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Government of Northwest Territories

Working Together to Manage Our Shared Waters

Alberta-Northwest Territories
Bilateral Management Committee
Annual Report to Ministers 2015-16

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MESSAGE FROM THE **BMC**

The Alberta-Northwest Territories Bilateral Water Management Agreement between the Government of Alberta (GOA) and the Government of the Northwest Territories (GNWT) was signed on March 18, 2015.

This inaugural Alberta-Northwest Territories (NWT) Bilateral Management Committee Annual Report to the Minister of Alberta Environment and Parks, GOA, and the Minister of Environment and Natural Resources, GNWT, highlights the achievements of the first year of implementation of the Alberta-NWT Mackenzie River Basin Bilateral Water Management Agreement.

One of the most comprehensive of its kind, the Agreement lays the foundation for long-term cooperative management of the water shared between Alberta and the NWT. The Agreement establishes decision making mechanisms between the jurisdictions and enables a strong working relationship.

Substantial progress was made during the first year of implementation, particularly towards increasing our knowledge of the Slave and Hay river basins. This first year of implementation also saw the establishment of the Bilateral Management Committee, which is comprised of representatives from the NWT and Alberta, including at least one senior manager, and, for the NWT, an Aboriginal member. Other achievements include the completion of a state of the knowledge report about the Hay River Basin, a transboundary groundwater study, and a review of publicly available traditional knowledge in the Hay and Slave river basins.

The *Alberta-Northwest Territories Bilateral Water Management Agreement: Implementation Highlights of Inaugural Year* document was also made public in March 2017. This highlights report provided a progress update of the first year of the Agreement's implementation and listed some of the main tasks that will be undertaken in the next five years. Further details on the progress made during the first year of implementation are provided in this report.

The first year of implementation established a spirit of collaboration as well as significant knowledge exchange. There is, however, much more to learn and plenty of work ahead. We look forward to continued implementation of this important, proactive Agreement.

Rick Blackwood
Assistant Deputy Minister, Strategy
Alberta Environment and Parks,
Government of Alberta

Dr. Erin Kelly
Assistant Deputy Minister,
Environment and Natural Resources
Government of the Northwest Territories

Tim Heron
Lands and Resources Manager,
Lands and Resources,
Northwest Territory Métis Nation

EXECUTIVE SUMMARY

On March 18, 2015, the governments of Alberta and the NWT signed an historic transboundary water management agreement that provides a long-term framework to manage shared water resources in the Mackenzie River Basin in a sustainable manner for current and future generations.

With the signing of the Agreement, the Bilateral Management Committee (BMC) was established to implement the Agreement. The current BMC is made up of representatives from the governments of Alberta and the NWT, as well as an NWT Aboriginal member.

Working Together to Manage Our Shared Waters is the BMC's first annual report to the responsible ministers from the governments of Alberta and NWT. The report highlights the governments' efforts to manage their transboundary waters in a way that protects the ecological integrity of the aquatic ecosystem. It focuses on the activities and accomplishments towards implementing the Alberta-NWT Bilateral Water Management Agreement for the April 2015 to March 2016 period.

Some of the achievements involved establishing decision making mechanisms, such as an emergency notification mechanism, and others involved research and learning. Highlights included:

- The *Hay River Basin State of the Aquatic Knowledge* (2016) report which informs the learning plan for the Hay River.
- The *Preliminary State of Groundwater Knowledge in the Transboundary Regions of the Mackenzie River Basin, NWT* (2016) report which contributes to learning plans and informs the classification of transboundary groundwater.

- *The Slave River and Delta State of Knowledge* (2016) and *Vulnerability Assessment* (2016) reports which contribute to biological indicator development for the Slave River.
- A literature review of traditional knowledge research for the Slave and Hay river sub-basins through the Tracking Change research project, which contributes to learning plan development.
- A technical workshop held with Mackenzie River Basin (MRB) jurisdictional representatives and subject matter experts to advance discussions on methods to derive site-specific water quality triggers and objectives.
- An update to the Mackenzie River Basin Hydraulic Model with recent water quantity monitoring data to help increase understanding of the influence of climate on flows and water levels versus the impact of water use throughout the basin (in progress).
- Implementation of Alberta's Lower Athabasca Regional Plan which contributes to the Slave River learning plan and informs the classification of transboundary waters.

Assessment of the 2015 water quantity data for the Hay and Slave rivers determined that no triggers were reached on either river and annual flows were within the range of natural variability. However, new minimum water level values were recorded on the Hay River near the Alberta-NWT border on days in May, June, July, and August, while new minimum flows were recorded on days in July, August, and September on the Slave River.

Assessment of the 2015 water quality data for the Hay and Slave rivers determined that the majority of the water quality parameters had values lower than the interim triggers and were within their historical range of natural variability. Only one parameter for the Slave River and two for the Hay River were out of their historical range, likely because of low flows during the fall in both rivers. Special attention will be given to these parameters and any trending parameters in the following year's assessment as they can indicate potential changes in water quality due to climate change and/or upstream land uses.

In addition to outlining the work that has been undertaken and introducing the members of the BMC, the report provides some of the future activities, presents relevant data from monitoring efforts, and offers insight into how the BMC is addressing issues like climate change and how traditional and local knowledge is being incorporated into the BMC's work.

While this report contains complex technical information and concepts, efforts have been made to use plain language where possible. As a result, some terms include definitions and explanations.

Working Together to Manage Our Shared Waters highlights the efforts of the governments of Alberta and the Northwest Territories to manage their transboundary waters in a way that protects the ecological integrity of the aquatic ecosystem.

INTRODUCTION

At 1.8 million square kilometres, the Mackenzie River Basin is the largest drainage basin in Canada and is among the most intact large-scale ecosystems in North America.

It serves a central role ecologically, culturally and economically for users throughout the entire basin, including acting as an important transportation corridor, as a source of food and as an essential drinking water source for communities. The basin's waters are important for traditional uses, as well as industrial and agricultural uses ranging from oil and gas extraction and hydroelectric development to farming and forestry.

Five provincial and territorial jurisdictions share the basin, each with its own legal and regulatory framework. The federal government also has legislative responsibilities in the basin under such statues as the *Fisheries Act* and *Navigation Protection Act*. In addition, some groups of Aboriginal people who live in the NWT have settled, or are negotiating, land claims and/or self-government agreements that may set out authority and management roles with respect to water and rights to water. Monitoring and protecting this immense basin requires a cooperative approach amongst all the jurisdictions.

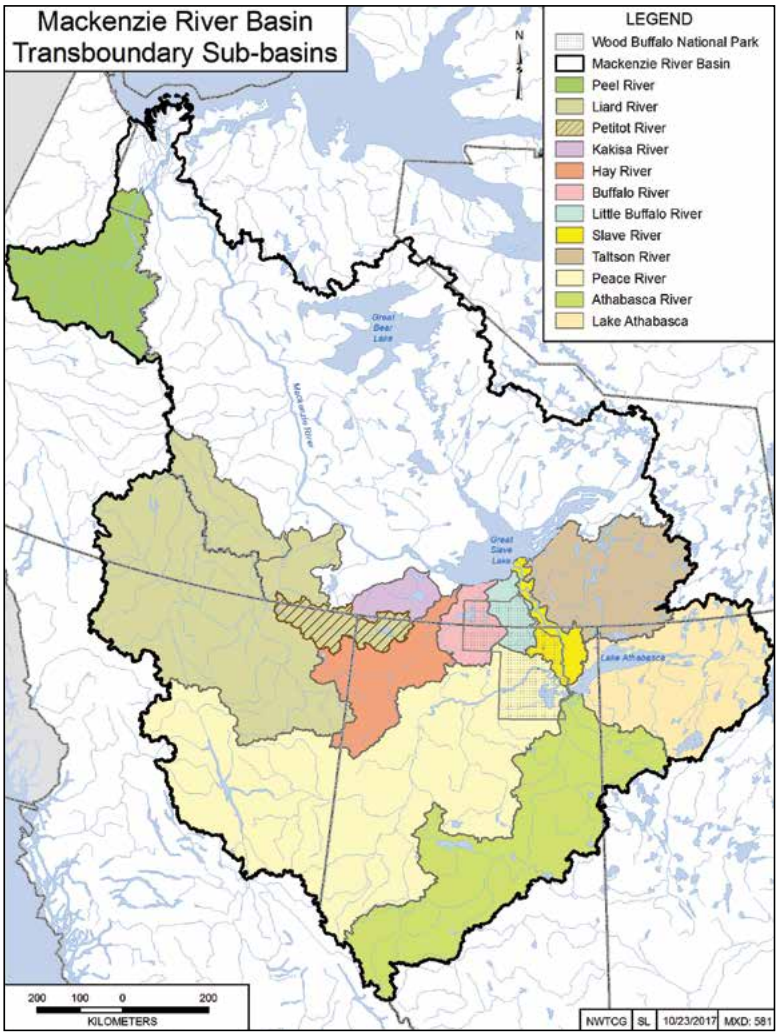

Figure 1. Map of the Mackenzie River Basin Transboundary Sub-basins

The Mackenzie River Basin drains 20% of Canada's land mass, gathering waters from parts of British Columbia, Alberta, Saskatchewan, Yukon, and the Northwest Territories. These waters travel hundreds of kilometres to the basin's outlet in the Arctic Ocean.

A number of large rivers flow across jurisdictional boundaries in the Mackenzie River Basin, including the Hay and Slave rivers, from Alberta into the NWT.

The Hay and Slave rivers flow into Great Slave Lake, whose outflow is the Mackenzie River.

The Mackenzie River is called Dehcho (South Slavey) or Deho (North Slavey) by the Dene. Its Gwich'in name is Nagwichoonjik and in Inuvialuktun it is Kuukpak. In Michif (Métis) its name is Grande Rivière.

All of the Aboriginal names translate as a variation of 'big' or 'great' river, underscoring its importance.

The Master Agreement

Talks on the need for bilateral agreements on transboundary water management began as early as the 1970s when a number of large oil and gas, forestry/pulp and paper, and hydroelectric projects in the Mackenzie River Basin were believed to potentially affect waters of neighbouring jurisdictions.

An important milestone was reached in 1997 when the governments of Alberta, Saskatchewan, British Columbia, Yukon, NWT and Canada signed the *Mackenzie River Basin Transboundary Waters Master Agreement* (the Master Agreement). This Agreement commits all six governments to work towards cooperatively managing the water and aquatic ecosystems of the entire Mackenzie River Basin and makes provisions for the Parties to develop bilateral water management agreements.

The Master Agreement commits the governments to:

- Manage the resources in a way that preserves the ecological integrity of the aquatic ecosystem.
- Manage the use of the water resources in a sustainable manner for present and future generations.
- Allow each Party to the Agreement to use or manage the use of water resources within its jurisdiction, as long it does not unreasonably harm the ecological integrity in any other jurisdiction.
- Provide for early and effective consultation, notification and sharing of information on developments and activities that might affect the ecological integrity of the aquatic ecosystem in another jurisdiction.
- Resolve issues cooperatively.

The Master Agreement established the Mackenzie River Basin Board to encourage the assessment of water issues and promote sustainable water use and management. This Board helps transboundary jurisdictions meet the terms of the Master Agreement.

Bilateral water management agreements

Bilateral water management agreements between neighbouring jurisdictions help ensure water and aquatic ecosystems within the Mackenzie River Basin are managed cooperatively, in a way that maintains healthy and diverse ecosystems.

Bilateral agreements are important to both upstream and downstream jurisdictions because they provide a long-term framework to manage shared water resources in the Mackenzie River Basin in a sustainable manner for current and future generations. Bilateral agreements help to ensure that upstream jurisdictions do not unreasonably harm the aquatic ecosystem of downstream jurisdictions. They also commit the jurisdictions to consult, notify and share information on developments and activities[1] that might affect the aquatic ecosystem in other jurisdictions, as well as to learn and take action should the level of risk to shared water bodies increase. The bilateral agreements apply to all water resources, including rivers, deltas, lakes, wetlands and groundwater shared by the Parties to the specific bilateral agreement and within the Mackenzie River Basin.

The bilateral agreements do not address the effects of past actions but these effects could be addressed by other means, if governments choose to do so.

While each Party to the bilateral agreements continues to make its own decisions about water and land use within its jurisdiction, the Parties agree to cooperate in good faith and take all reasonable actions to achieve the principles of the Master Agreement and the commitments in the bilateral agreements. The Parties agree to work together in a manner that is proactive, timely, transparent and respectful of each Party's applicable laws.

Further in line with the Master Agreement, clause 15.5 of the Bilateral Water Management Agreement between the Governments of Alberta and NWT states:

Nothing in this Agreement shall be interpreted in a manner inconsistent with the exercise of any existing aboriginal and treaty rights as recognized and affirmed in Section 35 of the Constitution Act, 1982, which include rights now existing by way of land claims Agreements or which may be acquired either under land claims Agreements or otherwise.

[1] **"Developments and Activities"** means all phases of a project, initiative or activity from pre-feasibility through to final closure, and all changes to or new laws, regulations, policies, plans, and programs that might affect the ecological integrity of the aquatic ecosystem of the other Party.

The Alberta-NWT Bilateral Water Management Agreement

After years of engagement, consultation and negotiations, on March 18, 2015 the Government of Alberta and the Government of the Northwest Territories signed a bilateral water management agreement. This Agreement applies to all transboundary waters shared between Alberta and the NWT in the Mackenzie River Basin. These waters include the Slave, Hay, Buffalo, Little Buffalo, Whitesand, Yates, Kakisa, Petitot, Salt, and Tethul rivers and their tributaries.

This Agreement, one of the most comprehensive of its kind, facilitates joint learning to inform bilateral water management actions on transboundary waters and provides for improved monitoring and reporting of effects from upstream development. It also includes provisions to develop transboundary objectives.

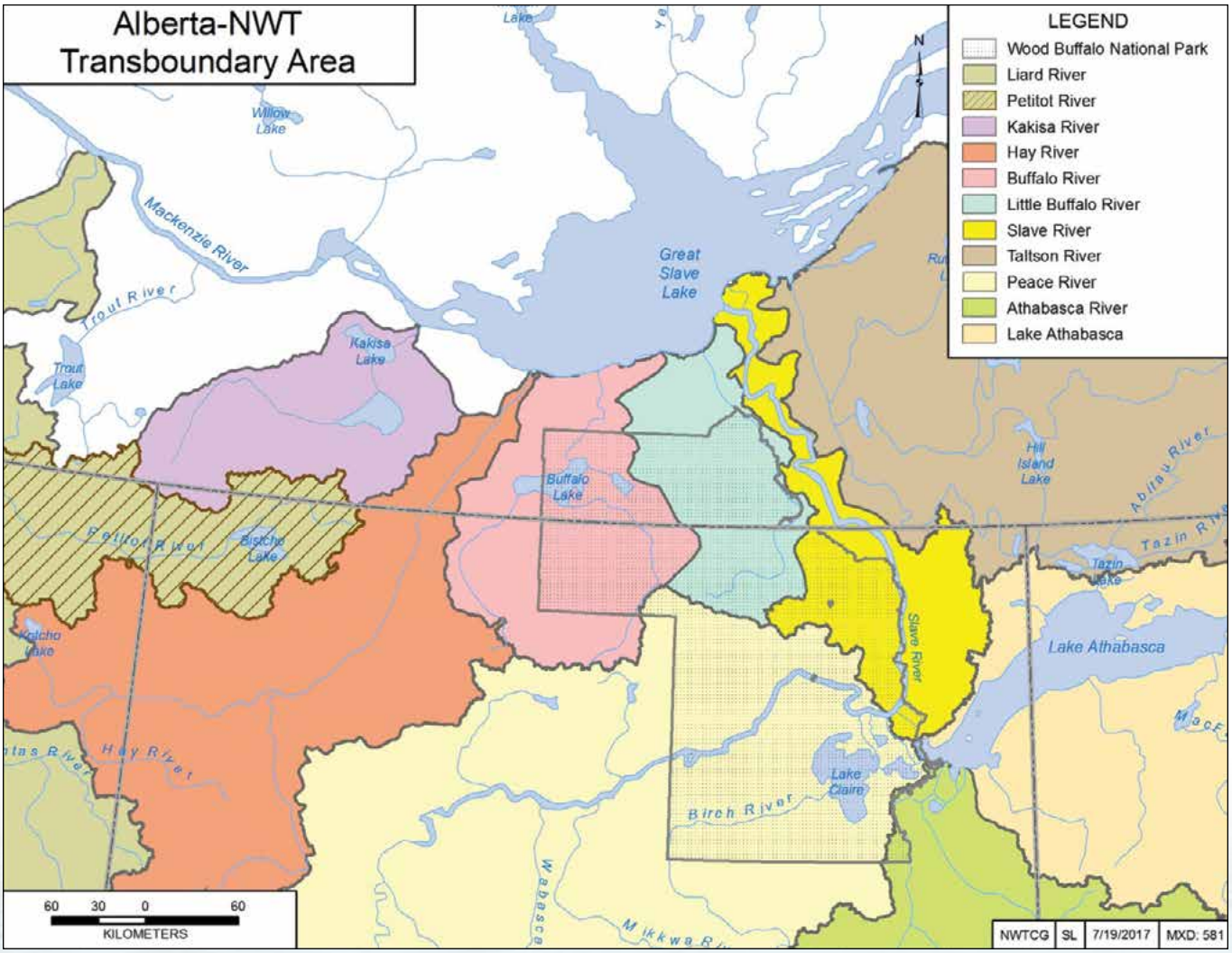

Figure 2. Map of the Alberta-NWT Transboundary Area

WORKING TOGETHER

The Agreement includes general commitments for the Parties to cooperate in good faith and work together in a proactive, timely and transparent manner.

The Bilateral Management Committee

As part of the Agreement, the Parties were tasked with establishing a Bilateral Management Committee (BMC) responsible for administering the Agreement and reporting on its achievements. The BMC consists of one senior water manager from each jurisdiction, and may include Aboriginal organization representation. Meetings of the BMC may include other senior officials, advisors and technical staff. The BMC is required to meet at least once annually.

Current status

To represent the NWT, Dr. Erin Kelly, Assistant Deputy Minister of the Department of Environment and Natural Resources (ENR), and Mr. Tim Heron, Aboriginal member recommended by the NWT Water Strategy Aboriginal Steering Committee[2], have been appointed to the committee by the ENR Deputy Minister. The Alberta Environment and Parks Deputy Minister appointed Mr. Rick Blackwood, Assistant Deputy Minister, Strategy Division, Alberta Environment and Parks, as the Alberta BMC member. The first BMC meeting was held on May 11, 2016[3].

The BMC established a Technical Committee to undertake the technical work required for implementation of the Agreement. The Technical Committee met in person in August 2015 and on May 10-11, 2016. It also has met as needed by phone and will continue to hold regular teleconferences to ensure implementation initiatives move forward.

The BMC is required to document outcomes of consultations, track achievements of the Agreement commitments, and prepare an annual report for submission to the responsible ministers who may identify issues and recommendations as required. This Annual Report to the Ministers represents part of that commitment.

[2] The NWT Water Strategy Aboriginal Steering Committee guides the implementation of the NWT Water Stewardship Strategy and has members from the Acho Dene Koe First Nation, Dehcho First Nations, Gwich'in Tribal Council, Inuvialuit Regional Corporation, Kátł'odeeche First Nation, North Slave Métis Alliance, Northwest Territory Métis Nation, Sahtù Secretariat Incorporated, Salt River First Nation, Tłı̨chǫ Government, Akaitcho Territory Government (observer) and Environment and Natural Resources (GNWT).

[3] The first BMC meeting was held May 11, 2016, outside of the current reporting period, along with a Technical Meeting on May 10-11, 2016.

Next steps

Reports will be published annually and will include data for the previous calendar year. Other completed reports related to implementation also will be made available online.

To guide the implementation activities and prioritize tasks for the bilateral management of transboundary waters, the BMC drafted a three-to-five-year work plan.

BMC members

Dr. Erin Kelly

Assistant Deputy Minister,
Environment and Natural Resources,
Government of the Northwest Territories

Erin Kelly joined the Government of the Northwest Territories' (GNWT) Department of Environment and Natural Resources in 2010 as a Water Specialist. She was appointed Manager, Watershed Programs and Partnerships in 2011, became Associate Assistant Deputy Minister in November 2014 and Assistant Deputy Minister, Corporate and Strategic Planning, in September 2015. Erin's involvement in the negotiation of the Alberta-NWT Bilateral Water Management Agreement began as a Technical Advisor for the NWT negotiation team prior to acting as the GNWT lead negotiator until signing of the Agreement in 2015. Erin is currently the Bilateral Management Committee member for the NWT.

Tim Heron

Lands and Resources Manager,
Lands and Resources,
Northwest Territory Métis Nation

Tim Heron, born and raised in Fort Smith, NWT, has long been involved in lands and resources issues in the Northwest Territories. He has worked with the Northwest Territory Métis Nation (NWTMN) for the past 17 years, starting out as the mapping coordinator and later moving on to become the community coordinator. For the last six years, Tim has been the Lands and Resources Manager with NWTMN.

Since 2009, Tim has represented the NWTMN on the NWT Water Strategy Aboriginal Steering Committee, guiding development of the *Northern Voices, Northern Waters: NWT Water Stewardship Strategy* (released in 2010) and its subsequent implementation. Tim also has represented the NWTMN on the NWT Protected Areas Strategy Steering Committee and currently is the Chair for the Northern Contaminants Committee. Tim was appointed as the NWT Aboriginal Member to the Alberta-Northwest Territories Bilateral Management Committee (BMC) in 2015 and is responsible for bringing forward to the BMC the interests of NWT Aboriginal governments through the NWT Water Strategy Aboriginal Steering Committee.

Robert Jenkins B.Sc., M.A.Sc.

Director, Water Resources,
Environment and Natural Resources,
Government of the Northwest Territories

Formerly the Director of Renewable Resources and Environment with Indigenous and Northern Affairs Canada, Robert Jenkins was appointed the Director of the newly formed Water Resources Division in the GNWT's Department of Environment and Natural Resources on April 1, 2014. In this role, Robert is responsible for the continued implementation of the NWT Water Stewardship Strategy, delivery of water monitoring programs, provision of technical advice to co-management boards on resource development projects, management of water licence securities, and operation of the Taiga Environmental Laboratory. Robert is closely involved in the implementation of the Alberta-NWT Bilateral Water Management Agreement as the GNWT's alternate on the Bilateral Management Committee.

Rick Blackwood

Assistant Deputy Minister, Strategy
Alberta Environment and Parks,
Government of Alberta

Over the course of his career, Rick Blackwood has held a variety of senior management positions within the Alberta Environment and Parks (AEP) department and also was seconded to the role of General Manager of the Foothills Model Forest in support of Alberta's role in Canada's Model Forest Network.

As Assistant Deputy Minister for Strategy, Rick is responsible for helping the department to:

- Engage with Albertans to listen and understand and advance AEP's innovative policy and plans.
- Build collaborative forums to leverage resources, capacity and a shared responsibility to environmental stewardship.
- Facilitate long-term, innovative thinking and collaboration across the department and its clients.
- Work in partnership with Indigenous communities on their Treaty Rights and implement the United Nations Declaration on the Rights of Indigenous Peoples.
- Represent the department's interests on municipal, national, and international files.
- Anticipate and minimize the impacts of major flood and drought events on communities.

Rick is also the Stewardship Commissioner under the *Alberta Land Stewardship Act* and is responsible for overseeing the development, implementation, review and amendment of regional plans, and for reviewing complaints.

Brian Yee P. Eng.

Director, Transboundary Waters Secretariat, Alberta Environment and Parks

Brian Yee worked for 30 years with Environment and Climate Change Canada and held a number of positions at the technical and management level related to water monitoring, environmental science, and interjurisdictional water management.

In 2011, he moved to Edmonton to join Alberta Environment and Park's Transboundary Waters Secretariat (TWS) providing technical support on interjurisdictional water quantity. In November 2013, Brian became the Director, TWS. TWS is responsible for ensuring Alberta receives its entitlements and meets its obligations under existing interjurisdictional water management agreements, and, where such agreements do not exist, TWS works to develop such agreements.

Brian has worked to develop cooperative relationships with other jurisdictions, Alberta stakeholders, and Alberta's Indigenous peoples. He led the Government of Alberta's team that worked with the Government of the Northwest Territories to develop the Alberta-NWT Bilateral Water Management Agreement. Brian is the Alberta member on the Mackenzie River Basin Board and the Prairie Provinces Water Board, and he is the Government of Alberta's alternate on the AB-NWT Bilateral Management Committee.

Technical team members

Alberta

Carmen de la Chevrotière,
Transboundary Water Quantity Specialist

Gongchen Li,
Transboundary Water Quality Specialist

Tim Toth,
Senior Transboundary Water Advisor

Jacquie Browne,
Transboundary Water Advisor

Sangeeta Guha,
Hydrogeologist

NWT

Meghan Beveridge,
A/Manager, Transboundary Waters

Andrea Czarnecki,
Aquatic Quality Scientist

Derek Faria,
Hydrologist

Annie Levasseur,
Water Management Advisor

Isabelle de Grandpré,
Hydrogeologist

Information sharing, notification and consultation

The Alberta-NWT Bilateral Water Management Agreement establishes clear information sharing, prior notification and consultation mechanisms that commit the jurisdictions to consult, notify and share information on developments and activities that might affect the aquatic ecosystem in the other jurisdiction.

Current status

The Agreement includes provisions for information sharing, notification, and consultation on developments and activities that might affect the ecological integrity of the aquatic ecosystem.

Discussions were held between Alberta and NWT environmental assessment coordinators to implement information sharing and notification processes.

The Parties agree that, if and when a development or activity triggers a legislated public environmental review process, formal consultation will occur through that process. An example of this is a proposal to develop a major hydroelectric dam.

Next steps

Procedures to efficiently share information about the aquatic ecosystem will be developed. The BMC will make decisions on what and how to share information. The BMC will develop and implement agreed upon processes for notification and consultation.

Emergency response

The Agreement commits the Parties to have emergency response protocols in place to address, mitigate and, where possible, prevent adverse effects to the aquatic ecosystem in the event of a water-related emergency (e.g., a spill). In the event of an emergency, the Parties must maintain clear communication and notify the other jurisdiction without delay.

Current status

There are two spill response systems in Alberta: the Alberta Environment Support and Emergency Response Team (ASERT), and the Alberta Energy Regulator Field Incident Response Support Team (AER FIRST) for oil and gas related spills. In Alberta, the release of substances that could harm the environment must be reported.

In accordance with the Alberta emergency response protocol, ASERT or AER FIRST staff call the NWT Spill Response Line if they detect a spill or water-related emergency that could cross the border between Alberta and the NWT.

Similarly, in the NWT, the Department of Environment and Natural Resources (ENR) operates the 24-hour NWT Spill Response Line for reports of spills such as diesel, gasoline and used oil. ENR also maintains a database of spills reported.

Alberta authorities will be alerted if a water-related incident or emergency occurs in the NWT that might have transboundary effects.

Next steps

A tracking system is being considered for water-related emergencies that could cause transboundary effects. ENR is updating its emergency response protocols to ensure consistent notification to Alberta authorities should a spill occur in shared waters.

RISK INFORMED MANAGEMENT

The Bilateral Water Management Agreement is based on a Risk Informed Management (RIM) approach. This approach helps the team identify and carry out actions to protect the ecological integrity of the aquatic ecosystem.

The RIM approach means understanding the risks associated with the use of, or impacts to, a water body and the sensitivity of the aquatic ecosystem, classifying a water body based on those risks, and taking management actions necessary for that classification of the water body. The higher the risks, the higher the classification, and the more intensive the management actions.

Under the RIM approach, each transboundary water body is assigned one of four classes depending on the likelihood of risk from development, the extent of traditional use, and the sensitivity of its ecosystem, among other factors. Specific management actions are required in each class.

The goals of the RIM approach are set out in Appendix A of the Agreement. This approach is a key part of the oversight provided by the BMC as well as each Party's jurisdictional water management practices.

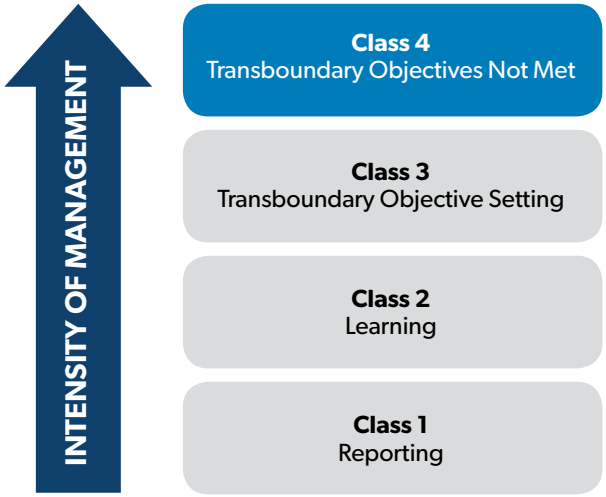

Figure 3: The Risk Informed Management Approach

The nature and intensity of Bilateral Management and Jurisdictional Water Management increase from Class 1 to Class 3 (varying levels of learning, Transboundary Objective setting, monitoring, etc.)

Classification system

The RIM approach uses a classification system based on risks for each water body crossing the border. Along with the extent of traditional use, the sensitivity of its ecosystem, and other factors, the classifications consider both existing and projected development, based on a detailed five-year development forecast, as well as a longer-term (ten-year) outlook. The Parties jointly decide which class to assign to a transboundary water body.

If a water body is assigned as class 1, water management practices (e.g., existing monitoring) already in use by each jurisdiction will be sufficient to meet transboundary commitments. In general, water bodies with little or no development or use are designated as class 1. However, if increased development, use or other factors occur, the water body will be moved to a higher class and management actions will be identified to address the increased risk.

Water bodies with moderate level of existing or projected development or use are assigned as class 2. Learning plans are required to be developed for water bodies at class 2 or higher to explore relevant water quality, water quantity, groundwater and biological considerations, to gather baseline data, and to prepare for setting transboundary objectives. (See the Learning Plan section below for more information.)

Water bodies with either high levels of development or a combination of moderate development with natural vulnerabilities, sensitive uses, use conflicts or controversy and/or negative conditions or trends are assigned as class 3. A water body at class 3 will require development of site-specific transboundary objectives and implementation of joint and/or jurisdictional monitoring programs.

Current status

The Hay River and Slave River, two water bodies that cross the Alberta-NWT border, have been designated as class 3 – the basis for this classification is outlined in the table below. All other transboundary water bodies are assigned as class 1.

Table 1. Hay and Slave river classification

Water Body	RIM Class	Rationale/Comments
Hay River	3	Development is present, high traditional use, existing trend of increasing winter flows, existing annual trends in water quality, community drinking water supply.
Slave River	3	Development is present, high traditional use, existing trend of decreasing annual flows, existing trends in water quality, community drinking water supply.

If the BMC determines that transboundary objectives are not met for a class 3 water body, the water body will become a designated class 4 and actions will be implemented with the goal of returning the water body to class 3.

Groundwater has been assigned as class 1 but can be moved to a higher class if the BMC determines a need. Factors to be considered in the classification of transboundary groundwater include groundwater quality and quantity, domestic well density, community wells, irrigation and other large production wells, water source wells, surficial geology, hydrogeology and subsurface geology data, along with land use.

Discussions among Mackenzie River Basin jurisdictions will contribute to development of a consistent approach for classifying transboundary surface and groundwater in all Agreements under the *Mackenzie River Basin Transboundary Waters Master Agreement*.

Learning plans

A learning plan helps improve understanding of the ecological integrity of the aquatic ecosystem, inform any adjustments to water body classifications, and gather information to inform objective setting. Some of the steps required to develop learning plans include the review of available relevant watershed information, assessment of information gaps, and developing plans to fill those gaps. Learning plans can include existing data and information and, if necessary, the collection of additional baseline data including water quality, water quantity and biological data. As part of the learning plan for class 2 and 3 transboundary waters, the Parties will assess the monitoring needs and priorities, as well as appropriate locations for monitoring those waters. This monitoring could include surface water quantity and quality, groundwater quantity and quality, and biology monitoring. The Parties may consider the addition of social and/or air monitoring in the future.

The Slave and Hay rivers are assigned class 3 based on development, traditional use, trends in surface water quality and flow, and other considerations. Learning plans are being developed for these rivers.

Current status

Hay River

The *Hay River Basin State of the Aquatic Knowledge* report was completed in March 2016 to inform the Hay River Basin learning plan. The report provides information about the basin and its environmental setting, hydrologic conditions, water quality, aquatic biota (or organisms), existing water users and allocations, and existing potential development, activities and pressures. The report also identifies knowledge gaps and recommends how to prioritize work to fill those gaps. The report is available online: *http://www.nwtwaterstewardship.ca/transboundary-water-Agreement-implementation*.

Other jurisdictional or federal monitoring data collection and analysis also contribute to the Hay River Basin learning plan and inform the classification of the Hay River.

Slave River

During the first year of implementation, the *Slave River and Delta State of Knowledge* report and the *Slave River and Delta Vulnerability Assessment* report were finalized and will contribute to the Slave River Basin learning plan. These reports reveal what is known about the Slave River watershed and priorities for further learning.

A learning plan helps improve understanding of the ecological integrity of the aquatic ecosystem, inform any adjustments to water body classifications, and gather information to inform objective setting.

Other existing reports inform the learning plan and classification of transboundary waters.

These reports include: *Lower Athabasca Regional Plan: 2012-2022* (Government of Alberta, 2012; online at: https://landuse.alberta.ca/LandUse%20Documents/Lower%20Athabasca%20Regional%20Plan%202012-2022%20Approved%202012-08.pdf);

the *Water and Suspended Sediment Quality of the Transboundary Reach of the Slave River, Northwest Territories* (Indigenous and Northern Affairs Canada, 2012; online at: http://www.nwtwaterstewardship.ca/sites/default/files/YELLOWKN-%23555560-v1-SLAVE_RIVER_REPORT_WITH_APPENDICES_-_FINAL%20%282%29.PDF); and

the *Wood Buffalo National Park Water Quality: Status and Trends from 1989-2006 in Three Major Rivers: Athabasca, Peace and Slave* (Environment Canada, 2009; online at: http://donnees.ec.gc.ca/data/substances/monitor/surface-water-quality-oil-sands-region/expanded-geographic-extent-oil-sands-region/WBNP_Water_Quality_Eng.pdf).

Although dated, additional background information can be found in the *Northern River Basins Study* (http://arbri.athabascau.ca/news-feed/Northern-River-Basins-Study-added-to-ARBRI-Repository.php).

Additionally, the *Mackenzie River Basin Hydraulic Model* is being updated. This model will help all Parties understand and differentiate between downstream water quantity impacts caused by upstream water use and impacts attributed to climate variability.

Other jurisdictional or federal monitoring data collection and analysis, such as monitoring done to support Alberta's *Lower Athabasca Regional Plan*, also contribute to the Slave River Basin learning plan and informs the classification of the Slave River.

Next steps

The BMC will review knowledge gaps identified in the *Hay River Basin State of the Aquatic Knowledge* to advance on the Hay River Basin learning plan. Subsequent steps will be identified when this task is completed.

Work towards the development of the learning plan for the Slave River Basin will continue and will include tasks such as looking at information in existing reports and identifying gaps.

A reproducible approach to classifying surface water and groundwater will be discussed at the basin level.

TRADITIONAL AND LOCAL KNOWLEDGE

Aboriginal people of the Mackenzie River Basin have a long and intimate relationship with the natural environment. They draw their spiritual and cultural integrity and strength from the land and water.

Their traditional knowledge comes from a deep understanding of the natural world around them. This knowledge is an essential source of information about the relationships with the land and water, for respecting values and practices, for interacting with the natural environment and for tracking environmental change in aquatic ecosystem health.

Current status

To account for and ensure this knowledge informs bilateral implementation, Appendix C of the Agreement (Use of Traditional and Local Knowledge) outlines practices for the use of traditional and local knowledge in bilateral water management. This will guide the inclusion of traditional and local knowledge in a meaningful way under the RIM approach. Scientific, traditional and local knowledge will be considered in learning plans, research, monitoring, and setting of transboundary objectives.

The BMC also is committed to developing a framework to meaningfully include traditional and local knowledge in decision making. The process for reviewing traditional knowledge sources was discussed during the first BMC meeting. These sources include: the GNWT Traditional Knowledge framework, Environmental Monitoring and Science Division of Alberta Environment and Parks, and the Mackenzie River Basin Board Traditional Knowledge and Strengthening Partnership Committee.

Traditional knowledge research for the Liard, Hay and Slave river sub-basins through the Tracking Change research project[4] will help develop learning plans. Dr. Brenda Parlee, from the University of Alberta, gathered publicly available traditional knowledge in the NWT's transboundary areas, as well as updated previous work on the Athabasca and Peace river basins. This research will identify knowledge gaps and inform learning plans for the Hay and Slave rivers.

Next steps

The BMC will review traditional knowledge frameworks to determine what might be relevant to bilateral water management. The Mackenzie River Basin Board will also discuss the frameworks. The ongoing goal is to identify and implement ways to synthesize and blend traditional and local knowledge, science, social science and other forms of knowledge to help set and assess transboundary water objectives.

[4] Tracking Change is a research project led by University of Alberta in partnership with the GNWT and the Mackenzie River Basin Board, along with many Aboriginal governments and organizations throughout the Mackenzie River Basin, as well as academic partners from across Canada. The project also has international community and academic partners. See www.trackingchange.ca for more information.

PUBLIC ENGAGEMENT

The Agreement sets out responsibilities for each Party to engage and consult with their public—including Aboriginal peoples—about matters of the Agreement, so their input can be considered in bilateral water management.

Current status

BMC meeting attendees discussed a process to solicit and share input and interests of public and Aboriginal governments. They explored creating a web application where stakeholders could provide their input, which would then be discussed during BMC meetings. Currently both jurisdictions have general email addresses that the public may use to share input or ask questions.

GNWT staff regularly meets with the NWT Water Strategy Aboriginal Steering Committee to gather input and understand interests of NWT's Aboriginal governments.

Next steps

A web application for public input will be explored, building on or modeling existing applications if possible.

AQUATIC ECOSYSTEM

Surface water quantity

Bilateral Agreements describe how water is shared. As per the Risk Informed Management approach, the Parties classify the water body, and then, depending on the class of the water body, monitor it, create a learning plan, and set **transboundary water quantity objectives**. These transboundary objectives are designed to ensure that the aquatic ecosystem continues to receive the water it needs to remain healthy. Any water that is available after the needs of the ecosystem have been met (i.e., **available water**) is shared evenly between the jurisdictions. The BMC establishes triggers to ensure appropriate action is taken to meet objectives.

The Alberta-NWT Bilateral Water Management Agreement specifies that a licence to transfer water into or out of the Mackenzie River Basin will not be issued in Alberta, unless the licence is specifically authorized by a special act of the legislature. Even then, flow requirements at the Alberta-NWT border and the information, notification and consultation requirements still must be met.

Transboundary water quantity objectives

The Agreement commits Alberta and the NWT to establish and implement transboundary water quantity objectives and monitoring according to the RIM approach.

A transboundary water quantity objective is the minimum amount of water calculated at the border that the upstream Party must pass to the downstream Party. This minimum amount of water must first meet the needs for the ecological integrity of the aquatic ecosystem, after which at least 50% of the remaining water must pass to the downstream Party.

Current status

At the time the Agreement was signed, site-specific water quantity objectives for the Slave River had not been determined. Because **consumptive use** in the Slave River Basin is very low, the Parties agreed to defer objective setting and to establish a consumptive use threshold based on the best available sources of information. Further discussion on establishing water quantity objectives for the Slave River would be triggered once the annual consumptive use in Alberta reaches the threshold defined in the Agreement, 2 billion cubic metres (m^3).

For the Hay River, the Parties agreed to be guided by a modified desktop approach, which uses the available historical flow monitoring data to determine water for the ecosystem. Fisheries and Oceans Canada produced a science advisory report in 2013[5] stating there is low probability of detecting negative impacts to aquatic ecosystems with 10% human use of the instantaneous natural flow (flow before human diversions). The Parties used this approach to define an interim objective, and will refine the approach or pursue detailed field studies once triggers are reached.

[5] Framework for Assessing the Ecological Flow Requirements to Support Fisheries in Canada. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2013/017: *http://www.dfo-mpo.gc.ca/csas-sccs/Publications/SAR-AS/2013/2013_017-eng.html*

Transboundary water quantity objectives are site-specific water quantity conditions that the Party or Parties will meet based on an assessment of the needs for the ecological integrity of the aquatic ecosystem.

Available water is the amount of water available for human use after the needs of the aquatic ecosystem are considered.

Interbasin transfer, for this Agreement, is a transfer of water into or out of the Mackenzie River Basin.

Consumptive use is that portion of water withdrawn from the basin that is lost or otherwise not returned to the basin, excluding any volume of water stored in hydroelectric projects.

Allocation is the maximum amount of water that a licensee can take from a water body.

Transboundary water quantity triggers

Slave River

The BMC will initiate further discussion about the Slave River if:

1. Alberta's annual consumptive use reaches the 2 billion m^3 threshold;
2. 2 billion m^3 becomes significantly different from 1.9% of the long-term average (1972-present) annual flow; or
3. 50% of the consumptive use in Alberta is in the form of **interbasin transfers**.

Should any of these conditions be reached, the Parties will review and agree on next steps, which may include either agreeing to a further deferral, or determining the needs for the ecological integrity of the aquatic ecosystem of the Slave River and each Party's share of the available water (i.e., the transboundary water quantity objective).

Current status

Alberta's current licensed annual **allocations** were used as a surrogate for actual water consumed (i.e., annual consumptive use). This is a conservative approach because the licensed volume is the maximum annual consumptive use allowed (whereas actual use is typically in the range of 50 percent of licensed consumptive use). It also assumes diversion is constant throughout the year, and does not include any restrictions on diversions that may exist in the licence or other policies.

Flow is monitored by the Water Survey of Canada (WSC), a section of Environment and Climate Change Canada (ECCC).

Figure 4 below represents the long-term annual Slave River flow in a pie chart. In Figure 4, Alberta's consumptive use threshold value of 2 billion m^3 includes Alberta's surface water allocations (dark green) and groundwater allocations (light green) and the remainder of threshold not used (light blue).

At the time of signing, 2 billion m^3 was 1.9% of the long-term annual flow of the Slave River[6]. This is still the case after including 2015 data (1972-2015).

Figure 5 shows daily flows for 2015, as well as the historical "percentiles" or "P values" for each day of the year. The same day of the year is compared by ranking its flows across the historical record (1972 to 2014). The median, or 50th percentile, is the flow value exactly in the middle. The 25th percentile is at the lower end, with only 25% of the years on that day falling below that flow.

As illustrated in Figure 5, new minimum flows were recorded for some days in July, August, and September in the Slave River.

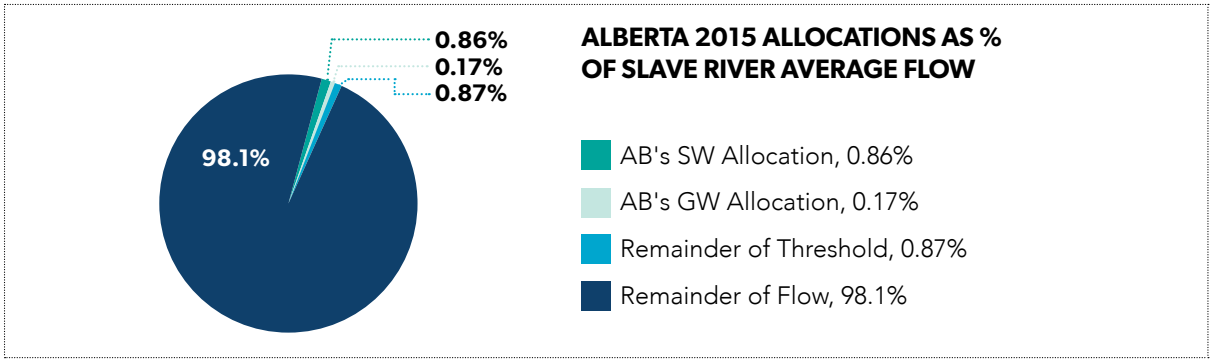

Figure 4. Alberta 2015 allocations as percentage of Slave River average flow

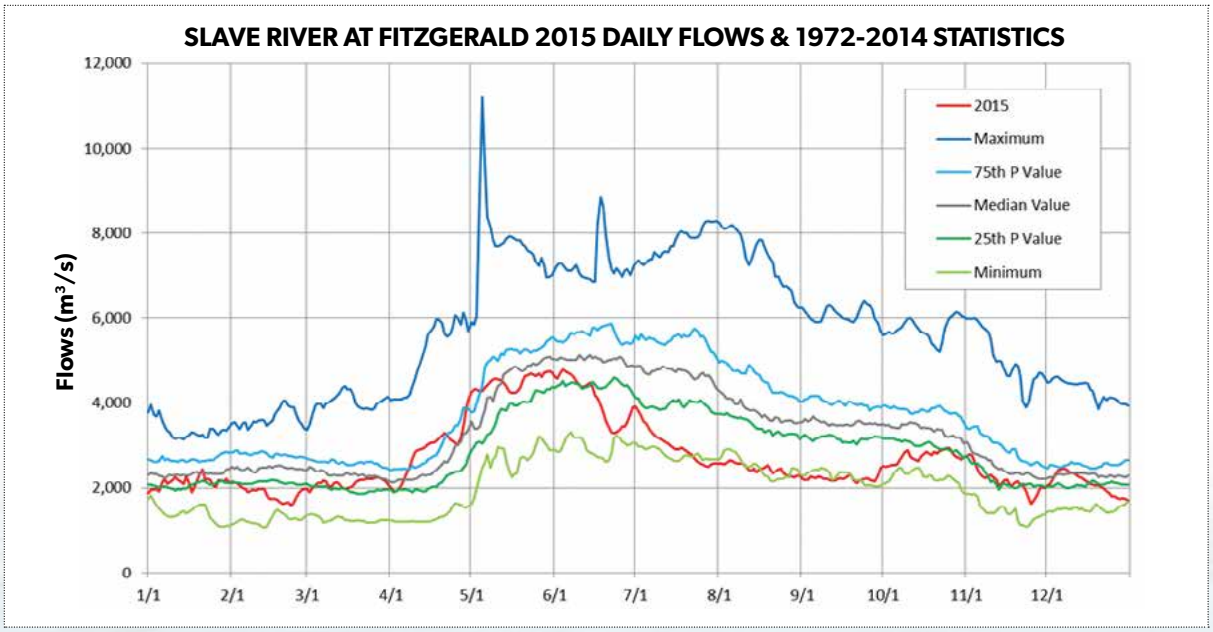

Figure 5. Slave River at Fitzgerald 2015 daily flows and 1972-2014 statistics

[6] The average annual flow for the Slave River over 1972-2014 was 105.9 billion m^3. The average annual flow over 1972-2015 is 105.4 billion m^3.

The Parties agreed to track interbasin transfers into or out of the Mackenzie River Basin, as discussions will be triggered if 50% of Alberta's consumptive use is in the form of interbasin transfers. Only one special act has been passed in Alberta for a transfer of water out of the Mackenzie River Basin (Country of Westlock Water Authorization Act, SA2007, cC-29.5, http://www.qp.alberta.ca/documents/Acts/C29P5.pdf) This Act allows for a transfer of treated municipal water from the Athabasca River Basin to the North Saskatchewan River Basin that is not to exceed 209 thousand m^3 per year, an amount that is included in the surface water allocation pictured in Figure 4 above.

Next steps

The Parties will continue to track, and report on, consumptive use, annual flow, and interbasin transfers as well as refine the methods for the calculation of consumptive use and annual flow when needed.

Hay River

The Parties agreed to set two interim triggers for the Hay River, and for any other class 3 water bodies (other than the Slave River). For the Hay River, interim trigger 1 is reached when allocations reach 50% of a Party's share of available water. Interim trigger 2 is reached when water consumption reaches 80% of a Party's share of available water. The Parties agreed to confirm water consumption (actual withdrawals and estimated return flows) if the total allocated water reaches 50% of a Party's share of available water.

Figure 6 below represents the estimated 2015 average natural flow[7] of the Hay River. As mentioned above, the Parties agreed to use a modified desktop approach where 10% of the natural flow (flow before human diversions) is the total available water to be shared equally between the two jurisdictions. Alberta's annual surface water and groundwater allocations are shown as a constant rate of diversion throughout the year.

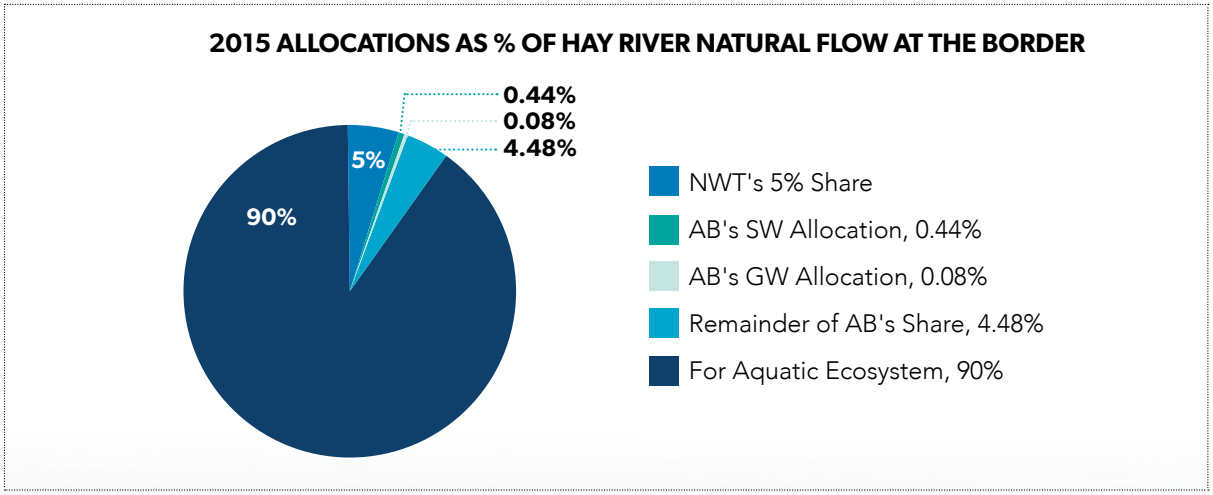

Figure 6. 2015 allocations as a percentage of Hay River natural flow at the border

[7]The natural flow was estimated at the AB-NWT border by: first, taking 94% of the flow recorded at the WSC station Hay River at Hay River (07OB001) (since it is further downstream and has higher flows), and, second, by adding the surface water allocations in Alberta, assuming they are taken at an even rate throughout the year. With this assumption, the surface water allocations are 0.2 m^3/s and the groundwater allocations are 0.04 m^3/s. The estimated 2015 natural flow at the border (the full pie) is 46.4 m^3/s.

Figure 6 shows the annual situation; however, during the year, higher flow occurs during the spring and summer, and much lower flow occurs in the winter months.

Figure 7a shows the monthly flow for monitoring data from July 1963 to December 2014. Each month shows the maximum, 75th percentile, median, 25th percentile and minimum flow. The monitored flows for 2015 are also shown for comparison to the historical data. Figure 7b shows an enlarged view of the lower flows in the winter months.

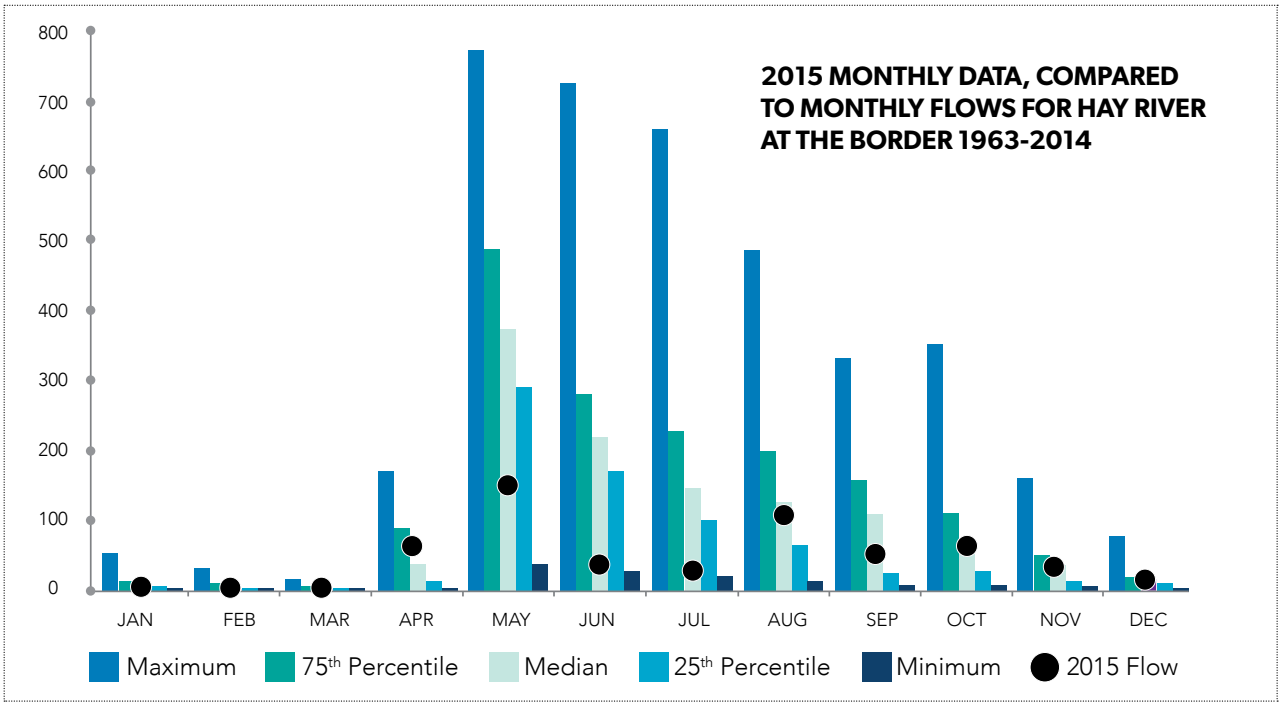

Figure 7a. 2015 monthly data compared to monthly flows for Hay River at the Border, 1963-2014

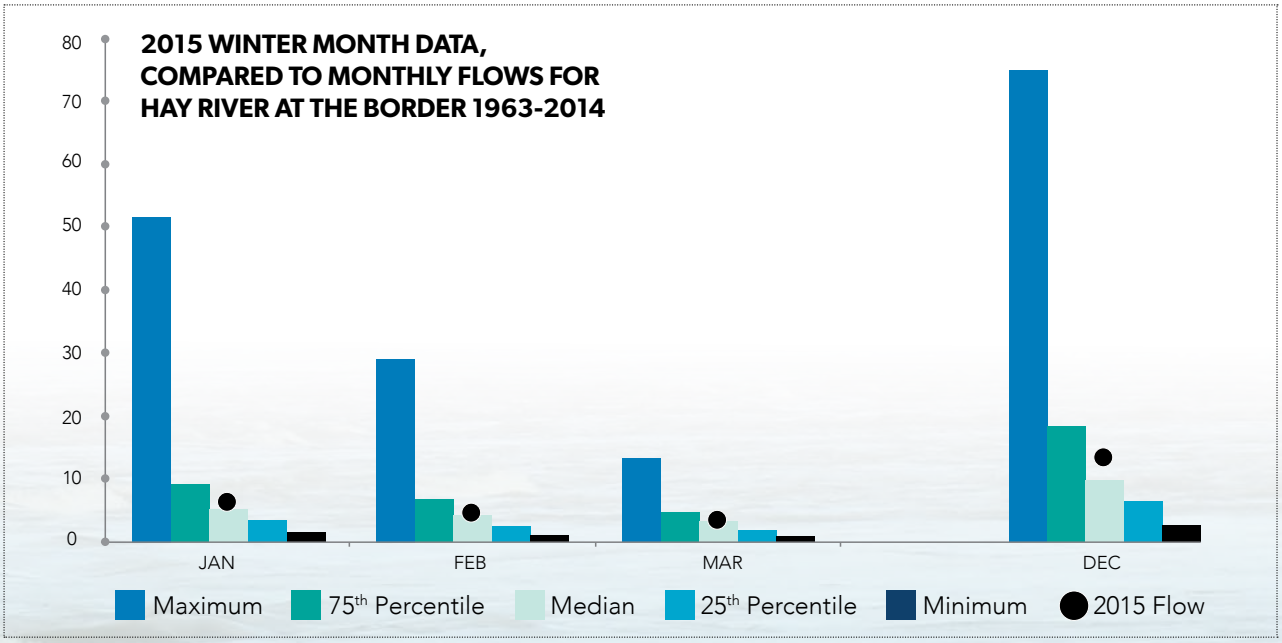

Figure 7b. 2015 winter month data compared to winter months for Hay River at the Border, 1963-2014

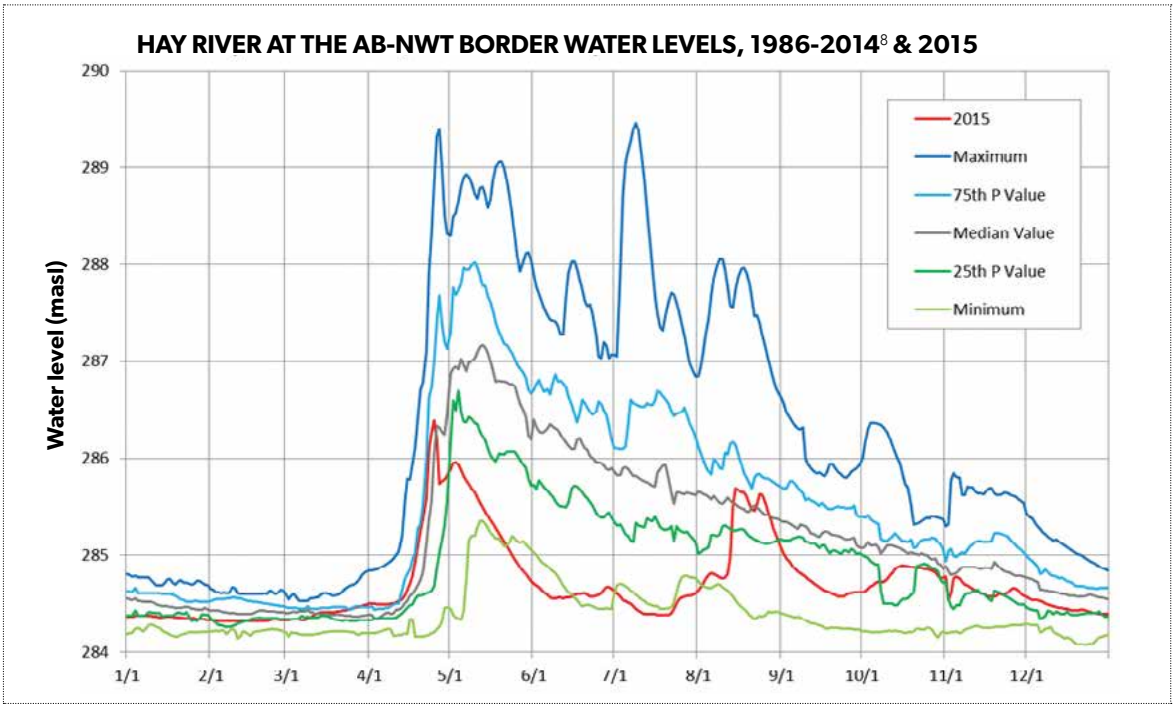

Figure 8. Hay River at the AB-NWT Border water levels, 1986–2014 & 2015

Figure 8 shows daily flows for 2015, as well as the historical "percentiles" or "P values" for each day of the year. The same day of the year is compared by ranking its flows across the historical record (1986 to 2014). The median, or 50th percentile, is the flow value exactly in the middle. The 25th percentile is at the lower end, with only 25% of the years on that day being below that flow.

As shown in Figure 8, new minimum water levels were recorded on the Hay River near the Alberta-NWT border on days in May, June, July, and August.

Next steps

The Parties will refine the estimates of natural flow and consumptive use for the Hay River Basin to consider the variation in flows throughout the year. The Parties agree that it is impractical to calculate an 'instantaneous' flow; however, time-steps that are refined from an annual time-step will be discussed, analyzed, and reflected appropriately in future annual reports.

Surface water quality

The Alberta-NWT Bilateral Water Management Agreement describes how water quality in the Slave and Hay rivers is monitored, assessed and managed. Guided by the RIM approach, the Parties to the Agreement classify a water body, and then, depending on the class, monitor it, create a learning plan, and set transboundary water quality triggers and objectives. Transboundary water quality triggers and objectives are designed to maintain the ecological integrity of the aquatic ecosystem by ensuring the quality of water it needs to remain healthy.

The goals of the Agreement's surface water quality monitoring are to develop transboundary water quality triggers and objectives to help protect surface water quality, support pollution prevention, and proactively address any emerging water quality concerns.

[8] *Water level data between 1998-2010 are not available.*

What is site-specific water quality?

Naturally, water quality varies from place to place, with the seasons, climate, and types of soils and rocks through which water moves. Sometimes, when generic guidelines are used to assess water quality, the guidelines can be exceeded due to natural factors such as high sediment loads. In other cases, the generic guidelines for some parameters may be considerably higher than the natural levels.

Water quality triggers in the Agreement are derived based on site-specific monitoring data and are known as site-specific water quality triggers. Triggers provide a relevant set of benchmarks against which future data can be compared. Also, where generic guidelines do not currently exist for certain parameters (e.g., phosphorus), site-specific water quality triggers are useful.

Transboundary water quality objectives

A transboundary water quality objective is defined as the site-specific water quality conditions that the responsible Party or Parties will meet in accordance with the RIM approach.

Current status

At the time of signing, the Parties committed to work together to develop transboundary water quality objectives for the Slave and Hay rivers. The approach to develop and implement objectives is ongoing. Methods and processes to develop appropriate water quality objectives are being discussed among the jurisdictions within the Mackenzie River Basin to promote as much consistency as possible among approaches.

Transboundary water quality triggers

A transboundary water quality trigger is a pre-defined early warning of potential changes in typical (Trigger 1) and/or extreme (Trigger 2) water quality conditions which results in Jurisdictional and/or Bilateral Water Management to confirm that change.

Current status

At the time of signing, interim site-specific water quality triggers were incorporated into the Agreement. These interim site-specific water quality triggers were calculated using historical ambient data at the median and 90th percentile levels to track variations of water quality parameters in each river. Where sufficient data were available, seasonal triggers were set for the conventional parameters monitored at the transboundary sites.

Slave and Hay river water quality monitoring programs

Transboundary water quality monitoring takes place in the Slave River at Fitzgerald, Slave River at Fort Smith and Hay River near the Alberta/NWT Boundary. Surface water samples are analyzed for conventional parameters including physical variables (e.g., pH, total suspended solids); major ions (e.g., calcium, magnesium, sulphate); nutrients (e.g., nitrogen, phosphorus); and metals (e.g., arsenic, copper, lead and mercury). Water samples are also analyzed for organic substances including pesticides and hydrocarbons.

Trigger 1: 50th Percentile

For the 2015 assessment, the 50th percentile (annual median) was designated as Interim Trigger 1. As a conservative step, a parameter was first flagged if the number of observations above the Trigger 1 value occurred more often than what was expected by chance (i.e., 50%). Annual and seasonal trend assessments were reviewed for the parameters flagged to see if concentrations were increasing over time.

Trigger 2: 90th Percentile

In a parallel step, the 2015 data were compared to Trigger 2 (seasonal 90th percentile). A parameter was first flagged if any observation was above the Trigger 2 value. Any parameter above its respective historical seasonal maximum value was evaluated further by: 1) reviewing trend assessments, 2) examining flow conditions, and 3) comparing values to existing water quality guidelines.

2015 Water quality assessment results

Results show no concern with 54 of the 66 (82%) water quality parameters monitored in the Slave River during 2015 when compared to Trigger 1. Among the 12 flagged parameters, pre-existing

What is a percentile?

A percentile is a value below which a certain proportion of observations fall. For example, if the 90th percentile for dissolved sodium is 15.9 mg/L (Hay River, open-water season), then 90% of the historical observations have a sodium concentration of 15.9 mg/L or less.

Since percentiles are based on values that have been observed in the past, triggers are conservative values. Not all observations above a trigger value signal a concern, but rather can highlight those parameters that should be examined further to determine whether or not change is occurring.

increasing trends were revealed for nitrate/nitrite and dissolved sulphate (annually, open-water season), and dissolved sodium (open-water). An assessment of Trigger 2 also shows no concern with 59 of the 66 (89%) parameters when compared to Trigger 2. Seven of the 66 parameters (9/590 results) had values greater than the Trigger 2 level on one or two occasions. Dissolved magnesium was above its respective historical seasonal maximum value but still below its historical maximum value.

In the Hay River, there were no concerns with 33 of the 41 (80%) water quality parameters monitored during 2015 when compared to Trigger 1. No pre-existing increasing annual or seasonal trends were revealed for any of the eight flagged parameters. An assessment of Trigger 2 also shows no concern with 34 of the 41 (83%) parameters when compared to Trigger 2. Seven of the 41 parameters (7/131 results) were greater than the Trigger 2 level on one occasion (in October). Of these, dissolved sodium and sulphate were above their respective historical seasonal maximum values but still below their historical maximum values.

The parameters that were flagged are dissolved magnesium (Slave River) and dissolved sodium and dissolved sulphate (Hay River). These parameters are known collectively as major ions and are present naturally in source waters from the weathering of rocks and materials in the surrounding landscape. Major ions are dissolved salt constituents in water and tend to vary inversely with flow due to dilution. High concentrations during low flow normally reflect the higher mineralized composition of groundwater, whereas low concentrations reflect the lower mineralized water from snowmelt and/or rainfall runoff.

As shown in Figures 5 and 8, in 2015, fall flows in both rivers were low[9]. The low flows likely led to the higher concentrations of dissolved magnesium, sodium and sulphate because other dissolved parameters in both rivers also had elevated concentrations (but not above any trigger) at that same time. The concentrations of these dissolved ions were well below the available federal/provincial use protection guidelines[10], posing no risk to existing uses.

Toxic, bioaccumulative and persistent substances

The Parties are committed to pollution prevention and sustainable development to meet the objective of virtual elimination for substances that are human-made, toxic, bioaccumulative and persistent. Virtual elimination (VE) refers to reducing, in the medium-to-long term, the concentration of designated substances to levels below or at the limits of measurable concentrations.

[9]For detailed flow data, refer to the Water Survey of Canada historical hydrometric data website at *https://wateroffice.ec.gc.ca/mainmenu/historical_data_index_e.html* for station Hay River at Hay River (07OB001) and station Slave River at Fitzgerald (Alberta) (07NB001).

[10]A guideline does not exist for magnesium.

2015 Water Quality Technical Report

The 2015 water quality results were summarized from the technical companion report: *2015 Water Quality Report for the Slave and Hay Transboundary Rivers* which is available online at: www.aep.alberta.ca and www.enr.gov.nt.ca

The technical report:

1. Describes the transboundary water quality monitoring programs used for the assessment;
2. Describes the approach to the 2015 water quality assessment and evaluation;
3. Presents and discusses the results of the water quality assessment and evaluation; and
4. Provides recommendations for future BWMA water quality-related tasks.

The BMC reports on the detection of any VE substance found in the Slave and Hay rivers. During the summer of 2015, three water samples were collected from the Slave and Hay rivers and analyzed for 14 VE substances. Total polychlorinated biphenyls (PCBs) were detected on all three occasions in both rivers but concentrations were very low and do not pose any risk to aquatic life. Results suggest that long-range atmospheric transport, historical residuals and/or laboratory contamination may be the potential sources for these compounds. No other VE substance was detected in the 2015 water samples.

Conclusion

Overall, the majority of water quality parameters assessed for the Slave and Hay rivers in 2015 were within their historical range. New seasonal maximum values for dissolved magnesium (Slave River) and dissolved sodium and sulphate (Hay River) are likely due to the low water levels. Special attention will be given to these parameters and any trending parameters in the following year's assessment because they can indicate potential changes in water quality due to climate change and/or upstream land uses. Monitoring for PCBs and other VE substances will continue.

Next steps

When the Agreement was signed in March 2015, the Parties acknowledged that work was required in several areas to fully implement the Agreement. The Parties recognized that they would learn together through implementation, and that modifying the interim triggers may occur during that time. The following tasks are underway:

1. Jointly review and assess the 2016 Slave and Hay river water quality data. Special attention will be paid to the parameters flagged in 2015.
2. Review water quality monitoring undertaken by ECCC and the NWT. Discuss possibilities of merging the two sets of monitoring data to increase annual sample size.
3. Explore methods to better use water quality data from upstream water quality monitoring sites to inform the transboundary water quality assessment.
4. Continue collecting water samples for mercury analysis so that interim water quality triggers for mercury can be developed for the Slave and Hay rivers in the near future.
5. Explore other test statistics to identify changes in transboundary water quality.
6. Continue to discuss methods and processes to derive water quality objectives for conventional parameters and organic (i.e., hydrocarbons) substances.

"Groundwater" means water that collects, flows or freezes beneath the Earth's surface.

Groundwater

The Agreement describes how groundwater may be shared reasonably and equitably. However, there is limited knowledge about the quality, quantity and location of groundwater shared between Alberta and the NWT.

Current status

Learning about groundwater is expensive. As a result, the Parties will follow the RIM approach to classify transboundary groundwater, monitor groundwater, share information, create learning plans, and set transboundary groundwater[11] objectives as appropriate according to the level of risk. Early assessment (see Figures 4 and 6) indicates groundwater use is very limited, so baseline information about groundwater will be gathered on a case-by-case basis as use is proposed or increased. For any areas with moderate levels of existing or proposed development, or areas considered vulnerable, Alberta and the NWT are committed to developing learning plans to learn more about the groundwater.

On March 31, 2016, the *Preliminary State of Groundwater Knowledge in the Transboundary Regions of the Mackenzie River Basin, NWT* was completed. This report includes information on known aquifers (bodies of rock or soil through which groundwater can move) in the transboundary region; use by various sectors in the jurisdictions; activities with potential impacts on groundwater (e.g., remediation of contaminated sites, oil and gas activities); an overview of monitoring in the various jurisdictions; information on groundwater-surface

[11]Transboundary groundwater refers to shared aquifers when they have been mapped, or shared surrogate groundwater areas when groundwater has not yet been mapped.

water interaction (e.g., information on springs); and information on gaps and recommendations. The *Hay River Basin State of the Aquatic Knowledge* report, which was completed in March 2016, also looked at groundwater at a regional scale.

Next steps

The Parties will collect information on how aquifers are commonly identified and to determine groundwater flow and groundwater monitoring best practices. The study will explore the various methods that can be used, providing information needed to design a suitable monitoring program.

> **"Indicator"** means a qualitative or quantitative assessment of water and associated ecosystem elements (such as invertebrates, plants, fish, birds, wildlife, humans or air) using ecological and social science, and/or traditional and local knowledge, which are indicative of the state of the ecological integrity of the aquatic ecosystem.
>
> **"Biological Indicator"** means a species, community or biological process used to provide qualitative and/or quantitative information on the state of the ecological integrity of the aquatic ecosystem and how it changes over time.

The gaps and recommendations of the *Preliminary State of Groundwater Knowledge in the Transboundary Regions of the Mackenzie River Basin, NWT* and the groundwater section of the *Hay River Basin State of the Aquatic Knowledge* report will be reviewed and prioritized.

Clearly defined transboundary groundwater areas will also be established to define common management areas. The Parties will develop a methodology to track activities that could impact groundwater.

Biological component

The commitments in the Agreement are intended to be proactive and protect the ecosystem and its biological components, including fish, wildlife, invertebrates, plants and people, and how they relate to one another. The commitments include:

- Developing safe objectives for water quality and quantity that protect the ecological integrity of the aquatic ecosystem.
- Establishing biological indicators and, if necessary, developing biological objectives and related actions for class 3 water bodies.
- Applying the RIM approach to better understand the links between water quality, water quantity, groundwater, airborne pollution, biology and human health.

Current status

The Parties have agreed to establish and monitor biological indicators and measurement methods to track the condition of the aquatic ecosystem. These indicators may also provide

Benthic macroinvertebrates include insects and other small organisms that live on or in the sediment on river or lake bottoms. These communities are useful as indicators of aquatic ecosystem health because many species are sensitive to pollution and sudden changes in their environment. They also are less mobile than fish and as such may be better site-specific indicators.

information about the cumulative effects of a number of factors, including contaminants, water withdrawals, climate change and changes to habitats, insofar as possible.

Changes in biological indicators such as fish health may require changes in management actions. These actions could include reviewing, setting or revising surface and groundwater quality and quantity objectives or developing biological objectives. The Parties will monitor these indicators and manage their water and land use to meet the objectives for class 3 water bodies.

The Agreement currently identifies four categories of interim biological indicators: large-bodied fish, small-bodied fish, invertebrates (including benthic macroinvertebrates), and aquatic mammals, where data are available. Final biological indicators are to be developed.

Information related to past biological monitoring and biological indicators in the Slave and Hay river basins exists in a number of sources. Alberta has undertaken biological monitoring and collected information since 1997, including under the Regional Aquatics Monitoring Program (*http://www.ramp-alberta.org/RAMP.aspx*); in work in association with ECCC (under the Canada-Alberta Oils Sands Environmental monitoring program: *http://www.jointoilsandsmonitoring.ca/default.asp?lang=En&n=5F73C7C9-1*); and through Alberta Environmental Monitoring and Reporting Agency (AEMERA) (*2015 annual report at: http://environmentalmonitoring.alberta.ca/uncategorized/news-release-aemera-annual-report-released/*).

More specific biological-related work includes the *Hay River Basin State of the Aquatic Knowledge* report (2016) and the *Slave River and Delta State of Knowledge* and *Vulnerability Assessment* reports (2016). Other information from the *Water and Suspended Sediment Quality in the Transboundary Reach of the Slave River, Northwest Territories* report (2012), from Indigenous and Northern Affairs Canada, and work completed under the draft *Lower Athabasca Region Biodiversity Management Framework* (2014) also will inform biological indicator selection. Collectively, this information and discussions with experts and traditional knowledge holders will inform the development of final biological indicators for the Agreement.

Next steps

Future efforts will include a literature review of relevant biological monitoring that has occurred on the Slave and Hay rivers, and a summary of previous biological indicator work undertaken in the Mackenzie River Basin. Future work will explore methods to monitor benthic macroinvertebrates in large transboundary rivers. In combination, these initiatives will inform recommendations to develop final biological indicators and the design of a biological monitoring program for large northern rivers.

MONITORING

Long-term monitoring is critical to understanding whether significant changes are taking place in the natural environment. Data collected about water quantity and quality, and groundwater and biology over the long term reveal important patterns.

These patterns allow trends, cycles, and rare events to be identified. These long-term data are particularly important for complex, large systems where environmental signals may be subtle and slow to emerge. Interpreting results of monitoring tells us whether the Agreement commitments are being met.

Water quantity

Setting transboundary water quantity objectives requires site-specific knowledge of stream flow and available water. The primary goals of water quantity monitoring of transboundary waters are to track changes in water quantity over time, determine anthropogenic and natural drivers for changes in water quantity, and ensure that sufficient water is available for downstream uses. Long-term continuous monitoring of stream flow is important to understand the hydrology of a water body and to estimate available water.

Current status

Table 2 shows the monitoring sites that provide information to assess and refine transboundary water quantity interim triggers and objectives. ECCC (Water Survey Division) undertakes the hydrometric monitoring, the costs of which are shared with the provincial/territorial jurisdictions.

A list of hydrometric stations in the Slave and Hay river basins is included in Appendix I of the Agreement. The list identifies several monitoring sites that provide data to help understand regional climate conditions and influence on water quantity. For example, higher 'production' of water in headwaters that have high slopes influence both precipitation and surface water flows downstream.

Next steps

The Parties will continue to notify and provide information to each other about hydrometric monitoring occurring in their respective jurisdictions that is relevant to the Agreement. Jurisdictions will follow up with ECCC about the feasibility to convert the Water Survey of Canada Hay River station near the Alberta-NWT border from a water-level station to a flow monitoring station, as well as to conduct year-round monitoring, as opposed to seasonal monitoring. Two stations that currently are monitored by Water Survey of Canada will be added to the list in Appendix I (Table I3): one lake-level station that monitors water-level fluctuations on Great Slave Lake and one flow station below the outflow of Great Slave Lake on the Mackenzie River.

Table 2. Hay and Slave river water quantity monitoring sites for assessment of triggers and objectives

Monitoring Station/ Assessment Point	Site Status
Hay River near Town of Hay River (flow monitoring, 1963-present)	Continuous monitoring since July 1963, one incomplete month (July 2010) Drainage Area: 51,700 km²
Hay River near AB-NWT border (level monitoring, 1986-present)	Intermittent monitoring began in 1986, stopped in 1998, and restarted in 2004 Drainage area: 48,800 km²
Hay River at the AB-NWT Border (calculated flow estimate)	Used to assess the Interim Triggers for the Hay River basin. This is done by reducing the flow to the smaller drainage area at the border. The flow at the border is estimated as 94% of the flow at the town of Hay River.
Slave River at Fitzgerald (flow monitoring, 1960-present)	Intermittent monitoring 1921-1922, 1930-1931, and 1953-1958 Continuous monitoring since May 1959, nine incomplete months (2011-2014) This location is used to assess whether the 2 billion m³ consumptive use threshold becomes significantly different from 1.9% of the long-term average annual flow.

Water quality

The primary goals of monitoring transboundary surface water quality are to track changes in water quality over time, determine anthropogenic and natural drivers for changes in water quality, and make sure that water quality is protected for all uses.

Jurisdictions are responsible for managing their risks to water quality. In addition, the Agreement commits the Parties to support long-term monitoring of surface water quality. This monitoring will help protect our transboundary waterways from pollution. Long-term monitoring will allow identification of risks and trends, better enabling jurisdictions to recognize and address cumulative effects on aquatic ecosystems.

Current status

To fulfill the monitoring requirements of the Agreement, ECCC and the GNWT collect water quality samples from the Slave and Hay rivers. Monitoring includes the collection of water quality samples for the analysis of physical parameters, nutrients, major ions, metals and organic compounds including pesticides, PCBs and hydrocarbons.

As a requirement of the Agreement, the BMC annually reviews the results from the following surface water quality monitoring sites:

- Slave River at Fitzgerald,
- Slave River at Fort Smith, and
- Hay River at the Alberta-NWT border

Slave River Monitoring Program

In 2015, ECCC collected nine surface water quality samples from the Slave River at Fitzgerald. Samples were collected in January, February, March, June, July, August, September and October. Also in 2015, the GNWT collected three water samples from the Slave River at Fort Smith in June, July and August.

Hay River Monitoring Program

In 2015, ECCC collected four water samples from the Hay River near the Alberta-NWT border (April, May, July and October). Unfortunately, some of the ECCC sample bottles from the July sampling trip were lost when shipped from the field site to the Ontario laboratory and, subsequently, results from the July sampling trip were available only for conventional parameters and nutrients. Also in 2015, the GNWT collected three water samples from this monitoring location (June, July, and August).

Next steps

The Parties agreed that there will be no changes to identified monitoring programs or sites for the Hay and Slave rivers at this time.

CLIMATE CHANGE

Climate change can cause challenges for the management of transboundary waters. Changes in the amount of precipitation directly affect the level of the rivers and the level of the water table in aquifers.

The changes in the timing of the precipitation (rain and snow) affect the seasonal stream flow, while the changes in the intensity and amount of precipitation have an effect on erosion rates and water quality (e.g., lack of water quantity causing increasing concentrations of various water quality parameters). Climate change also can affect ice formation and break up as well as water temperature.

The effects of climate change are more drastic in permafrost regions where the thawing of permafrost can lead to the drainage of lakes, emergence of thermokarsts, and new stream flow patterns, as well as changes to water quality.

Climate change also can affect forest fire frequency, vegetation, wildlife distribution, and weather events.

The Agreement does not have one specific section that addresses the effects of climate change; the entire Agreement is intended to be responsive to a changing climate. Its commitments are designed to be adaptive and responsive to new information and changing conditions, including information related to climate change. The commitments that address climate change impacts are:

- Water quantity interim triggers and objectives are a percentage of flow, accounting for whether flow increases or decreases.
- Protective and precautionary water quantity and quality objectives have been set, or will be set when needed, to maintain aquatic ecosystem health, and to allow the Parties the flexibility to adapt to climate change impacts as they occur.
- Bilateral management under the RIM approach is based on the most up-to-date knowledge, including information about climate impacts.
- Classification of water bodies accounts for the risk from climate change.
- Continual monitoring at the borders and other priority locations in the Mackenzie River Basin helps to assess the impacts of climate change on the health of the basin.
- Proactive identification of research needs will continue in support of bilateral management, including research on climate change.

Current status

While continual monitoring at the borders and other priority locations in the Mackenzie River Basin helps to assess the impacts of climate change on the health of the basin, more work is needed.

The Parties agreed, as part of the first five-year work plan, to conduct a scoping study to examine the potential methods, feasibility and benefits of a broader study to inform the BMC about how to take account of the effects of climate change in the setting and monitoring of transboundary objectives.

The Mackenzie River Basin Hydraulic Model is being updated. It will be used to increase understanding of climate influences on flows and water levels versus water use impacts throughout the basin. Research to look at the effects of forest fires on water quality and quantity has also been initiated.

Next steps

The Parties will continue to consider climate change in their monitoring programs under each joint hydrometric agreement with the Government of Canada. The GNWT is expanding its hydrometric network which will better contribute to the understanding of climate changes in the NWT portion of the Mackenzie River Basin. Collaborative research and studies will be discussed at the Mackenzie River Basin Board level. The Parties will conduct a scoping study to consider the effects of climate change in setting and monitoring transboundary objectives.

CONCLUSION

In the first year of implementation, the governments of Alberta and the NWT, through the BMC, worked together to meet many of the commitments in the Agreement.

Working Together to Manage Our Shared Waters: Alberta-Northwest Territories Bilateral Management Committee Annual Report to Ministers, 2015-16 represents one of those commitments.

In 2015-16, substantial progress was made toward meeting commitments in several sections of the Agreement. Most importantly was establishing the BMC, comprised of representatives of Alberta and the NWT. The technical teams necessary for implementing the Agreement were then designated by the BMC. With the BMC and technical teams in place, the accomplishments of the inaugural year included:

- The BMC established decision-making mechanisms, emergency response protocols, and processes to give each jurisdiction prior notification of proposed development and activities. These processes will be improved and modified as the need arises and implementation progresses.
- Assessment of the 2015 water quantity data for the Hay and Slave rivers determined that no triggers were reached on either river and annual flows were within the range of natural variability. However, new minimum water level values were recorded on the Hay River near the Alberta-NWT border on days in May, June, July, and August, while new minimum flows were recorded on days in July, August, and September on the Slave River.
- Assessment of the 2015 water quality data for the Hay and Slave rivers determined that the majority of the water quality parameters had values lower than the interim triggers and were within their historical range of natural variability. Only one parameter for the Slave River and two for the Hay River were out of their historical range, likely because of low flows during the fall in both rivers. Special attention will be given to these parameters and any trending parameters in the following year's assessment as they can indicate potential changes in water quality due to climate change and/or upstream land uses.
- A literature review of publicly available traditional knowledge research for the Slave and Hay river sub-basins, through the Tracking Change research project, was conducted and contributes to learning plan development.
- Considerable work was done to identify knowledge gaps and gain better understanding of the Hay and Slave rivers. For example, a state of the knowledge report for the Hay River was completed; a report on the state of groundwater knowledge in transboundary areas was finished; and an update for the Mackenzie River Basin Hydraulic Model was initiated. These studies, along with others currently underway, will inform long-term objectives for transboundary waters.

To further pursue commitments in the Agreement, the BMC has drafted a three-to-five-year work plan. Some of the work planned over the next few years include:

- Review and address knowledge gaps to advance the development of learning plans for the Hay and Slave river basins.
- Monitor surface water quantity by tracking, and reporting on, the triggers as well as refining calculation methods as required.
- Establish tracking metrics for the Hay and Slave rivers—for example, to track consumptive water use, water allocations, and river flow, including during low flow conditions.
- Monitor and report on surface water quality by jointly reviewing and assessing the Slave and Hay river water quality data. Address methodological questions about interim water quality triggers. Review all mercury data from the Slave and Hay rivers to establish interim triggers for mercury.
- Work towards consistency on methods to derive water quality objectives.
- Refine biological indicators and develop a biological monitoring, evaluation, and reporting plan for the Hay and Slave rivers.
- Conduct a scoping study to consider the effects of climate change in setting and monitoring transboundary objectives.
- Collect information on how aquifers are commonly identified and develop best practices to determine groundwater flow and groundwater monitoring.
- Identify and implement ways to synthesize and blend traditional and local knowledge, western science and social science, and other forms of knowledge relevant to setting and assessing transboundary water objectives.

As the BMC continues to cooperate in good faith, it is taking all reasonable actions to not only ensure Agreement commitments are met, but also to sustain the spirit under which it was signed.

Overall, Alberta and the NWT have accomplished much in the first year of implementation. These two jurisdictions have created a partnership that is both collaborative and cooperative. Now with year two (2016-17) wrapped up and data analysis under way, the second annual report is being compiled.

APPENDIX

Links to source materials:

Alberta-NWT Bilateral Water Management Agreement:
http://www.enr.gov.nt.ca/sites/enr/files/ab-nwt_water_management_agreement_final_signed_2.pdf

Appendices to the Alberta-NWT Mackenzie River Bilateral Water Management Agreement:
http://www.enr.gov.nt.ca/sites/enr/files/bwma_ab-nt_appendices_24_february_2015.pdf

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