the hydrology, but not to the degree that it does in the south. In the Rengleg River and Caribou Creek basins, spring freshet is happening earlier. This is indicative of earlier snowmelt and ice break up. In both basins, the snowmelt runoff is also increasing in magnitude. This could either be the result of increases in snowfall, a faster snowmelt period, or increased precipitation in the fall, which would limit the amount of land that can absorb water in the spring. Significant increases in streamflow are being observed in both basins, mainly driven by increases in fall and winter flows, which may be caused in part by a higher proportion of fall precipitation falling as rain and warmer temperatures that delay freezing.

Monitoring changes in permafrost

Ashley Rudy and Tristan Gingras-Hill spoke about monitoring changes in permafrost in the NWT. Understanding how permafrost has changed, and continues to change, is important for anticipating what kind of changes we can expect on the landscape in the future. On the whole, permafrost temperatures have increased across the Arctic.

The NWT is unique because it is underlain by the whole suite of permafrost conditions ranging from cold continuous permafrost in the north to discontinuous and sporadic permafrost in the south. Permafrost is the foundation of the territory and, in the past, infrastructure was built on the assumption that permafrost would remain stable. But that is no longer the case and there is now a need to adapt. The NWT is also underlain by permafrost that is very ice rich. Thaw of ice-rich permafrost can result in subsidence and is a large concern for community infrastructure.

To date, there is no NWT-wide map describing permafrost and thermokarst features in the territory. Thus, the [NWT Thermokarst Mapping Collective](#) is generating NWT-wide thermokarst and permafrost feature inventory maps. The maps will provide information to NWT communities about changing permafrost conditions, including impacts on water resources, and support planning and climate change adaptation. The permafrost feature inventory will include thermokarst and permafrost features maps for 33 NWT communities and the entire NWT and transboundary watersheds. The maps will provide a baseline to track landscape change and calculate rates of change over time. This information can be overlaid with other areas of interest, such as traditional sites.

The primary features being mapped are mass movements, organic terrain, hydrological features and periglacial features. The distribution of these features will vary across the territory and will highlight the varying impacts of climate change within NWT communities. In addition, understanding where these changes happen in relation to waterbodies will help in understanding how water resources could be affected. Some of the water-related changes include the creation of ponds, draining of lakes, increased sediment loading, changing courses of rivers and streams, and disruption of wetlands.

On the ground observations are still important, and this work will allow people to share their knowledge about landscape change and thawing permafrost. Charles Klengenber of the Inuvialuit Land Administration is leading a program to develop a protocol and template to document permafrost changes to the landscape. This project focuses on training and engagement of Inuvialuit environmental monitors in permafrost-related research projects and is in collaboration with NTGS and Aurora Research Institute.

Questions from water partners:

Question: According to stories told by elders, there was an island in the lake north of Wekweètì that is not there anymore. Is it possible that the island sunk due to permafrost thaw?

Answer: There is a lot of research and work being done to better understand how lakes underlain by permafrost are changing. It is possible that the island may have been underlain by permafrost which has since thawed, leading to the disappearance of the island as it sunk into the lake.

Question: Are landslides a result of spring runoff, or are they just natural?

Answer: Landslides are naturally occurring; however, their frequency and magnitude are changing as a result of climate change. Landslides are triggered by a number of factors including large precipitation events, bank erosion, and forest fires. If ice that was once buried becomes exposed, the sun causes it to melt and could trigger a landslide or cause an existing one to grow larger.

Using earth observation and open access data to understand water quality changes over time

John Bennett of C-CORE spoke about using earth observation data to model water quality changes over time. C-CORE has just completed a five-year project to research and validate Earth Observation (EO) applications for monitoring water indicators in the Slave River and Delta. One of the key outcomes of this project was the proof of concept and development of an EO application that used free multi-spectral data to derive water temperature, suspended sediment concentration values and colouration. This operational service uses the large archive of multi-spectral data available to generate a 10-year archive over the water portions of the area.

The dataset itself can serve as a baseline in the region as it can be used by decision makers and the scientific community to analyze how these indicators vary. The project relates general water quality and changes to an important water body within the NWT. Trend analysis of these datasets can be indicative of water quality levels and potential changes due to new developments or climate change.

Community members were involved in sampling and providing *in situ* measurements to enable validation and development of the models. The information outputs from this project are directly relevant to the Water Stewardship Strategy by aiming to provide information on water indicators for future decision-making involving communities in the Slave River and Delta and Great Slave Lake. This project also attempts to bring the science and results to the community level, through community involvement as much as possible to achieve the goal of providing key water information about local quality and changes.

An overall indication of temperature and suspended sediment concentration change can be linked to a number of other water indicators, including fish health, habitat and overall changes in quality and quantity of fish available along these water ways. The increased awareness and use of these archive and future measures will allow for better informed decision-making, as well as the potential to observe future impacts of development and climate change on these water indicators such as suspended sediment concentration and temperature colouration.

Lindsay Day of the Gordon Foundation provided an overview of Mackenzie DataStream. Mackenzie DataStream is an independent and open-access platform for sharing water quality data. Mackenzie DataStream currently hosts the data generated by the NWT-wide Community-based Water Quality Monitoring Program, as well as the Cumulative Impact Monitoring Program. Long-term monitoring at the watershed scale is critical to understanding and managing the impacts of climate change. The intent

of DataStream is to raise the profile of the Mackenzie River Basin, connect decision-makers with water quality data, and support basin-wide collaboration.

2.6 World Café: Young Water Leaders

During this interactive, youth-led dialogue, workshop participants circulated between tables, considering how the NWT's youth can be engaged to take a leading role in addressing water and climate challenges, and exploring opportunities for support, capacity building and mentorship. The tables were chaired by: Monique Chapman, Jennifer Hickman, Lindsay Vician, Bryana Matthews, Katherine Thomas, Jasmine Lum, Jessi Pascal, Trena Weyallon, Aleksandra Taskova, Laura Malone, Ella Kokelj, Terrell Knapton-Pain, and Kaitlyn Menard. The discussion findings are summarized in Tables 6-8 below:

Table 6: What are the most effective methods for engaging youth in water and climate initiatives?
• Social media is a powerful tool for engaging youth and sharing information. To be effective, social media content needs to be accurate, focused on topics that interest youth, and delivered in an appealing fashion.
• Offer opportunities for internships, summer jobs, and job shadowing. These opportunities should be made visible through career fairs and other programming so that youth understand what water-related opportunities are available. An effective example of this is the Tłjcho Government advertising in high schools.
• Engage youth in their mother tongues and use accessible language.
• Offer incentives for participation, such as per diems, payment, or academic credits.
• Include water stewardship, climate change and the Water Stewardship Strategy in school curriculums. A good example of this is the Know Your Watershed education program, which is delivered throughout the Columbia Basin. Games are an effective way of engaging students.
• Provide scientific and monitoring equipment for youth to use and learn from.
• Offer training opportunities and water and climate-related workshops and special events such as Rivers to Oceans Day. A successful example of this is the Protected Area Youth Workshop at Thaidene Nënë. It brought together exclusively youth and gave them an opportunity to share ideas openly.
• Hand over opportunities and delegate responsibilities to youth, rather than depending on them to volunteer. This is a good way of helping youth get outside their comfort zone and build confidence.
• Encourage further and higher education as a means of accessing career opportunities related to water and climate change.
• Engagement with elders helps youth understand changes related to water and climate.
• Foster connections with other youth who can serve as role models.
• Get youth out on the land at any early age to develop and apply skills. For example, the Tłjcho Government hosts fish monitoring training for youth, followed by fish monitoring camps to apply the skills gained.
• Allow youth to contribute their traditional knowledge to land use planning.
• Partner with community organizations who are already engaging youth in activities.
• Incorporate water and climate change-related themes into the Tundra Science and Culture Camp.
• Youth is defined broadly, so it is important to target all ages.
• Solicit youth perspectives on the best way of engaging them.
• Technology is really attractive for youth. InReach is a good bridging tool for youth to operate and learn from on-the-land knowledge holders and elders.
• Fund youth to attend national and international conferences.

Table 7: What kind of skills, competencies and knowledge do youth need to engage with water and climate change issues?
• Exposure to on-the-land activities to foster a connection with the land, develop bush skills such as boat operation and wilderness first aid, and gain a better understanding of traditional knowledge.
• Improved opportunities to pursue post-secondary education and technical training in the north.
• Curiosity and passion are necessary conditions for developing skills and knowledge.
• A basic understanding of environmental science, climate change and water management gained through a better curriculum in schools, especially in smaller Indigenous communities.
• An appreciation of both the global and local dynamics of water and climate change to help them understand that they can make a difference.
• Strategic planning and the ability to navigate the government system.
• Need to recognize that youth have different aspirations and learning needs.
• Skills to recognize the signals of climate change so that youth can identify and monitor change.
• Offering summer jobs can help build skills and competencies across the board, including communications, planning and sampling.
• Mentors can serve as guides and positive role models of what skills and knowledge are valuable.
• Promote a two-eyed seeing approach whereby youth gain an understanding of both traditional knowledge and western science.
• Build links with the Building Environmental Aboriginal Human Resources (BEAHR) program to help youth build the skills for future employment related to water and climate change.
• Project WET training.

Table 8: How can youth engagement be strengthened in the next Water Strategy Action Plan?
• Host a Water Strategy Workshop for youth, and/or include a youth session at the next Water Strategy workshop, to provide input into the next Action Plan. Youth should also be involved in the evaluation of the Strategy/ Action Plan, particularly to give feedback on how youth engagement could be improved.
• Youth need to be able to see themselves in the Action Plan. There should be a section of the Action Plan designated to youth engagement and youth water partners should be included as the leads or co-leads on some actions. If youth can see that what they're doing is important, they might be inspired to pursue further work in this area.
• Partner with Aurora College's Environment and Natural Resources Technology Program. Perhaps students can contribute ideas to the new Action Plan as part of their course work.
• Create a youth coordinator position for each region to implement the next Action Plan.
• Establish a Youth Water Committee/Council, led by youth coordinators. A successful example of this model is the Gwich'in Youth Council.
• Create a youth-elder mentorship program to enable knowledge transfer.
• Facilitate connections between keen youth and subject area experts to share information and provide guidance.
• Approach water partners (governmental and non-governmental agencies) to partner with organizations that work with youth.
• Solicit feedback from youth who were previously involved in water stewardship, but have lost interest about why this happened and how this could be avoided in the future.
• Incorporate youth-led traditional knowledge monitoring into the next Action Plan. Youth could monitor the changes identified by elders.



3. Day 2 Workshop Summary

3.1 Building synergy between the GNWT Climate Change Strategic Framework and NWT Water Stewardship Strategy

During this session facilitated by ENR’s Kevin Smith , Meghan Beveridge and Jennifer Hickman of ENR delivered presentations on the linkages between the NWT Water Stewardship Strategy and the GNWT Climate Change Strategic Framework before the floor was opened up to participants for broader discussion.

Jennifer Hickman, Adaptation Planning Specialist from the Climate Change and Air Quality unit of ENR, provided an overview of the climate change context in the NWT. The territory is experiencing a wide range of climate change impacts, which have been observed through western science and local and traditional knowledge. Some climate change impacts that have been identified include: increased occurrence and severity of droughts and wildfires, permafrost thaw, changes to water quality, changes to snow and ice conditions, decreased sea ice and coastal erosion, and increased frequency and severity of storms. Climate change impacts are anticipated to continue and increase in frequency and severity in the future. Furthermore, the interconnectedness of the natural environment means that climate change impacts can have cascading effects on the quality and quantity of water resources in the NWT.

The GNWT recognizes the importance of mitigating and adapting to climate change and identified the development of an NWT-wide climate change strategy as a priority of the 18th Legislative Assembly. The

2030 NWT Climate Change Strategic Framework was released in May 2018 and outlines how the NWT plans to respond to challenges and opportunities associated with a changing climate. The framework applies to all of the NWT, including Indigenous and community governments.

The 2019-2023 Climate Change Action Plan is the first of two five-year Action Plans to guide the implementation of the Strategic Framework. Actions are focused on the natural environment, human health and well-being, public safety, culture and heritage, and infrastructure. Implementation of the Action Plan is led and coordinated by ENR in collaboration with action item leads, co-leads and partners including Indigenous and community governments, federal departments, non-governmental organizations, academics, industry and others. The Framework and Action Plan have three broad goals: (1) Transition to a lower carbon economy; (2) Improve knowledge of climate change impacts; and (3) Build resilience and adapt to a changing climate.

Part 1 of the Action Plan includes actions that are resourced and scheduled to be completed over the next five years. Part 2 includes areas for future collaboration where resources are still required to develop the actions.

There are several Action Items in the Action Plan which relate to water in the NWT. Under Goal 2, continued water monitoring contributes to the assessment of climate-related changes in quality and flow over time, while snow surveys contribute to a better understanding of climate-related changes in winter precipitation. Additional water-related action items include wetland inventory mapping and assessing cumulative impacts on water. Water-related action items under Goal 3 include implementation of the Thaidene Nënë protected area, hazard mapping, and implementation of the SmartICE monitoring and information service in select NWT communities to facilitate safe passage over ice. Part 2 of the Action Plan outlines areas for future collaboration, including water-related action items such climate change vulnerability assessments, reviewing monitoring networks, and identifying technologies for remote assessment of water, snow and ice conditions.

The Climate Change Strategic Framework and the NWT Water Stewardship Strategy are complementary strategic policy documents. While the visions contained in the two documents are distinct, both use an adaptive management approach to improve the ways risks to the environment and human health are managed. They are also guided by similar principles of sharing responsibility, respecting Aboriginal and Treaty rights, assessing all knowledge types, and being transparent and accountable.

Meghan Beveridge, Manager of Transboundary Waters at ENR, explained that addressing climate change is critical to meeting the vision of the Water Stewardship Strategy. Specific action items aim to improve the assessment of cumulative effects on water from climate change, and to ensure that the strategy is integrated with other natural resource management frameworks, including the Climate Change Strategic Framework. The current Water Strategy Action Plan is coming to an end in 2020. To kick off the discussion period, participants were asked to consider how the next Action Plan for 2021-2025 can better address climate change from a water perspective.

Questions and comments from water partners:

Comment: Regarding the action item to create a web-based map tool to host information from the Climate Impacts Tracking Analysis System, Joel Heath developed an app that the Inuit use to model ice and update it with community information such as ice thickness and trail maps. There is an opportunity to adapt this approach for the rest of the NWT.

Question: Can you share more information about the Mackenzie River Basin hydraulic model, specifically about the Slave River watershed?

Answer: A Mackenzie River Basin hydraulic model was created to help understand changes in flow in the Athabasca, Peace and Slave rivers. The intent of recent updates to the model was to be able to distinguish whether changes were a result of climate change or upstream development, but more work is needed to get to that point. The model is not available online, but more specific information can be requested.

Question: Regarding the Taltson Dam, there has been no mention of baseline studies of water flow. Can you share more information?

Answer: That is a fairly specific question which can be addressed to ENR hydrologist, Ryan Connon. The area referred to is considered in the transboundary negotiations with Saskatchewan. There are two Water Survey of Canada gauges within the Taltson watershed which provide information on flow rates and levels and have been operating since 1994.

Comment: The Climate Change Strategic Framework doesn't really address what is causing climate change. It should involve reviewing policies and regulations related to industry, such as mining, forestry and oil and gas.

Response: That is a good suggestion. The GNWT works to put a climate change lens on all policies, which will continue in the future.

Additional information

The 2030 Climate Change Strategic Framework and associated 2019-2023 Action Plan are being implemented in tandem with the 2030 Energy Strategy: Energy Action Plan 2018-2021 and the NWT Carbon Tax. These are all interconnected policy measures that together will help the NWT realize its goal of transitioning to a lower carbon economy. Actions included within the 2030 Energy Strategy: Energy Action Plan 2018-2021 and the NWT approach to carbon pricing contribute significantly to meeting Goal #1 of the Framework through the mitigation of greenhouse gases.

The Energy Action Plan 2018-2021 outlines approximately \$177 million in investments to improve the security, affordability, and sustainability of energy supply and use in the NWT, including energy efficiency, electricity generation in diesel communities, renewable energy for community heating, and energy used for transportation and industry.

Additionally, The NWT Carbon Tax came into effect on September 1, 2019 and starts at \$20 per tonne of greenhouse gas emissions, increasing annually to \$50 per tonne for various types of fuel, with an exemption for aviation fuel. The NWT Carbon Tax will generate an estimated \$16.3 million in 2019-20, increasing to \$54.5 million when fully implemented. Funds generated through the NWT Carbon Tax will be applied towards projects that reduce greenhouse gas emissions.

Comment: The Mackenzie Valley Environmental Impact Review Board (MVEIRB) is a part of both the NWT Water Stewardship Strategy and the Climate Change Strategic Framework and Action Plan. In environmental assessments, the board considers how climate change and related impacts can affect the well-being of communities, residents, and Indigenous peoples. The board is specifically working on improving consideration of: (1) resilience and adaptability – to ensure projects operate safely and protect the environment within the context of a changing climate; (2) climate emissions – how projects contribute to climate change; and (3) predictions of ‘future baseline’ – to understand how the environment is changing and will continue to change in the future and how that affects impact predictions. At a recent pan-territorial meeting, the need to consider these three areas was identified as a shared priority and a shared challenge.

3.2 Fireside Chats: Integrating Climate Change into Water Stewardship Activities

The morning of Day 2 featured three concurrent sessions related to integrating climate change into water stewardship activities in the NWT: 1) *Observing climate change through community-based water monitoring*, 2) *Community adaptation to water-related climate change impacts*, and 3) *Transboundary agreements and climate change monitoring*.

Observing climate change through community-based water monitoring

This session featured a series of speakers who discussed observations of climate change impacts on water through community-based water monitoring programs in the NWT and elsewhere in Canada. The session included presentations from Patrick Riley (Kát’odeeche First Nation), Prairie Desjarlais (Łutsel K’e Dene First Nation), Melaine Simba (Dehcho First Nations), Raegan Mallinson (Living Lakes Canada) and Gila Somers (ENR).

Patrick Riley shared experiences from Kát’odeeche First Nation’s (KFN) Nahendeh Kehotsendj Monitoring Program. The goals of the program are twofold. The first is to establish a comprehensive land monitoring program based on traditional observation and experience, which utilizes contemporary technology and techniques as required. The second goal is to develop a knowledge base that can be used to guide and influence land management decisions by KFN and other governments, where applicable.

KFN is involved in a number of water monitoring programs including Dehcho AAROM, ENR's NWT-wide Community-based Monitoring program and Cumulative Impacts Monitoring Program, as well as the Guardians program and Indigenous Community-based Climate Change Monitoring. However, there was a gap in the monitoring of smaller water bodies. Some very important water bodies weren't being monitored, so KFN decided to create its own monitoring program. By combining funding streams and programming, KFN maximizes its time on the land and the amount of water monitoring that can be conducted. Water monitoring helps with monitoring climate change impacts, as KFN members are out on the land and able to observe changes to water levels. For example, water levels are lower than they used to be on Buffalo Lake, which makes navigation difficult. There is also a need to map the lake in order to understand where inconnu are resting, and what effect changing dissolved oxygen levels are having on fish stocks.

Prairie Desjarlais, Nihatni Coordinator for Łutsel K'e Dene First Nation (LKDFN), shared experiences from the Ni Hat'ni (Watchers of the Land) program. The program was initiated in 2008 after a group of elders and community members from Łutsel K'e visited Haida Gwaii to learn about the Watchmen Program. This started the LKDFN Ranger Program, which is aimed at watching the land, waters and wildlife in the eastern part of Great Slave Lake in and around McLeod Bay, Fort Reliance, Taltheilei narrows and Christy Bay. LKDFN elders gave the mandate to create the protected area at Thaidene Nëné due to increasing interest in mineral exploration and development in the area. The agreement to protect Thaidene Nëné was signed on August 22, 2019. Through the protected area, LKDFN wants to preserve the water for future generations. The Ni Hat'ni program involves weekly fish monitoring activities during the summer, as well as water quality monitoring in various locations across the eastern part of Great Slave Lake, conducted with YSI handheld multi-parameter water quality meters.

Melaine Simba from Kakisa spoke about her work as technical advisor with the Dehcho AAROM (Aboriginal Aquatic Resources and Oceans Management) program. Dehcho AAROM works collaboratively with communities, university researchers and government departments, including ENR, to carry out water and fish monitoring in the Dehcho region. Through its monitoring, Dehcho AAROM has collected observations from the land about the impacts of climate change on water resources. Rivers have become very shallow in the region, which poses safety concerns. There have been a number of incidents of people becoming stranded in recent years and needing to be rescued. To equip youth with the ability to carry this work into the future, Dehcho AAROM takes university students out on the land with elders to participate in water and fish monitoring training, which incorporates both traditional knowledge and western science.

Raegan Mallinson of Living Lakes Canada (LLC) presented on community-based monitoring in a changing climate. LLC is affiliated with Living Lakes International, a global network of over 120 non-governmental organizations that share the mission to enhance the protection, restoration and rehabilitation of lakes, rivers, wetlands and watersheds throughout the world. LLC is based in British Columbia at the headwaters of the transboundary Columbia Basin. The basin faces a number of climate change-related pressures including forest fires, melting glaciers, decreasing lake levels, and changes to vegetation and soil. On top of climate change impacts, the basin is affected by the effects of land use such as logging, mining, agriculture, and increasing community water use, which affects water quantity and quality.

LLC works to normalize water stewardship in the basin by leading field practicums in the Canadian Aquatic Biomonitoring Network (CABIN) protocol for assessing freshwater ecosystems, primarily river and stream habitats, using benthic macroinvertebrates. Related to this work, LLC is participating in a new partnership called STREAM with the World Wildlife Fund Canada, Environment and Climate Change Canada and the University of Guelph to pilot the use of the same CABIN protocol with DNA metabarcoding for the analysis of benthic macroinvertebrates present. The pilot program will collect 1,500 samples over three years in 15 priority watersheds.

For monitoring of lakes, LLC uses Sensitive Habitat Inventory Mapping or Foreshore Inventory Mapping, which is a Department of Fisheries and Oceans protocol used for measuring and assessing the health of shoreline habitat. The protocol helps identify climate and temperature impacts on mapped riparian habitat, and opportunities to restore riparian health. LLC is also working with the province of British Columbia to develop a provincial lake monitoring framework for community-based water monitoring groups and a groundwater monitoring program in the Columbia Basin. Additionally, LLC is leading the Columbia Basin Water Monitoring Collaborative, a project to fill water data gaps in the basin and to establish an open source data hub to share local, traditional and scientific water data. Finally, LLC led a national roundtable discussion for elevating community-based water monitoring in Canada. The final recommendations from this roundtable can be found on the [Living Lakes Canada website](#).

Gila Somers of ENR spoke about the NWT-Wide Community-based Water Quality Monitoring program. The program was developed in 2012 as a key implementation area of the Water Strategy. The program includes 21 NWT communities and over 40 sampling sites. Water is sampled three to four times per year during June to September. The program builds capacity in communities and supports existing programs by providing training, equipment and financial support. Sampling is conducted using YSI water quality meters, covering a variety of parameters. The program works in partnership with the Gordon Foundation on data management. Water quality data collected by community monitors is stored and shared on the Mackenzie DataStream website.

Climate change is a stressor on water security in the NWT, namely through the impacts of extreme weather events, increased variability in precipitation, wildfires, and thawing permafrost. Community-based water monitoring can help in understanding the impacts of climate change on water quality in the NWT over time.

Questions from water partners:

Comment: A concern that is raised about citizen science is whether the data are reliable and useable.

Response: The NWT-Wide CBM program tries to ensure that data are reliable and useable by following a CBM protocol, in which monitors are trained, so that there is a consistent standard for data collection.

Question: How are you measuring the impacts of hydraulic fracturing in the Columbia River Basin?

Answer: There is very little *hydraulic fracturing* occurring in the basin.

Question: Because you are doing monitoring, what can you tell us in terms of changes in wildlife? Just wondering if you have made any observations of how wildlife is affected by climate change.

Answer: Wildlife is a big part of the KFN Guardian program. Recently we've seen more moose than ever before, but caribou sightings are few.

Question: What data and information are available on hydraulic fracturing in the Liard and Mackenzie River Basin?

Answer: ECCC established a long-term monitoring station in the Petitot River that is being monitored.

Answer: The NWT-wide CBM program has passive samplers that sit in the water for a month at a time, as well as continuous YSI equipment and grab samples.

Answer: There isn't a lot known about how groundwater is affected by hydraulic fracturing. It was discussed during a recent Aboriginal Steering Committee meeting. ENR, in partnership with the University of Guelph, is piloting some groundwater monitoring in the Liard Basin.

Comment: The Department of Fisheries and Oceans has a newly formed unit that is working with Indigenous relations. Indigenous Habitat Protection Funding is available.

Community adaptation to water-related climate change impacts

This session featured a series of speakers who discussed community adaptation to the water-related aspects of climate change. The session included presentations from Craig Scott of Ecology North, Miki Ehrlich of the NWT Association of Communities (NWTAC), and Olivia Lee and Emily King of the GNWT's Department of Municipal and Community Affairs (MACA).

Craig Scott spoke about the global and regional impacts of climate change and adaptation measures as they relate to communities in the NWT. Water is inextricably linked to climate change. Globally, wet areas are getting wetter and dry areas are getting drier. Sea levels are rising and ocean acidification is increasing. Extreme weather events are increasing in both frequency and magnitude, and coastal areas are experiencing saltwater intrusion. In the NWT, glacial thaw provides us with much of our water, and that will be impacted as glaciers retreat. With longer open water seasons, water in rivers and lakes evaporates more, which results in variable water levels. The Beaufort Sea is now ice free all summer, which affects coastal erosion and weather patterns. Additionally, increased sublimation results in less runoff, which increases the risk of forest fires. The Gwich'in, Inuvialuit, and Sahtú regions are highly impacted by permafrost thaw and slumping, while the South Slave and Tłı̄cho regions are impacted by forest fires and drought.

As Doug Ritchie, the late Yellowknife environmentalist and former head of Ecology North, once said, "healthy communities and healthy people are the first step to addressing climate change". Communities need to be self-sufficient and this requires good planning and preparedness. Communities need to

understand climate change and the risk factors in order to plan effective adaptation measures. There seems to be a lack of follow through on adaptation planning, and regional action plans might be a good solution. Existing emergency plans are not updated frequently enough and not communicated properly to community members. Everyone needs to know where to muster when there is an emergency.

There is a need to protect drinking water in the face of climate change. Ecology North created a Source Water Protection Plan with the community of Sambaa K'e, but such plans do not exist in other NWT communities. The NWT has abundant clean drinking water, and that's why Ecology North is working to promote source water protection and eliminate the use of bottled water through the #loveNWTwater campaign. While some communities have climate change adaptation plans, others still do not. To support communities with climate change adaptation, Ecology North, in collaboration with NWTAC, developed *Integrating Climate Change Measures into Municipal Planning and Decision-Making: A Guide for Northern Communities*.

Miki Ehrlich spoke about NWTAC's work on climate change adaptation. NWTAC represents all NWT community governments. They work to build momentum for climate change adaptation by sharing approaches, building partnerships and spreading the word about funding opportunities. The pace of climate change is increasingly rapid and is unpredictable. Communities are on the frontlines of the impacts. Climate change adaptation should take a holistic and community-led approach to reduce a community's vulnerability to climate change impacts through education, capacity building and proactive actions. NWTAC assists communities to understand climate change issues and approaches to adaptation, and to access funding to develop and implement their own plans.

Olivia Lee and Emily King of MACA spoke about climate change planning at the municipal level in the NWT. The NWT Emergency Management Organization (EMO) has responded to approximately 49 emergency events over the past 10 years, many of them, such as floods and wildfire emergencies, are related to climate change. The EMO maintains an updated territory-wide Hazard Identification Risk Assessment to inform communities and GNWT departments of hazards specific to their environment. This information can be used in updates to territorial and community emergency plans, in the development of territorial or community disaster risk mitigation plans, to improve emergency response protocols and structures, and to guide the development of emergency response exercises, training and awareness. The top five hazards in the NWT are: wildfire, flood, severe weather, transportation incidents, and critical infrastructure failure.

In recent strategic planning workshops, climate change has been identified as a priority area for consideration in future plans and policy development. Emergency plans also use the information from the Hazard Identification Risk Assessment. Suggestions for adaptation and mitigation are highlighted in addition to planning, response and recovery actions. To build capacity for climate change planning, MACA offers an online Climate Change module, which is a 10-hour course that looks at ways we can mitigate climate change impacts by integrating measures into municipal planning and decision-making.

Transboundary agreements and climate change monitoring

Ryan Connon of ENR spoke about how climate change monitoring is integrated into the NWT's transboundary water management agreements. In all cases except Nunavut, the NWT is downstream to other jurisdictions.

The *Alberta-NWT Mackenzie River Basin Bilateral Water Management Agreement* was signed in 2015. It includes commitments for setting and assessing transboundary objectives and triggers, learning plans, and producing annual reports. The agreement is cooperative in nature, and the Bilateral Management Committee, which administers the agreement, can identify research needs to understand if changes in transboundary waters are due to climate change.

Base flow in northern rivers is determined by monitoring flow rates during winter months. The Water Survey of Canada has a long-term monitoring program with a standard for calculating under ice flow. In the NWT, an increase in base flow has been observed, which may be due to thawing permafrost. However, there is risk involved in making predictions of flow rates in the future. The goal of creating modeling frameworks in the NWT is to better understand different future scenarios.

There is a need to talk to land users to understand if the changes being observed correspond with the data and if they are consistent across the basin. Traditional knowledge is included in the framework of transboundary agreements to inform implementation and decision-making.

Questions from water partners:

Comment: In the Tjicho region, the changes that are being observed are consistent.

Comment: Smith's Landing First Nation is gathering traditional knowledge to help inform better monitoring. They have been supported to conduct a fish study, but it's been difficult for them to get into Alberta's oil sands aquatic monitoring, since Alberta claims that Smith's Landing is too far away. Smith's Landing is looking for long-term support to participate in monitoring and would like to collaborate with the GNWT.

Answer: The GNWT have pushed to have oil sands monitoring up into the NWT and could share this documentation with Smith's Landing.

Question: Is there monitoring during low water? Specifically, regarding the inlet of a watershed that is in another jurisdiction and considering climate change. For example, if two metres per second flow is required but it's a low flow year, what happens if the objective isn't met?

Answer: For the Slave, Alberta needs to meet a "consumptive use threshold" that works out to be approximately 1.9% annual flow and Alberta doesn't use anywhere near this amount. Commitments for the Hay River require that aquatic ecosystem needs are met first, after which the remaining water (about 10% of the flow) is shared equally between Alberta and the NWT. If Alberta doesn't meet its commitments, discussion and management action are required.

Question: What triggered Alberta to collaborate with NWT?

Answer: Concerns about pulp mill effluent and other activities spurred collaboration among the federal government and the jurisdictions in the Mackenzie River Basin to undertake basin-wide studies and negotiate and sign the *Mackenzie River Basin Transboundary Waters Master Agreement* in 1997. This Master Agreement established the Mackenzie River Basin Board and committed the provinces and territories to negotiate bilateral agreements.

3.3 Wrap-up and takeaways

During this closing session, participants were asked to consider the following questions, capture their answers on post-it notes, and post them on corresponding posters. The input from the participants was then grouped into themes by Gila Somers, Meghan Beveridge and Tyler Farrow of ENR, and synthesized as follows:

1. One thing you've learned:

- Greater awareness and appreciation of what work is being done on water in the NWT.
- The links between the Climate Change Strategic Framework and the Water Strategy.
- The complexity and interrelation of water and climate issues.
- Traditional knowledge is an important element of any work on water or climate change and must be utilized responsibly.
- The scale of community-based water monitoring in the NWT and elsewhere.
- The importance of collaboration.

2. One question or concern you still have:

- More time should be devoted to the important discussions had at the workshop.
- More political will is needed to take meaningful action on water and climate change.
- We must better utilize the information we have to take action.
- More capacity is needed at all levels.
- Traditional knowledge should play a bigger role in future workshops, and should be used responsibly and effectively for work on water and climate change.
- Youth should be more engaged in work on water and climate change.

3. One new idea you now have:

- Youth should be more involved in the Water Strategy.
- There should be more regional representation at the Water Strategy Workshop.
- More industry stakeholders should be represented at the Water Strategy Workshop.
- There is a need for increased biomonitoring in the north.
- Collaboration between youth and scientists and researchers on the land holds promise to build capacity of youth and expose scientists and researchers to traditional knowledge.

- There is a need for greater policy coherence on water and climate change, beyond adaptation.

Comments from water partners:

Comment from Tim Heron: What I’ve been monitoring over the years of these meetings is the involvement of youth. Members of the Aboriginal Steering Committee have been pushing for this. I’m hoping youth can be more involved in the actual implementation of the Strategy. There should be a gathering where they can provide their contributions to the Strategy and new Action Plan.

3.4 Closing remarks and ceremony

Meghan Beveridge thanked everyone for their input to the workshop. The Yellowknives Dene Drummers then concluded the event with a closing prayer and song.



4. Appendices

4.1 Appendix A: Workshop Participants

Aaron Tambour	Kát’odeeche First Nation
Alex Latta	Wilfrid Laurier University
Allan Torng	Health and Social Services
Amanda Annand	Mackenzie Valley Environmental Impact Review Board
Andrea Czarnecki	Water Management and Monitoring Division (WMMD), ENR
Angie McLellan	Fisheries and Oceans Canada
Annie Levasseur	WMMD, ENR
Ashley Rudy	Northwest Territories Geological Survey, ITI
Bijaya Adhikari	Inuvialuit Water Board

Brett Wheler	Mackenzie Valley Environmental Impact Review Board
Bridget Rusk	Wilfrid Laurier University
Brittany Armstrong	Environment and Climate Change Canada
Brooke Barber	Acho Dene Koe First Nation
Cari-Lyn Epp	Environment and Climate Change Canada
Carolina Mora	City of Yellowknife
Cat Fauvelle	North Slave Métis Alliance
Catherine Paquette	World Wildlife Fund Canada
Charles Klengenber	Inuvialuit Regional Corporation
Chris Spence	Environment and Climate Change Canada
Cochise Paulette	Smith's Landing First Nation
Craig Scott	Ecology North
Dalton Simba	Parks Canada Agency
David Livingstone	Tsa Tse Biosphere Reserve
Douglas Sauer	NWT Centre for Geomatics
Eldon Horassi	Tulita Dene Band
Ella Kokelj	Ecology North
Emily King	Municipal and Community Affairs
Emma Garden	Environment and Climate Change Canada
Frank McKay	On the Land Unit, ENR
Gila Somers	WMMD, ENR
Hannah Clark	Health and Social Services
Heather Crochetiere	World Wildlife Fund Canada
Heather Scott	Mackenzie Valley Land and Water Board
Isabelle de-Grandpre	WMMD, ENR
Jasmine Lum	Ecology North
Jeanne Arsenault	WMMD, ENR
Jennifer Hickman	ESCC, ENR
Jeremy Freeman	Mackenzie Valley Environmental Impact Review Board
Jessi Pascal	Ehdiitat Renewable Resource Council
John Bennett	C-Core
Joline Huskey	Tłı̄cho Government - Lands
Joseph Judas	Tłı̄cho Government
Joyce Gourlay	Infrastructure
Kaitlyn Menard	Health and Social Services
Kat Hartwig	Living Lakes Canada
Katharine Thomas	Ecology North
Kerry Pippy	Environment and Climate Change Canada
Kevin Smith	WMMD, ENR
Kristie Trainor	Environment and Climate Change Canada
Kristielyn Jones	Smith's Landing First Nation

Laura Krutko	WMMD, ENR
Laura Malone	WMMD, ENR
Leigh-Ann William-Jones	Inuvialuit Regional Corporation
Lindsay Day	Gordon Foundation
Lorraine Brekke	Cumulative Impact and Monitoring Program, ENR
Meghan Beveridge	WMMD, ENR
Melaine Simba	Dehcho First Nation
Michael Birlea	Tłı̄cho Government
Mike Palmer	Aurora Research Institute
Miki Ehrlich	Northwest Territories Association of Communities
Monique Chapman	Environmental Stewardship and Climate Change Division (ESCC), ENR
Nathen Richea	WMMD, ENR
Niels Weiss	Wilfrid Laurier University
Olivia Lee	Municipal and Community Affairs
Orla Tobin	Environment and Climate Change Canada
Paden Lennie	Parks Canada Agency
Patrick Riley	Kátł'odeeche First Nation
Paula Siwik	Mackenzie River Basin Board
Paulina Ross	Infrastructure
Phoebe Rabesca	Tłı̄cho Government
Prairie Desjarlais	Łutsel K'e Dene First Nation
Rachel McVety	City of Yellowknife
Raegan Mallinson	Living Lakes Canada
Richard Simon	Deninu Kue First Nation
Ryan Connon	WMMD, ENR
Ryan Gregory	WMMD, ENR
Sam Gargan	Fort Providence
Satish Garikaparathi	WMMD, ENR
Sean Richardson	Tłı̄cho Government – Lands
Barrett (Sonny) Lenoir	Ducks Unlimited Canada
Stephanie Strachan	Environment and Climate Change Canada
Tanya Lantz	Mackenzie Valley Land and Water Board
Terrell Knapton-Pain	Tłı̄cho Government
Tim Heron	Northwest Territory Métis Nation
Tori Lafferty	Deninu Kue First Nation
Trena Weyallon	Tłı̄cho Government
Tristan Gingras-Hill	Wilfrid Laurier University
Tyler Farrow	WMMD, ENR
Zoe Guile	Canadian Parks and Wilderness Society

4.2 Appendix B: Workshop Agenda

DAY 1: TUESDAY OCTOBER 22, 2019

8:30	Bus departs Days Inn (Yellowknife) for Dettah	
9:00	Sign-in and Opening Ceremony (<i>Chief Edward Sangris & Yellowknife Dene Drummers</i>) Welcoming Remarks (<i>Dr. Joe Dragon, Deputy Minister, ENR</i>)	
9:30	Introduction: Water Strategy Update & Workshop Purpose and Objectives (<i>Tyler Farrow, ENR</i>)	
9:45	Aboriginal Steering Committee Role of the ASC and perspectives on the linkages between water and climate change	
Northern waters in a changing climate: Mapping change		
10:30	Breakout groups explore the changes being observed in NWT waters and the linkages to climate change. Participants circulate between thematic tables, sharing their experiences and observations and placing them on a map of the NWT	
12:00	Lunch (provided) and Water Partners Exhibition	
1:00	Water and climate change: Perspectives from Traditional Knowledge holders Personal perspectives and experiences related to water and climate change, followed by question and answer	
Fireside Chats: Monitoring Water-Related Climate Change Impacts		
	<u>Main Room</u>	<u>Outside Tipi</u>
2:00	Monitoring changes in stream flow, snow conditions and permafrost landscapes <ul style="list-style-type: none"> • <i>Ryan Cannon, ENR</i> • <i>Ashley Rudy, NTGS</i> • <i>Tristan Gingras-Hill, WLU</i> 	Using earth observation and open access data to understand water quality changes over time <ul style="list-style-type: none"> • <i>Gila Somers, ENR</i> • <i>John Bennett, C-Core</i> • <i>Lindsay Day, Gordon Foundation</i>
3:00	Fishbowl Discussion: Monitoring Water-related Climate Change Impacts What are the gaps in our understanding of climate change impacts on water in the NWT? What approaches and opportunities are available?	
3:30	World Café: Young Water Leaders During this interactive, youth-led dialogue, workshop participants will circulate between tables, considering how the NWT's youth can best be engaged to take a leading role in addressing water and climate challenges, and exploring opportunities for support, capacity building and	

	mentorship.
4:30	Bus departs Chief Drygeese Centre (Dettah) for Yellowknife

DAY 2: WEDNESDAY OCTOBER 23, 2019

8:30	Bus departs Days Inn (Yellowknife) for Dettah		
9:00	Sign-In and Agenda Overview		
9:15	<p>Building synergy between the GNWT Climate Change Strategic Framework and NWT Water Stewardship Strategy</p> <p>Facilitated discussion about the GNWT Climate Change Strategic Framework and how it relates to the NWT Water Stewardship Strategy.</p>		
Fireside Chats: Integrating Climate Change Into Water Stewardship Activities			
	<u>Main Room</u>	<u>Outside Tipi</u>	<u>Outside Tent</u>
10:00	<p>Observing climate change through community-based water monitoring</p> <ul style="list-style-type: none"> Patrick Riley, Kát'odeeche First Nation Prarie Desjarlais, Łutsel K'e Melaine Simba, Dehcho AAROM Raegan Mallinson, Living Lakes Canada Gila Somers, ENR 	<p>Community adaptation to water-related climate change impacts</p> <ul style="list-style-type: none"> Craig Scott, Ecology North Miki Ehrlich, NWT Association of Communities Olivia Lee and Emily King, Municipal and Community Affairs 	<p>Transboundary agreements and climate change monitoring</p> <ul style="list-style-type: none"> Ryan Connon, ENR
11:00	<p>Wrap-up and takeaways</p> <p>During this closing session, participants will be asked to write down:</p> <ol style="list-style-type: none"> One thing they've learned and how they'll use it One question or concern they still have One new idea they now have <p>Participant takeaways will be placed on corresponding posters, and discussed in plenary.</p>		
11:30	Closing Remarks and Ceremony		
12:00	Bus departs Chief Drygeese Centre (Dettah) for Yellowknife		