APPENDICES

MACKENZIE RIVER BASIN
BILATERAL WATER MANAGEMENT AGREEMENT

Between the

Government of Alberta

And the

Government of the Northwest Territories

2015-02-24

FINAL

List of Appendices

Appendix A – Risk Informed Management

A1. Overview

Risk Informed Management (RIM) is an approach that guides the identification and implementation of management actions and that is informed by an understanding of the risks to and uses of a transboundary water body. It applies to all Transboundary Waters, including both surface and Groundwater.

The goals of the RIM approach are:

- To support the achievement of the principles of the Master Agreement;
- To facilitate joint learning and proactive and adaptive actions;
- To apply human and financial resources in an efficient and effective manner.

Key principles include:

- The nature and intensity of Bilateral Water Management is commensurate with the nature and intensity of the risks to and uses of Transboundary Waters;
- Bilateral Water Management is based on a mutual understanding of the Ecological Integrity of the Aquatic Ecosystem;
- Bilateral Water Management builds on the Jurisdictional Water Management actions of each Party as required to achieve the commitments of the Agreement.

The RIM approach will be implemented in a manner consistent with these goals and principles.

The RIM approach is one of several tools for collectively meeting the Master Agreement principles. It complements the oversight provided by the Board as well as each Party's Jurisdictional Water Management practices.

The specific RIM Commitments are documented in section 4.3 of the Agreement. This appendix provides an overview of the approach, which will guide the implementation of this Agreement. Additional details that guide the implementation of this approach for surface water quantity, surface water quality, Groundwater and biological components are outlined in respective appendices and supplementary bilateral-specific RIM documents. RIM details will be further developed by the Bilateral Management Committee (BMC) over time.

A2. Classifying Transboundary Waters

Operationally, the RIM approach involves assigning Transboundary Waters to one of four classes (Figure 1), defining Bilateral Water Management actions commensurate with the class, and establishing a structured and transparent process for Bilateral Water Management.

Classifications will be applied to Transboundary Waters at the border. The classification will consider development and use in the contributing basin as well as downstream needs. Bilateral Water Management actions may be directed at those contributing water bodies, but the classification is applied at the border. Criteria for classifying Transboundary Waters will be based on the type and magnitude of development along with other quantitative and qualitative factors. Classification will consider both existing and projected development, based on a detailed five-year development forecast, as well as consider the longer-term (ten-year) outlook. Assignment of a transboundary water body to a particular class will be a joint decision by the Parties.

Figure 1: Risk Informed Management Approach

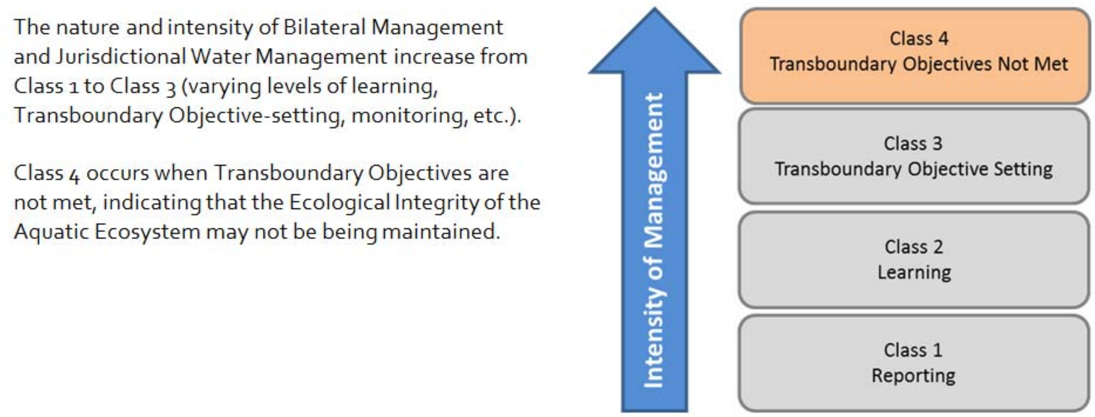

Table 1 provides a high-level summary of the four classes, including key commitments at each class, and some considerations for classification. To improve the transparency and consistency of classification, the Appendices of each Bilateral Water Management Agreement may contain more specific criteria and representative conditions that correspond to each class. However, the Parties recognize the need to retain flexibility in the future, as it will be impossible to identify every possible consideration.

In general, as described in Table 1, water bodies with no or very low development/use are class 1. At class 1, it is expected that the Jurisdictional Water Management practices of each Party will be sufficient to meet transboundary commitments. Other than reporting, no Bilateral Water Management actions are required in this class. As warranted by increased development/use and other factors, Transboundary Waters will be moved to higher classes, where Bilateral Water Management actions are identified to complement Jurisdictional Water Management practices.

Some level of current or planned development/use is necessary for a water body to move from class 1 to class 2, but there is no single threshold of development/use that causes a water body to move to class 2 or 3. To move from a class 1 to 2 or from class 2 to 3, the level of development/use is considered along with other factors to classify water bodies using a risk-informed approach. Other factors beyond development levels that may influence the assignment of a water body to class 2 or class 3 include, but are not limited to:

- Natural or other anthropogenic stressors or vulnerabilities;
- Sensitive water or ecosystem uses (e.g., traditional uses, drinking waters, heritage sites or parks);
- Use conflicts or controversy;
- Water quality and quantity conditions or trends;
- Aquatic Ecosystem (e.g., biological, human health or traditional use) conditions or trends.

In other words, a water body that is stressed or vulnerable (e.g., low flows, etc.), supports sensitive uses (e.g., traditional use, drinking water, etc.), experiences water use conflicts (e.g., conflicts among users or public controversy about water or ecosystem conditions), and/or demonstrates negative conditions or trends in water quality, water quantity or Aquatic Ecosystem Indicators may move up in class at a lower level of development/use than a water body that does not.

The intensity of Bilateral Water Management will increase as required to support continued achievement of RIM goals and Transboundary Objectives. At class 2, a Learning Plan tailored to the needs of the water body will be developed. Learning Plans will be developed using an integrated approach and will address relevant water quality, water quantity, Groundwater and biological considerations. As part of the Learning Plan, Triggers may be established to support learning, to prepare for setting and assessing the achievement of Transboundary Objectives, and to proactively address any negative trends. Triggers are defined in the Agreement as specific conditions defined by the Parties that will require a Jurisdictional and/or Bilateral Water Management response. More specifically, in the context of RIM, a Trigger is a pre-defined early warning of change in typical or extreme conditions that results in confirmation of the change and Jurisdictional and/or Bilateral Water Management to address the change/trend. Multiple Triggers can be set to invoke additional actions as necessary (e.g., degrading conditions). At class 3, Transboundary Objectives will be established based on detailed, site-specific analysis. Transboundary Objectives establish conditions that the responsible Party or Parties commit to meet. If the BMC determines that Transboundary Objectives are not met, the water body will be designated class 4, at which point the responsible Party or Parties will identify and implement action as in section 4.3 j) through m) of the Agreement with the goal of returning the water body to class 3.

Table 1: Transboundary Classes

Class	Key Commitments	Classification Considerations
1 **Reporting**	Ensure that each Party's Jurisdictional Water Management practices meet transboundary commitments and that its policy/regulatory processes include a provision to check for transboundary impacts. Report on Developments and Activities and share available information on Aquatic Ecosystems. No additional Bilateral Water Management actions are required.	Examples of Transboundary Waters in this class include those characterized by no or very little existing and projected development.
2 **Learning**	Initiate a Learning Plan (e.g., issue scoping, monitoring, data analysis, investigations into potential effect pathways) to improve our understanding of the requirements for protecting the Ecological Integrity of the Aquatic Ecosystem. A Learning Plan will include the compilation and review of existing data and information and, if necessary, the collection of additional baseline data. The Learning Plan will form the basis for the setting of Transboundary Objectives, should they be required. As part of the Learning Plan, Triggers may be established to initiate various kinds of management oversight or action.	Examples of Transboundary Waters in this class include water bodies with a moderate level of existing and/or projected development. Water bodies that are stressed or vulnerable (e.g., low flows), support sensitive uses (e.g., traditional uses, drinking water supply, etc.), experience a high degree of conflict or controversy, and/or demonstrate negative conditions or trends may be moved to class 2 at a lower level of development/use than other water bodies.

Class	Key Commitments	Classification Considerations
3 Objective Setting	Set objectives or firm conditions that the responsible Party or Parties will meet. Initiate intensive Bilateral Water Management to address specific issues. Conduct site-specific analyses where needed to assess the needs for protecting the Ecological Integrity of the Aquatic Ecosystem and to establish Triggers and Transboundary Objectives. Establish joint and/or jurisdictional monitoring programs and investigations. A jurisdiction may prepare action plans to outline how they will ensure that Transboundary Objectives are met.	Examples of Transboundary Waters in this class include 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. As indicated above, some water bodies may move to class 3 at lower levels of development/use than other water bodies.
4 Objectives not met	Initiate immediate action in support of meeting the Transboundary Objective and report progress on an agreed schedule. Additional action can follow to consider alternative ways to address the situation, such as adjusting a Transboundary Objective. The terms in section 4.3 j) through m) of the Agreement apply.	The intent of the RIM approach is to prevent any water body from moving to this class. Water bodies in this class have failed to meet Transboundary Objectives and the Ecological Integrity of the Aquatic Ecosystem may not be being maintained. The responsible Party or Parties must undertake Jurisdictional Water Management action in support of meeting Transboundary Objectives. The responsible Party will consult the other Party but retain the right to select which actions are implemented in its jurisdiction. Either Party may request the consideration of alternative ways to address the situation. The Parties will establish an agreed timeframe to implement Jurisdictional Water Management action.

A3. Bilateral Water Management Actions

Bilateral Water Management actions that could apply at the different classes or under different conditions are documented in appendices or will be developed by the BMC. The intent is to provide sufficient documentation to ensure that action occurs when warranted, while giving the Parties flexibility to choose which actions are most appropriate given the actual conditions and priorities and updated information and knowledge.

Key guidelines for the selection of Bilateral Water Management actions include:

- Bilateral Water Management actions will be designed and implemented at a level of detail and rigor commensurate with the assigned class;
- The Parties will jointly decide on Bilateral Water Management actions;
- There may be both Jurisdictional Water Management actions (actions undertaken by one Party) and/or Bilateral Water Management actions (actions undertaken collaboratively by both Parties);
- There will be both mandatory and optional actions; appendices to the Agreement may define Triggers that require action to be taken, along with an illustrative set of sample actions, while leaving the choice of which specific action to the discretion of the Bilateral Management Committee;
- A diversity of sources of relevant available knowledge, including scientific, local and traditional knowledge, and information from the general public may be considered;

- Bilateral Water Management actions will be designed in recognition of data availability constraints, opportunities and needs (e.g., Transboundary Waters with limited data availability may be subject to different actions than water bodies with more sufficient data).

A4. Annual Transboundary Meeting

The RIM approach includes a mandatory annual meeting of the Parties to discuss transboundary issues. At this meeting the Parties will:

- Share information about the condition of, and trends in, the Ecological Integrity of the Aquatic Ecosystem, including but not limited to hydrological, meteorological, and ecological science, traditional knowledge and input from the general public of either Party;
- Share updated information about current and future Developments and Activities that could affect the Ecological Integrity of the Aquatic Ecosystem of the other Party;
- Share information about relevant activities, policies and programs (e.g., conservation programs, policy changes that could affect transboundary water management, etc.).

Based on updated information, the Parties will:

- Jointly determine the classification for Transboundary Waters and update the relevant appendices to this Agreement;
- Jointly develop and/or update Learning Plans, tracking metrics, Triggers and Transboundary Objectives, monitoring and other studies or investigations as required and update the relevant appendices;
- Review the effectiveness of Bilateral Water Management and Jurisdictional Water Management actions and identify additional or revised actions;
- Identify any other issues that need to be addressed.

Appendix B – **List of Transboundary Waters**

A list of Transboundary Waters relevant to the Agreement is provided in Table 2. This list does not include Groundwater which is described in Appendix F. These water bodies were identified using 1:250,000 National Topographical System (NTS) maps available from Natural Resources Canada. All major Transboundary Waters are included on the list. The list is not exhaustive; all small Transboundary Waters may not be included. If development or water use occurs on Transboundary Waters that are not listed in Table 2, the water body will be added. All Transboundary Waters with current or projected (1-5 years) development or use must be listed.

Table 2: List of AB-NWT Transboundary Waters

No.	Water Body Crossing at 60° N Latitude	Flow Direction	Longitude West	Area (km²)
1	Kakisa River tributary (Unnamed)	AB to NWT	-119.982	-[1]
2	Kakisa River 2 (final crossing into NWT)	AB to NWT	-119.948	-
3	Kakisa River 1 (first crossing into AB)	NWT to AB	-119.558	-
4	Unnamed Lake (tributary to Bistcho Lake and Petitot River)	NWT to AB	-119.117 to -119.033	-
5	Petitot River 2 (Spawn Lake)	NWT to AB	-118.467	-
6	Petitot River 1	AB to NWT	-118.158	-
7	Esmond Creek	NWT to AB	-117.867	-
8	Unnamed Creek (tributary to Hay River)	NWT to AB	-117.400	-
9	Hay River tributaries (several) (from the Cameron Hills)	NWT to AB	-117.317 to -117.083	-
10	Hay River	AB to NWT	-116.942	48,800
11	Swan Lake (tributary to Hay River)	AB to NWT	-116.767	-
12	Unnamed Creeks (2) (tributaries to Buffalo Lake)	AB to NWT	-116.500 and -116.433	-
13	Yates River	AB to NWT	-116.071	-
14	Unnamed Creek (tributary to Yates River)	AB to NWT	-115.961	-
15	Unnamed Creek (tributary to Whitesand River)	AB to NWT	-115.736	-
16	Whitesand River	AB to NWT	-115.592	3,410
17	Tourangeau Creek tributary (Unnamed)	AB to NWT	-115.508	-
18	Tourangeau Creek	AB to NWT	-115.442	-
19	Buchan Lake	AB to NWT	-114.983 to -114.900	-

[1] Indicates the drainage area upstream of the boundary crossing has yet to be determined.

No.	Water Body Crossing at 60° N Latitude	Flow Direction	Longitude West	Area (km^2)
20	Buffalo River tributaries (Unnamed)	AB to NWT	-114.817 to -114.700	-
21	Buffalo River 3 (meander-final crossing into NWT)	AB to NWT	-114.508	4,350
22	Buffalo River 2 (meander into AB)	NWT to AB	-114.500	-
23	Buffalo River 1 (first crossing into NWT)	AB to NWT	-114.492	-
24	Unnamed lake (tributary to Buffalo River)	AB to NWT	-114.317	-
25	Copp River	AB to NWT	-114.161	-
26	Unnamed Lake (tributary to Copp River)	AB to NWT	-114.033 to -113.967	-
27	Preble Creek	AB to NWT	-113.271	-
28	Little Buffalo River	AB to NWT	-112.871	3,330
29	Salt River	AB to NWT	-112.367	1,700
30	Slave River	AB to NWT	-111.833 to -111.783	606,000
31	Tethul River (tributary to Taltson River)	AB to NWT	-111.488	-
32	Donovan Lake (Tethul River)	NWT to AB	-111.225	-
33	Unnamed Lake (tributary to Donovan Lake)	AB to NWT	-111.167	-
34	Leland Lakes (Dog River)	NWT to AB	-110.983 to -110.967	-
35	Charles Lake (Tethul River)	AB to NWT	-110.600 to -110.583	-
36	Tethul River outflow from Disappointment Lake	NWT to AB	-110.483	-
37	Bayonet Lake (Tethul River)	AB to NWT	-110.308	-
38	Tethul River inflow to Largepike Lake	AB to NWT	-110.300	-
39	Harker Lake (Tethul River)	AB to NWT	-110.233	-
40	Wells Lake (Tethul River)	AB to NWT	-110.198	-
41	Miles Lake (tributary to Bedareh Lake and Hill Island River)	AB to NWT	-110.022	-

Note: Table 2 is sorted west to east by longitude. The drainage area in the upstream jurisdiction that contributes water to the boundary crossing is provided.

Appendix C – **Use of Traditional and Local Knowledge**

The Master Agreement acknowledges the need to consider traditional knowledge in cooperative water management decisions within the Basin. Traditional knowledge and local knowledge are not capitalized in this Agreement or appendices because they are not currently defined herein. Traditional and local knowledge will be defined as per the practices in section C1 below. Traditional and local knowledge are of critical importance to many Aboriginal and/or local communities. When peer reviewed by knowledge holders, traditional knowledge and local knowledge contribute to a greater understanding and more comprehensive analysis of the environment. Traditional knowledge has been considered as evidence under Canadian law.

The following practices will guide the meaningful inclusion of traditional and local knowledge under the RIM approach in Bilateral Water Management (as per the Agreement and appendices). This guidance is adapted from the Board's Traditional Knowledge & Strengthening Partnerships Committee and other published sources. The Parties see this appendix as a living document that will be informed by the future work of numerous parties, including the Parties, the Board, First Nations and Aboriginal organizations, and academics.

C1. Practices for the Use of Traditional and Local Knowledge in Bilateral Water Management

1. Acknowledge the value of traditional and local knowledge and the importance of traditional use;
2. Engage in dialogue and collaborative pursuits to better understand the basis, scope, and meanings of traditional and local knowledge and traditional use;
3. Identify the conclusions reached by the Parties regarding traditional and local knowledge;
4. Identify and implement ways to synthesize and blend traditional and local knowledge, western science and other forms of knowledge in decision-making under the RIM approach in Bilateral Water Management;
5. Establish and apply agreed definitions of traditional and local knowledge and traditional use with knowledge holders.
6. When requested by knowledge holders, ensure that the Parties protect sensitive traditional and local knowledge within the limits of a Party's applicable legislation, including;
   (a) Ensuring knowledge holders provide their informed consent for the use of their traditional and local knowledge;
   (b) Where consent is not given, respecting knowledge holders ownership and control of their traditional and local knowledge;
7. Where they exist, adhere to Party and Aboriginal community guidelines, policies or protocols regarding the collection and use of traditional and local knowledge, including:
   (a) Culturally appropriate methods of engaging with traditional and local knowledge holders when gathering knowledge;
   (b) Culturally appropriate methods of presenting traditional and local knowledge;
   (c) Culturally appropriate methods of presenting western science information related to Bilateral Water Management;
   (d) Providing reasonable benefits (e.g., cost reimbursement for participation) when working with traditional and local knowledge holders;
   (e) Following formal research licensing guidelines.

C2. Framework

The BMC will develop a framework toward meaningful inclusion of traditional and local knowledge in decision making related to Bilateral Water Management.

Appendix D – Surface Water Quantity

D1. Surface Water Quantity Classification

At the time of signing, the Slave and Hay Rivers were classified as class 3; whereas all other Transboundary Waters were classified as class 1. Rationale for the class 3 designation is included in Table 3. At the time of signing, no class 2 Transboundary Waters was identified.

Table 3: Water body classification according to RIM

Water Body	RIM Class	Rationale/Comments
Hay River	3	development is present, high traditional use, existing trends in winter flows, community drinking water supply
Slave River	3	development is present, high traditional use, existing trends in naturalized annual flows, community drinking water supply

Classification of Transboundary Waters will be reviewed at least annually by the BMC. Any Transboundary Waters subject to development or water use will be classified and added to Table 2 of Appendix B.

The BMC will work to develop a reproducible approach to classification of Transboundary Waters that meets both Parties' interests. The BMC will begin this work by reviewing relevant risk assessment tools (e.g., desktop tools for comparison of withdrawals/consumption to available water, flow statistics and/or flow needs).

Factors to be considered in the development of a reproducible approach to classification of Transboundary Waters for surface water quantity include, but are not limited to, the sensitivity of fish species and aquatic habitats, the seasonal flow fluctuations (e.g., winter and summer low flows and spring-summer floods), statistical probabilities of extreme flow rates (e.g., flood and drought risks), the average recorded flow rate (e.g. mean monthly flows), stream size (e.g., as a function of long term mean annual discharge), the annual totals of allocated withdrawals and, when required, the estimation of consumption and return flows.

The Parties have agreed to continue to support long-term surface water quantity monitoring on the Hay and Slave Rivers (Appendix I). Changes to monitoring, without discussion at the BMC, will not occur during the life of the Learning Plan.

D2. Learning Plans

A Learning Plan is required for Transboundary Waters that are class 2 or higher. The Learning Plan provides additional information to confirm or alter the assigned classification and contribute to baseline information for Transboundary Waters. See section H1 of Appendix H for a list of possible topics for a Learning Plan.

The Learning Plan is intended to facilitate the development or future development and use of Triggers (section D3) and Objectives (section D4). In support of this, tracking metrics will be developed at class 2 for information, assessment and learning purposes. Tracking metrics in water quantity conditions will include stream flow and amount of water allocated for various uses. Ratios of allocated withdrawals (or of actual consumption) to stream flow will be tracked on an instantaneous, daily, weekly, monthly or annual basis as required to support development or future development of Triggers and Objectives. Learning Plans should help to understand baseline water quantity and reflect the seasonal site-specific characteristics of each water body. This information will be used to aid with evaluation of whether a Transboundary Water should change RIM classification.

The Parties agree, 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 Bilateral Management Committee about how to take account of the effects of climate change in the setting and monitoring of Transboundary Objectives.

D3. Approach to Setting Transboundary Water Quantity Triggers

This section describes the general approach to setting Transboundary Water Quantity Triggers. Specific Triggers are defined in section D5.

As described in Appendix A, a Trigger is a pre-defined early warning of change that results in confirmation of change and Jurisdictional and/or Bilateral Water Management to address the change/trend. Multiple Triggers can be set to invoke additional actions as necessary (e.g., degrading conditions).

Triggers may be set for class 2 Transboundary Waters (where data is available) and will be set for class 3 Transboundary Waters, using the results of the Learning Plan if available, according to the RIM Approach.

For water quantity, the Parties have defined a Trigger as a percentage of the Available Water (e.g., 50%) that, if exceeded, results in Jurisdictional and/or Bilateral Water Management that will be determined by the BMC. See section D5 for specific Triggers for Hay and Slave Rivers.

D4. Approach to Setting Transboundary Water Quantity Objectives

This section describes the general approach to setting Transboundary Water Quantity Objectives. Specific Objectives are defined in section D5.

Available Water will be shared as per section 6.1 c) of the Agreement and the sharing will be formalized into a Transboundary Water Quantity Objective if the relevant Transboundary Water reaches class 3.

The setting of Transboundary Water Quantity Objectives requires site-specific knowledge of stream flow and Available Water. Long-term continuous monitoring of stream flow is important to characterize hydrology of a water body and to estimate Available Water.

For class 3 Transboundary Waters, the BMC will set Transboundary Water Quantity Objectives and identify, based on the best available scientific information and/or a desktop method and/or an instream flow needs study, the amount of water needed to maintain the Ecological Integrity of the Aquatic Ecosystem and, hence, the Available Water.

D5. Water Quantity Triggers and Objectives for Class 3 Water Bodies

For the Hay and Slave Rivers, which have been designated class 3, the following has been determined.

a) Slave River

The Parties agree to defer determination of Available Water as per section 6.3 of the Agreement with the following addition: The Parties acknowledge that, at the time of signing, 2 billion cubic meters is equivalent to 1.9% of the average annual flow of the Slave River at Fitzgerald. If there is a significant change in the average annual flow of the Slave River at Fitzgerald that results in a change from 1.9% consumptive use, it will trigger related discussions at the BMC.

b) **Other Class 3 Rivers**

This section currently includes the Hay River but will apply to any other rivers designated class 3, with the exception of the Slave River, unless otherwise agreed by the BMC.

The Parties agree that:

- There are vulnerabilities associated with winter flows and drought conditions;
- The determination of Available Water will be guided by the "modified" (see below) Alberta Desktop Method;
- The Alberta Desktop Method recommends allocating 85% of the instantaneous flow for ecosystem use, and that no abstractions of water be permitted below the weekly 20th percentile of flows; however, there are practical constraints associated with monitoring winter flows, precluding access to real time winter flow data;
- They will endeavor to avoid abstractions from flowing waters during low flow conditions;
- They will seek to improve their understanding of and ability to monitor winter flow conditions over time with the goal of improving management over time.

For the purposes of this section, "modified" means:

- Modified according to the recommendations by the Department of Fisheries and Oceans[2], which recommends allocating 90% of the instantaneous flow for ecosystem use;
- Modified to acknowledge that the goal is to achieve the lowest abstractions practicable during low flow conditions, but that abstractions may be greater than zero due to practical considerations, such as type of use, availability and extent of risk plans, and infrastructure (e.g., storage).

Given that the Parties agree that the determination of Available Water will be guided by the "modified" Alberta Desktop Method, and that the Available Water will be shared equally, the Parties define the following interim Triggers for the Hay River:

Trigger 1 is defined as water allocations reaching 50% of a Party's share of Available Water.
Trigger 2 is defined as water consumption reaching 80% of a Party's share of Available Water.

This approach will be used for other class 3 rivers unless agreed otherwise by the BMC.

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[2] Framework for Assessing the Ecological Flow Requirements to Support Fisheries in Canada. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2013/017.

Exceedance of these Triggers will result in management action as outlined in Table 4.

Elements of water quantity for the Learning Plan for the Slave River and Hay River may include, but are not limited to:

- Identification of science and monitoring gaps;
- Hydrometric monitoring of flow rate;
- Key hydrologic features, such as lakes;
- Trends in total annual and seasonal flows;
- Frequency and severity of flood and drought;
- Licensed allocation as compared to above, or other key tracking metrics;
- Key conditions and mitigation measures included in water licenses;
- Groundwater and surface water interactions;
- Understanding the relationship between flow and water quality;
- Understanding the relationship between flow and biology.

D6. Water Quantity Conditions and Actions

Table 4 outlines some of the required responses to certain water quantity conditions that may arise in Transboundary Waters. This list was not exhaustive at the time of signing and the BMC will add to it as it deems necessary. It includes Water Quantity Triggers from section D5, as well as other conditions.

Table 4: Conditions and Associated Actions

Water Quantity Condition	**Required Response**	**Sample Actions / Comments**
· Development and/or water use occurs in the Transboundary Water not listed in Appendix B	· The Transboundary Water will be added to the list in Appendix B. · Transboundary Water is classified	· Licensed withdrawals are tracked.
· Transboundary Water is designated as a class 2	· Learning Plan is developed and implemented. · Tracking metrics are determined. · Triggers may be developed · Amounts of withdrawals and return flows are estimated.	· Compile baseline data and assess need for new information. · Track ratios of licensed, other authorized, or actual withdrawals to stream flow. · Improve understanding of Aquatic Ecosystem. · Prepare for the setting of Transboundary Water Quantity Objectives, if required.

Water Quantity Condition	Required Response	Sample Actions / Comments
· A drought (or flood) event occurs in any classified Transboundary Water	· Notify other jurisdiction of event and identify any actions that will be taken immediately or if event persists.	· If required, assess impact to water quality, Groundwater and biological components of the Aquatic Ecosystem. · Determine whether a Trigger or Transboundary Water Quantity Objective (if applicable) has been reached. · Suspend uses as required to maintain Aquatic Ecosystem health
· Transboundary Water is designated as a class 3	· Learning Plans and/or Tracking metrics adjusted as needed · Develop or apply Triggers and set Transboundary Water Quantity Objectives based on an agreed desktop method or an instream flow needs study.	· Tracking metrics changed from licensed allocations to actual withdrawals · Assess need to conduct instream flow needs study.
· Total allocated water (licenses and other authorized withdrawals) in upstream jurisdiction exceeds Trigger 1 and/or 2.	· The BMC will seek confirmation of actual withdrawals and estimated return flows.	· Refine estimate of return flows
· Actual water consumption exceeds Trigger 2 (approaches Transboundary Water Quantity Objective)	· If Transboundary Water Quantity Objectives have not been set using an instream flow needs study, revise Trigger and/or Transboundary Water Quantity Objectives based on a refined desktop method or proceed with the determination of the Available Water through an Instream Flow Needs Study.	· Jurisdictional Water Management
· Actual water consumption exceeds Transboundary Water Quantity Objective	· Clauses in sections 4.3 j) through m) Agreement apply. · Transboundary Water may be designated a class 4	· Class 4 Jurisdictional Water Management actions, if designated.

Appendix E – Surface Water Quality

E1. Surface Water Quality Classification

At the time of signing, the Slave and Hay Rivers were classified as a class 3 for water quality (Table 5). All other Transboundary Waters listed in Table 2 were classified as class 1 and no class 2 Transboundary Waters were identified.

Table 5: Water body classification according to RIM

Water Body	RIM Class	Rationale/Comments
Hay River	3	Development is present, high traditional use, existing annual trends in water quality, community drinking water supply
Slave River	3	Development is present, high traditional use, existing trends in water quality, community drinking water supply

Ongoing monitoring of water quality in Transboundary Waters is essential for refining the approach used to assess risk to surface water quality. The Parties have agreed to continue long-term surface water quality monitoring on the Slave and Hay Rivers as per Appendix I. Changes to monitoring, without discussion at the BMC, will not occur during the life of the Learning Plan. The water quality monitoring on the Salt, Little Buffalo and Buffalo Rivers was discontinued in 2010. To date, no water quality monitoring has taken place on the Whitesand and Yates Rivers.

Classification of Transboundary Waters will be reviewed at least annually by the BMC.

The Parties agree that a reproducible approach for classification of Transboundary Waters is warranted. The BMC will develop an approach that meets both Parties' interests. The BMC will begin this work by reviewing the existing draft *Water Quality Ranking System to Classify Transboundary Water Bodies* provided by British Columbia and the *Receiving Water Classification System for the NWT* provided by the Northwest Territories. Other relevant approaches will also be considered.

E2. Learning Plans

A Learning Plan is required for Transboundary Waters that are class 2 or higher. The Learning Plan provides additional information to confirm or alter the assigned classification and contribute to baseline information for Transboundary Waters. See section H1 of Appendix H for a list of candidate topics for a Learning Plan.

The Learning Plan will include a screening level risk assessment which will incorporate a monitoring strategy, dependent upon the availability of information, and the level of risk to receptors. A key objective of the Learning Plan will be to evaluate the current and projected level of risk posed to water quality, quantity, biology and the Aquatic Ecosystem. This will involve the review of all available relevant watershed information (e.g., land and water use, ongoing and proposed resource development, existing water quality, quantity, biological Indicators data, and traditional use values) and the preparation of a conceptual model that describes the:

- Point and non-point source discharges;
- Parameters of concern and their environmental fate and transport pathways;
- Human, biological and ecological receptors.

The Learning Plan is intended to facilitate the development or future development and use of Triggers (sections E3 and E4) and Objectives (section E5). In support of this, tracking metrics will be developed at class 2 for information, assessment and learning purposes. They will be developed using valid methods to help understand baseline water quality, identify changes in water quality conditions, assess the risk of development, and enable the BMC to identify potential provincial/territorial water quality issues. Generally, they will be based on the same or complementary methods as those used for Triggers (see section E3), although there may be additional tracking metrics that require different methods (e.g., ratios). Tracking metrics will aid with the evaluation of whether a water body should change RIM classification.

The Learning Plan and the information gathered from tracking metrics will be useful to support the development of Triggers and Transboundary Water Quality Objectives (section E3 and E5), as required (see section H1 of Appendix H).

The Parties agree, 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 Bilateral Management Committee about how to take account of the effects of climate change in the setting and monitoring of Transboundary Objectives.

E3. Approach to Setting Water Quality Triggers

This section describes the general approach to setting Water Quality Triggers. Triggers are defined specifically in section E4.

As described in Appendix A, a Trigger is a pre-defined early warning of change that results in confirmation of change and Jurisdictional and/or Bilateral Water Management to address the change/trend. Water Quality Triggers may be defined for class 2 and will be defined for class 3. Triggers may include water quality parameters as well as human, biological, or ecological Indicators. Triggers will help to understand ambient water quality conditions, identify changes in water quality conditions and enable the BMC to identify potential interprovincial/territorial water quality issues. The Triggers also help to assess the impact of proposed or existing developments on water quality and enable the BMC to identify and discuss potential water quality issues.

The Parties agree that their intent is to manage water quality within the range of natural variability. Triggers are an aid to this. It is understood that Water Quality Objectives, when they are set, may be beyond the range of natural variability, while still being suitably precautionary (per section 7 of the Agreement) and in accordance with section E5 below.

Triggers will reflect the site-specific characteristics of each water body. Where possible, seasonal site-specific ambient water quality data will be used. Triggers will be established based on existing scientific literature (Table 6). They will cover a broad range of parameters to facilitate learning.

Table 6: Definitions, examples and potential management actions for Triggers that have been or will be set for water quality parameters as identified through the Learning Plan.

	Definition	Examples	Potential Management Actions
Trigger 1	· A pre-defined early warning of potential changes in typical conditions which results in Jurisdictional and/or Bilateral Water Management to confirm that change. Multiple Triggers can be set to invoke additional actions if conditions decline.	· Exceedance of a water quality concentration based on background conditions, beyond what is statistically expected. · Shift in central tendency (e.g., 50th percentile) and/or some other percentile (e.g., 75th) · A statistically significant degrading trend in water quality · A change in the dissolved:total ratio. · A pre-defined degree of change in land or water use.	· Trigger 1 can be used either alone or in conjunction with Trigger 2 · Jointly review water quality data/changes · Confirm the change is real · Jointly investigate cause and risk (e.g., land uses change) · Investigate other media (hydrometric, sediment and/or biota), as appropriate, to provide supporting evidence
Trigger 2	· A second early warning indication that extreme conditions are changing which results in Jurisdictional and/or Bilateral Water Management	· A second pre-defined early warning to provide additional information to confirm changes in conditions · For water quality or biological parameters, this would be defined statistically (e.g., 90th percentile background or 95 upper prediction limits)	· Trigger 2 can be used either alone or in conjunction with Trigger 1 · Continue investigation using an ecosystem approach using all available evidence (i.e., weight of evidence approach) · Adjust monitoring design (e.g., increase frequency, parameters, and/or sites) as necessary · Compare to upstream, downstream and/or regional sites · Discuss the need to change to class 3

E4. Interim Water Quality Triggers

The Parties have agreed to use the best currently available sources of information to establish Interim Water Quality Triggers. For these interim triggers, they have agreed to use the method defined in (HDR, 2014[3], 2015[4]). They acknowledge that there are a number of outstanding methodological questions, including but not limited to:

- Number of seasons and their definition
- Which percentile is the best to use
- How to use the triggers (e.g., separately and/or together) to draw conclusions about trends

They expect that mutual learning will occur through implementation and that they may modify the approach based on implementation experience.

The Parties have defined the following interim triggers for the parameters in Tables 7 and 8:

- Trigger 1 is defined as exceedance of the 50th percentile value beyond what is statistically expected (potential changes in typical conditions)
- Trigger 2 is defined as exceedance of the 90th percentile value beyond what is statistically expected (potential changes in extreme conditions)

When these values are exceeded at a frequency beyond what is statistically expected, the actions in Table 6 will be initiated. Trigger 1 and 2 may be considered separately and/or together in order to improve understanding and identify appropriate action.

The 50th and 90th percentiles have been calculated for water quality parameters that are part of the Slave River (at Fitzgerald) and Hay River (near the Alberta/NWT Boundary) water quality monitoring programs (Tables 7 and 8; HDR, 2014 & 2015).

Methods will be explored to develop Triggers for organic compounds (e.g., hydrocarbons, pesticides and herbicides) not already listed in Table 10 during the first Learning Plan.

Some of the data from total and dissolved mercury samples collected on the Slave and Hay Rivers historically has been deemed suspect (i.e., problems with field sampling techniques) by the organization that collected the samples. The BMC will review all total, dissolved and methyl mercury data collected from the Slave and Hay Rivers to determine appropriate interim Triggers for mercury within the first two years of signing.

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[3] HDR, Decision Economics. Site Specific Water Quality Objectives at Six Transboundary Rivers in the Northwest Territories: Technical Report. March 2014.

[4] HDR, Decision Economics. Site Specific Water Quality Objectives at the Hay and Slave Transboundary Rivers: Technical Report. February 2015.

Table 7. Reference Percentiles for Surface Water Quality Triggers for the Slave River at Fitzgerald

	Slave River at Fitzgerald													
Objective Class	**Seasonal**								**Open Water/Under Ice**				**Annual**	
Objective SubClass	**Spring**		**Summer**		**Fall**		**Winter**		**Open Water**		**Under Ice**			
Percentile	**50thP**	**90thP**	**50thP**	**90thP**	**50thP**	**90thP**	**50thP**	**90thP**	**50thP**	**90thP**	**50thP**	**90thP**	**50thP**	**90thP**
Alkalinity (mg/L)	84.7	93.5	85.9	97.0	81.0	92.3	84.4	93.6	*	*	*	*	*	*
Dissolved Oxygen (mg/L)	--	--	--	--	--	--	--	--	9.70	12.35	13.10	14.07	*	*
pH (pH units)	7.91	8.10	7.99	8.18	7.97	8.14	7.89	8.06	*	*	*	*	*	*
Specific Conductance (µS/cm)	212	262	212	256	200	247	210	240	*	*	*	*	*	*
Total Dissolved Solids (mg/L)	--	--	--	--	--	--	--	--	146	209	130	164	*	*
Total Suspended Solids (mg/L)	210	1370	148	1117	59	141	18	360	*	*	*	*	*	*
Turbidity (NTU)	141	850	81	1591	49	81	14	211	*	*	*	*	*	*
Calcium – dissolved (mg/L)	28.9	33.9	28.8	34.3	26.8	30.7	28.3	31.9	*	*	*	*	*	*
Chloride – dissolved (mg/L)	4.40	7.02	3.77	5.90	5.97	7.27	5.24	7.60	*	*	*	*	*	*
Magnesium – dissolved (mg/L)	6.49	7.40	6.91	7.94	6.52	7.42	6.58	7.06	*	*	*	*	*	*
Sodium – dissolved (mg/L)	6.50	8.12	5.96	7.30	6.90	8.61	6.09	7.74	*	*	*	*	*	*
Potassium – dissolved (mg/L)	1.20	2.16	0.95	1.26	0.86	1.00	0.84	1.50	*	*	*	*	*	*
Sulphate - dissolved (mg/L)	20.5	27.2	18.5	28.1	17.4	21.5	17.5	20.8	*	*	*	*	*	*
Ammonia - dissolved (mg/L)	--	--	--	--	--	--	--	--	0.013	0.052	0.018	0.107	*	*
Nitrogen – dissolved (mg/L)	0.270	0.544	0.240	0.425	0.180	0.356	0.206	0.527	*	*	*	*	*	*
Nitrate + Nitrite (mg/L)	--	--	--	--	--	--	--	--	--	--	--	--	0.070	0.201
Organic Carbon – dissolved (mg/L)	8.11	13.24	7.84	12.36	5.80	9.04	4.00	6.22	*	*	*	*	*	*
Organic Carbon – particulate (mg/L)	4.16	12.98	3.80	26.97	1.70	2.90	0.72	8.85	*	*	*	*	*	*

	Slave River at Fitzgerald													
Objective Class	**Seasonal**								**Open Water/Under Ice**				**Annual**	
Objective SubClass	**Spring**		**Summer**		**Fall**		**Winter**		**Open Water**		**Under Ice**			
Percentile	**50thP**	**90thP**	**50thP**	**90thP**	**50thP**	**90thP**	**50thP**	**90thP**	**50thP**	**90thP**	**50thP**	**90thP**	**50thP**	**90thP**
Phosphorus – dissolved (mg/)	0.016	0.061	0.012	0.033	0.010	0.014	0.008	0.020	*	*	*	*	*	*
Phosphorus – total (mg/L)	0.207	0.695	0.189	1.718	0.078	0.140	0.030	0.382	*	*	*	*	*	*
Aluminum – dissolved (µg/L)	--	--	--	--	--	--	--	--	--	--	--	--	29.1	90.4
Aluminum – total (µg/L)	--	--	--	--	--	--	--	--	1395	6192	223	5132	*	*
Antimony – dissolved (µg/L)	--	--	--	--	--	--	--	--	--	--	--	--	0.155	0.359
Antimony – total (µg/L)	--	--	--	--	--	--	--	--	--	--	--	--	0.130	0.291
Arsenic – dissolved (µg/L)	--	--	--	--	--	--	--	--	--	--	--	--	0.410	0.560
Arsenic – total (µg/L)	--	--	--	--	--	--	--	--	--	--	--	--	1.08	3.53
Barium – dissolved (µg/L)	--	--	--	--	--	--	--	--	--	--	--	--	47.0	54.3
Barium – total (µg/L)	116	391	108	541	73	102	80	160	*	*	*	*	*	*
Beryllium – dissolved (µg/L)	--	--	--	--	--	--	--	--	--	--	--	--	0.005	0.011
Beryllium – total (µg/L)	--	--	--	--	--	--	--	--	0.110	0.686	0.050	0.318	*	*
Bismuth – dissolved (µg/L)	--	--	--	--	--	--	--	--	--	--	--	--	0.0020	0.0063
Bismuth – total (µg/L)	--	--	--	--	--	--	--	--	--	--	--	--	0.018	0.052
Boron – dissolved (µg/L)	--	--	--	--	--	--	--	--	--	--	--	--	12.7	17.9
Boron – total (µg/L)	--	--	--	--	--	--	--	--	--	--	--	--	13.9	18.9
Cadmium – dissolved (µg/L)	--	--	--	--	--	--	--	--	--	--	--	--	0.021	0.112
Cadmium – total (µg/L)	0.40	1.45	0.30	3.52	0.10	0.94	0.11	1.00	*	*	*	*	*	*
Chromium – dissolved (µg/L)	--	--	--	--	--	--	--	--	--	--	--	--	0.130	0.480
Chromium – total (µg/L)	--	--	--	--	--	--	--	--	2.21	14.70	0.64	8.70	*	*

	Slave River at Fitzgerald													
Objective Class	**Seasonal**								**Open Water/Under Ice**				**Annual**	
Objective SubClass	**Spring**		**Summer**		**Fall**		**Winter**		**Open Water**		**Under Ice**			
Percentile	**50th P**	**90th P**	**50th P**	**90th P**	**50th P**	**90th P**	**50th P**	**90th P**	**50th P**	**90th P**	**50th P**	**90th P**	**50th P**	**90th P**
Cobalt – dissolved (µg/L)	--	--	--	--	--	--	--	--	--	--	--	--	0.060	0.144
Cobalt – total (µg/L)	2.15	8.41	1.76	14.30	0.80	1.72	0.50	3.25	*	*	*	*	*	*
Copper – dissolved (µg/L)	--	--	--	--	--	--	--	--	--	--	--	--	2.07	4.21
Copper – total (µg/L)	7.05	23.91	5.00	41.10	2.78	4.57	2.00	10.42	*	*	*	*	*	*
Iron – dissolved (µg/L)	--	--	--	--	--	--	--	--	*	*	*	*	91	211
Iron – total (µg/L)	--	--	--	--	--	--	--	--	2910	16160	473	11180	*	*
Lead – dissolved (µg/L)	--	--	--	--	--	--	--	--	--	--	--	--	0.129	0.417
Lead – total (µg/L)	3.18	11.72	2.77	24.40	1.25	3.06	0.90	6.62	*	*	*	*	*	*
Lithium – dissolved (µg/L)	--	--	--	--	--	--	--	--	--	--	--	--	3.90	5.30
Lithium – total (µg/L)	--	--	--	--	--	--	--	--	7.22	21.04	4.00	11.86	*	*
Manganese – dissolved (µg/L)	--	--	--	--	--	--	--	--	--	--	--	--	3.12	9.07
Manganese – total (µg/L)	--	--	--	--	--	--	--	--	72	361	16	359	*	*
Mercury – dissolved (µg/L)	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury – total (µg/L)	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Molybdenum – dissolved (µg/L)	--	--	--	--	--	--	--	--	--	--	--	--	0.770	0.954
Molybdenum – total (µg/L)	--	--	--	--	--	--	--	--	0.631	1.124	0.606	0.800	*	*
Nickel – dissolved (µg/L)	--	--	--	--	--	--	--	--	--	--	--	--	1.24	2.16
Nickel – total (µg/L)	6.85	26.44	5.55	41.00	2.80	6.21	1.70	9.97	*	*	*	*	*	*
Selenium – dissolved (µg/L)	--	--	--	--	--	--	--	--	--	--	--	--	0.210	0.310
Selenium – total (µg/L)	--	--	--	--	--	--	--	--	--	--	--	--	0.230	0.382

	Slave River at Fitzgerald													
Objective Class	**Seasonal**								**Open Water/Under Ice**				**Annual**	
Objective SubClass	**Spring**		**Summer**		**Fall**		**Winter**		**Open Water**		**Under Ice**			
Percentile	**50thP**	**90thP**	**50thP**	**90thP**	**50thP**	**90thP**	**50thP**	**90thP**	**50thP**	**90thP**	**50thP**	**90thP**	**50thP**	**90thP**
Silver – dissolved (µg/L)	--	--	--	--	--	--	--	--	--	--	--	--	0.0022	0.015
Silver – total (µg/L)	--	--	--	--	--	--	--	--	0.048	0.133	0.100	0.157	*	*
Strontium – dissolved (µg/L)	--	--	--	--	--	--	--	--	--	--	--	--	134	157
Strontium – total (µg/L)	--	--	--	--	--	--	--	--	147	192	133	158	*	*
Thallium – dissolved (µg/L)	--	--	--	--	--	--	--	--	--	--	--	--	0.009	0.024
Thallium – total (µg/L)	--	--	--	--	--	--	--	--	--	--	--	--	0.030	0.138
Uranium - dissolved (µg/L)	--	--	--	--	--	--	--	--	--	--	--	--	0.409	0.539
Uranium - total (µg/L)	--	--	--	--	--	--	--	--	--	--	--	--	0.510	1.060
Vanadium – dissolved (µg/L)	--	--	--	--	--	--	--	--	--	--	--	--	0.351	0.537
Vanadium – total (µg/L)	5.28	19.47	3.78	39.85	1.80	4.71	0.70	8.40	*	*	*	*	*	*
Zinc – dissolved (µg/L)	--	--	--	--	--	--	--	--	--	--	--	--	1.00	7.80
Zinc – total (µg/L)	20.0	79.4	13.2	146.5	6.7	14.9	7.4	38.8	*	*	*	*	*	*

Notes:

1. 50thP: Trigger 1 (50th percentile; median); 90thP: Trigger 2 (90th percentile)
2. "--" Less than 30 observations. Trigger values will be calculated and tested during the Learning Plan when sufficient data (n≥30) is available.
3. "*"In accordance with section E3, only the most detailed trigger values are included in this table. All subclass trigger values are included in the Technical Appendix entitled: Site Specific Water Quality Objectives at the Hay and Slave Transboundary Rivers: Technical Report (HDR Decision Economics, February 2015) and are available for testing during the Learning Plan.
4. Spring: May and June, Summer: July and August, Fall: September and October, Winter: November to April
5. Open Water: Spring, Summer and Fall; Ice Covered: Winter

Table 8. Reference Percentiles for Surface Water Quality Triggers for the Hay River near the Alberta/NWT Boundary

	Hay River near the Alberta / NWT Boundary					
Objective Class	**Open Water/Under Ice**				**Annual**	
Objective SubClass	**Open Water**		**Under Ice**			
Percentile	**50^{th}P**	**90^{th}P**	**50^{th}P**	**90^{th}P**	**50^{th}P**	**90^{th}P**
Alkalinity (mg/L)	93	127	191	272	*	*
Dissolved Oxygen (mg/L)	8.80	11.22	5.75	10.10	*	*
pH (pH units)	7.81	8.12	7.46	7.79	*	*
Specific Conductance (µS/cm)	322	401	584	793	*	*
Total Dissolved Solids (mg/L)	249	302	414	549	*	*
Total Suspended Solids (mg/L)	41.0	218.0	6.0	12.0	*	*
Turbidity (NTU)	33.1	149.0	12.5	20.5	*	*
Calcium – dissolved (mg/L)	40.0	49.0	73.7	99.5	*	*
Chloride – dissolved (mg/L)	2.84	5.21	7.42	12.27	*	*
Magnesium – dissolved (mg/L)	11.3	14.4	21.4	29.3	*	*
Sodium – dissolved (mg/L)	12.5	15.9	21.5	32.7	*	*
Potassium – dissolved (mg/L)	1.90	2.67	2.42	3.12	*	*
Sulphate - dissolved (mg/L)	61.0	88.4	105.0	141.4	*	*
Ammonia - dissolved (mg/L)	0.018	0.054	0.070	0.217	*	*
Nitrogen – dissolved (mg/L)	0.617	1.009	0.924	1.498	*	*
Nitrate + Nitrite (mg/L)	--	--	--	--	0.090	0.587
Organic Carbon – dissolved (mg/L)	25.6	32.7	28.2	37.2	*	*
Organic Carbon – particulate (mg/L)	2.10	4.77	0.68	1.57	*	*

	Hay River near the Alberta / NWT Boundary					
Objective Class	**Open Water/Under Ice**				**Annual**	
Objective SubClass	**Open Water**		**Under Ice**			
Percentile	**50thP**	**90thP**	**50thP**	**90thP**	**50thP**	**90thP**
Phosphorus – dissolved (mg/)	0.025	0.050	0.027	0.049	*	*
Phosphorus – total (mg/L)	0.107	0.256	0.054	0.113	*	*
Aluminum – dissolved (µg/L)	--	--	--	--	*[22.00]*	*[47.69]*
Aluminum – total (µg/L)	436	2086	89	211	*	*
Antimony – dissolved (µg/L)	--	--	--	--	*[0.16]*	*[0.20]*
Antimony – total (µg/L)	--	--	--	--	0.108	0.168
Arsenic – dissolved (µg/L)	--	--	--	--	*[0.765]*	*[1.153]*
Arsenic – total (µg/L)	--	--	--	--	*[1.49]*	*[3.27]*
Barium – dissolved (µg/L)	--	--	--	--	*[41.40]*	*[58.84]*
Barium – total (µg/L)	60	102	80	110		
Beryllium – dissolved (µg/L)	--	--	--	--	*[0.01]*	*[0.02]*
Beryllium – total (µg/L)	0.050	0.176	0.050	0.050		
Bismuth – dissolved (µg/L)	--	--	--	--	*[0.003]*	*[0.005]*
Bismuth – total (µg/L)	--	--	--	--	*[0.01]*	*[0.03]*
Boron – dissolved (µg/L)	--	--	--	--	*[30.00]*	*[49.49]*
Boron – total (µg/L)	--	--	--	--	31.95	47.25
Cadmium – dissolved (µg/L)	--	--	--	--	*[0.03]*	*[0.06]*
Cadmium – total (µg/L)	0.120	0.500	0.200	0.520	*	*
Chromium – dissolved (µg/L)	--	--	--	--	*[0.14]*	*[0.21]*
Chromium – total (µg/L)	0.790	3.370	0.344	0.660	*	*

	Hay River near the Alberta / NWT Boundary					
Objective Class	**Open Water/Under Ice**				**Annual**	
Objective SubClass	**Open Water**		**Under Ice**			
Percentile	**50th P**	**90th P**	**50th P**	**90th P**	**50th P**	**90th P**
Cobalt – dissolved (µg/L)	--	--	--	--	*[0.21]*	*[0.50]*
Cobalt – total (µg/L)	0.86	2.75	0.50	1.30	*	*
Copper – dissolved (µg/L)	--	--	--	--	*[2.04]*	*[3.35]*
Copper – total (µg/L)	3.00	7.01	2.10	3.10	*	*
Iron – dissolved (µg/L)	--	--	--	--	*[484.00]*	*[926.20]*
Iron – total (µg/L)	1790	6434	2080	3112	*	*
Lead – dissolved (µg/L)	--	--	--	--	*[0.15]*	*[0.25]*
Lead – total (µg/L)	0.90	3.40	0.50	1.30	*	*
Lithium – dissolved (µg/L)	--	--	--	--	*[13.30]*	*[22.12]*
Lithium – total (µg/L)	13.90	23.98	24.15	56.11	*	*
Manganese – dissolved (µg/L)	--	--	--	--	*[16.45]*	*[252.60]*
Manganese – total (µg/L)	78	169	192	666	*	*
Mercury – dissolved (µg/L)	--	--	--	--	--	--
Mercury – total (µg/L)	--	--	--	--	--	--
Molybdenum – dissolved (µg/L)	--	--	--	--	*[0.76]*	*[1.00]*
Molybdenum – total (µg/L)	0.76	1.22	0.62	1.05	*	*
Nickel – dissolved (µg/L)	--	--	--	--	*[3.17]*	*[3.80]*
Nickel – total (µg/L)	4.19	9.19	3.50	5.36	*	*
Selenium – dissolved (µg/L)	--	--	--	--	*[0.21]*	*[0.37]*
Selenium – total (µg/L)	--	--	--	--	0.24	0.39

	Hay River near the Alberta / NWT Boundary					
Objective Class	**Open Water/Under Ice**				**Annual**	
Objective SubClass	**Open Water**		**Under Ice**			
Percentile	**50thP**	**90thP**	**50thP**	**90thP**	**50thP**	**90thP**
Silver – dissolved (µg/L)	--	--	--	--	*[0.004]*	*[0.008]*
Silver – total (µg/L)	--	--	--	--	0.013	0.066
Strontium – dissolved (µg/L)	--	--	--	--	*[138.00]*	*[264.60]*
Strontium – total (µg/L)	126	156	224	305	*	*
Thallium – dissolved (µg/L)	--	--	--	--	*[0.008]*	*[0.014]*
Thallium – total (µg/L)	--	--	--	--	0.017	0.066
Uranium - dissolved (µg/L)	--	--	--	--	*[0.54]*	*[1.47]*
Uranium - total (µg/L)	--	--	--	--	0.645	1.494
Vanadium – dissolved (µg/L)	--	--	--	--	*[0.42]*	*[0.54]*
Vanadium – total (µg/L)	1.60	6.32	0.50	0.86	*	*
Zinc – dissolved (µg/L)	--	--	--	--	*[1.28]*	*[12.03]*
Zinc – total (µg/L)	6.3	22.5	4.9	17.0	*	*

Notes:

1. 50thP: Trigger 1 (50th percentile; median); 90thP: Trigger 2 (90th percentile)
2. "--" Less than 30 observations. Trigger values will be calculated and tested during the Learning Plan when sufficient data (n≥30) is available.
3. "*"In accordance with section E3, only the most detailed trigger values are included in this table. All subclass trigger values are included in the Technical Appendix entitled: Site Specific Water Quality Objectives at the Hay and Slave Transboundary Rivers: Technical Report (HDR Decision Economics, February 2015) and are available for testing during the Learning Plan.
4. Spring: May and June, Summer: July and August, Fall: September and October, Winter: November to April
5. Open Water: Spring, Summer and Fall; Ice Covered: Winter
6. Values in square brackets are preliminary calculations based on n=26 or 27. They will be recalculated when n=30.

E5. Approach to Setting Transboundary Water Quality Objectives

This section describes the general approach to setting Water Quality Objectives.

For class 3 Transboundary Waters, Transboundary Water Quality Objectives will be set to protect the most sensitive use/user of the water body which includes:

- Drinking water;
- Traditional uses;
- Aquatic life;
- Wildlife;
- Agriculture (irrigation and livestock watering);
- Recreation and aesthetics;
- Industrial water supplies including food processing.

In setting Transboundary Water Quality Objectives, the Parties will:

- Consider a range of relevant methods;
- Select methods that are credible and transparent;
- Utilize relevant science and traditional and local knowledge;
- Ensure that methods and resulting Transboundary Water Quality Objectives are based on a weight-of-evidence approach (including science and traditional knowledge);
- Use best available data and information, and improve / adapt over time;
- Consider the ecological significance of trends in water quality and quantity;
- Design Transboundary Water Quality Objectives to protect all uses, including traditional uses;
- For the protection of aquatic life, design Transboundary Water Quality Objectives to protect the most sensitive species at all life stages;
- Consider the potential for synergistic and cumulative effects from multiple sources and parameters;
- Recognize each Party’s right to use water and equitably share the assimilative capacity;
- Recognize that NWT has obligations to the terms of land claims agreements, which the Parties have reviewed and understood;
- Meaningfully engage other interested third parties and bring their input to the BMC.

The Parties agree that the approach to develop and implement Transboundary Water Quality Objectives requires further discussion and resources (Table 9). The Parties also agree that the task to develop Transboundary Water Quality Objectives is of utmost priority and work will begin on objective development within the first year of the Agreement being signed.

Table 9: Definitions, examples and potential management actions for Transboundary Water Quality Objectives

Definition	Examples	Potential Management Actions
· A Transboundary Water Quality Objective is a conservative value that is protective of all uses of the water body, including the most sensitive use. · Exceedance of a Transboundary Water Quality Objective identifies an unacceptable change and results in Jurisdictional and/or Bilateral Water Management including the responsible jurisdiction taking necessary action to stop trend and/or exceedance(s).	· A defined numerical value agreed to by both Parties through the BMC · A narrative statement describing the biological characteristics of the ecosystem e.g., healthy fish populations	· Responsible jurisdiction takes necessary Jurisdictional Water Management action to stop trend and/or exceedance(s). · Exceedance of a Transboundary Water Quality Objective may move the water body from a class 3 to a class 4.

E6. Toxic, Bioaccumulative and Persistent Substances

As per section 7 d) of the Agreement, 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 refers to reducing, in the medium- to long-term, the concentration of designated substances to levels below or at the limits of measurable concentrations. To meet this commitment, the Parties agree as follows.

a) The BMC will maintain and periodically update a list of substances that are subject to this commitment. A number of organizations and delegations including but not limited to those listed below have identified several human-made substances that have been slated for virtual elimination.

- Health Canada (Pest Management Regulatory Agency's Strategy for Implementing the Toxic Management Substances Policy)
- Environment Canada (Environment Canada's Risk Management Program: Toxic Substances Management Policy)
- Stockholm Convention (Persistent Organic Pollutants requiring control, Canada is a signatory)

The BMC will consider these and other relevant lists in developing and updating a list of substances subject to section 7 d) of the Agreement.

b) The current list of substances subject to section 7 d) of the Agreement is shown in Table 10, along with locations of monitoring. Those substances marked with a ✓ currently form part of the Slave River and Hay River Water Quality Monitoring Programs. Monitoring will continue unless a risk assessment demonstrates that a change is warranted. Substances may move from “monitored’ to “not monitored” status upon agreement by the BMC. Substances that are not currently monitored are marked with an X in Table 10. Should an unmonitored substance be detected by another party, this information will be evaluated by the BMC to determine if the substance should be monitored. Monitoring of these substances will be prioritized commensurate with the level of risk.

c) The BMC will assess the risks associated with the substances in Table 10 as part of Learning Plans. Monitoring efforts commensurate with that level of risk should be undertaken. If any of these substances are detected at the Transboundary Waters[5] monitoring sites and have the potential to alter the Ecological Integrity of the Aquatic Ecosystem, the Party will identify and implement appropriate courses of action, including continued prioritised monitoring of that substance. Monitoring priorities (i.e., species, frequencies) and management will be discussed at BMC and given to the substances that result from ongoing anthropogenic activities in the basins. It is recognized that, in some cases, it will take time to identify and implement alternative courses of action. The Parties will promote the use of safer chemical substances by supporting

[5] Presently, water quality monitoring for VE substances occurs at three AB-NWT transboundary water quality monitoring sites: 1) Slave River at Fitzgerald (AB), 2) Slave River at Fort Smith (NWT) and 3) Hay River near the Alberta-NWT Boundary (NWT).

technologies that reduce or eliminate the use and release of substances that have been deemed toxic, bioaccumulative and persistent.

d) The transboundary monitoring results of these substances will be shared with the Government of Canada's Chemicals Management Plan (CMP) Stakeholder Advisory Council (Health Canada) to raise awareness and, within reason, help to understand potential sources. The CMP describes the Government of Canada's existing monitoring commitments (such as the Great Lakes Water Quality Agreement, Stockholm Convention on Persistent Organic Pollutants) as well as being responsive to newer emerging contaminants of concern.

Table 10: Substances that have been listed as persistent, bioaccumulative and toxic in accordance with E6 (a).

Substance	**Monitored at Slave/Fitzgerald**	**Monitored at Slave/Smith**	**Monitored at Hay/Boundary**	**Not Monitored**
Aldrin	✓	✓	✓	
Chlordane	✓	✓	✓	
Dieldrin	✓	✓	✓	
Endosulfan	✓	✓	✓	
Endrin	✓	✓	✓	
Heptachlor	✓	✓	✓	
Hexachlorobenzene	✓	✓	✓	
Hexachlorobutadiene	✓		✓	
Hexachlorcyclohexane (HCH; alpha, beta,	✓	✓	✓	
Mirex	✓	✓	✓	
DDD, DDE, DDT	✓	✓	✓	
Toxaphene		✓		
PCBs	✓	✓	✓	
Pentachlorobenzene	✓	✓	✓	
Dioxins and Furans				X
Chlordecone				X
Heptabromodiphenyl ether (Hepta-BDE)				X
Hexabromobiphenyl (HBB)				X
Hexabromobiphenyl ether (Hexa BDE)				X
Octachlorostyrene				X
Pentabromodiphenyl ether (Penta-BDE)				X
Perfluorooctane sulfonate				X
Tetrabromodiphenyl ether (Tetra-BDE)				X

Appendix F – Groundwater

F1. Classification of Transboundary Groundwater

Hydrogeological information to delineate Transboundary Groundwater is scarce and aquifers in this area have not been fully defined and mapped. However, watershed boundaries can be used as a surrogate for delineating Transboundary Groundwater at the sub-basin level. These surrogates are referred to as Groundwater areas, which will be used until more information is available and aquifers are mapped. Groundwater areas provide an area-based framework for data collection and synthesis and identification of key information gaps. It is assumed that topographic slope reflects shallow Groundwater flow directions and that surface sub-basins generally reflect Groundwater flow patterns within the smaller discrete sub-watershed units in order to facilitate management and investigations of Groundwater. In this Appendix, use of the term Transboundary Groundwater refers to aquifers when they have been mapped or surrogate Groundwater areas when Groundwater has not yet been mapped.

Given the very limited use and lack of available hydrogeological information, all Transboundary Groundwater will be assigned to class 1 at time of signing. The Parties will work towards gathering information and delineating Transboundary Groundwater at the BMC. The Parties will reassess classification as information becomes available.

The BMC will work to develop a reproducible approach for classification of Transboundary Groundwater that meets both Parties' interests. Factors to be considered will include, but will not be limited to, Groundwater quality, Groundwater quantity, domestic well density, community wells, irrigation and other large production wells, water source wells, surficial geology, hydrogeology and subsurface geology data, and land use (including assessment of risk from hydraulic fracturing and deep water injection, etc.).

F2. Learning Plans

Learning Plans are initiated for class 2 Transboundary Groundwater, where there is some concern that current conditions or predicted conditions resulting from a proposed land use will pose a risk to Groundwater quantity and/or quality and associated aquatic resources. Learning Plans provide additional information needed to confirm or alter the assigned classification and contribute to the baseline information for Transboundary Groundwater.

A Learning Plan provides a screening level risk assessment which may include an assessment and monitoring strategy, dependent upon the availability of information, and the level of risk to receptors. A key objective of the Learning Plan will be to evaluate the current level of risk posed to Groundwater quantity and/or quality and the Aquatic Ecosystem. This will involve the review of available relevant information (e.g., land use, ongoing and proposed resource development, water quality, and biological Indicators data where applicable, etc.) and the preparation of a conceptual model that describes the:

- Sources of point and non-point discharges and substances of concern;
- Environmental fate and transport pathways for these substances;
- Human, biological and ecological receptors (including traditional use values where appropriate).

As part of the Learning Plan, surficial and subsurface geological mapping to outline the physical structure and extent of the different rock and soil units that cover the Transboundary Groundwater may be conducted. This could include an assessment of local surficial and bedrock geology, including stratigraphy, depth, thickness, composition, permafrost distribution, water-bearing potential and lateral continuity.

As part of the Learning Plan, tracking metrics will be developed to help understand baseline Groundwater quality and quantity. These tracking metrics will be used to aid with evaluation of whether a water body should change RIM classification.

The Groundwater Learning Plan is further described in section H2 of Appendix H: Groundwater Learning Plan.

F3. Triggers and Objectives

The Parties will work towards preventing, better understanding and, potentially, resolving Transboundary Groundwater issues.

Triggers, Groundwater Transboundary Objectives and management actions will be determined at the BMC after signing. A Trigger is a pre-defined early warning of change that results in confirmation of change and Jurisdictional and/or Bilateral Water Management to address the change/trend. Multiple Triggers can be set to invoke additional actions as necessary (e.g., degrading conditions). As defined in the Agreement, a Transboundary Groundwater Objective identifies a change in conditions that, if exceeded, results in Bilateral Water Management. Methods to develop Transboundary Groundwater Objectives for both quantity and quality will be discussed at the BMC. Transboundary Groundwater Objectives will be set for class 3 Transboundary Groundwater in accordance with the RIM approach. Transboundary Groundwater Objectives for quantity will be based on the equitable sharing of the sustainable yield of Transboundary Groundwater.

Conditions that could be used to assess if Transboundary Groundwater should be reclassified are included, but not limited to, the quantity and quality sections below. These will be further developed by the BMC.

F3.1 Quantity

- Temporal (and statistically significant) change in Groundwater level, at an established monitoring location, in Transboundary Groundwater; Impact to sensitive water body or wetland as demonstrated by water level changes;
- Decrease in base flow at a hydrometric station;
- Decreasing well supplies due to overall Groundwater-level decline;
- Accuracy of modeled versus measured conditions in established monitoring wells;
- Increase in Development and Activities.

F3.2 Quality

- A significant trend in Groundwater quality indicating a general degradation in quality.
- Occurrence of specific contaminants at levels above background at monitoring stations.

- Groundwater-quality results indicating that health-related maximum acceptable concentration(s) have been exceeded or treatment limits for aesthetic parameters have been exceeded due to anthropogenic activities.
- Increase in Development and Activities.

Appendix G – Biological

G1. Classification

The Parties agree to develop biological Indicators for class 3 Transboundary Waters (Slave and Hay Rivers) using interim Indicators at time of signing. Biological Indicators may be developed for class 2 Transboundary Waters.

The Parties agree that biological monitoring is not dependent on a change in water quality and/or water quantity and will be considered separately for the following reasons:

- Considering that biota are sensitive Indicators, biological monitoring can be used as an early warning that a change in the environment is occurring, which allows for an adaptive response.
- Biota can be affected by factors other than the quality or quantity of water such as cumulative effects, climate change, and loss of habitat or habitat degradation which can affect access, cover, substrate and food.
- The presence of exotic species cannot be detected through water quality or quantity monitoring.
- Contaminants can cause harm to aquatic life or pose a health hazard such as to people eating fish well before contaminant concentrations in water indicate there is a problem.

G2. Learning Plans

The biological component is incorporated into section H1 of Appendix H: Surface Water Learning Plan. class 2 and 3 Transboundary Waters must have Learning Plans that include learning about the biological component.

As part of the Learning Plan, biological Indicators will be discussed at the BMC. A biological Indicator is 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.

G3. Biological Monitoring and Indicators

Biological Indicators are used to track the status/conditions of living organisms in order to inform Bilateral Water Management, primarily the setting of Transboundary Objectives. Monitoring biological Indicators (e.g., plants, invertebrates, fish) provides complementary information to physical and chemical monitoring programs to assess ecosystem health with respect to the cumulative effects of multiple substances, water withdrawals, climate change and habitat alteration. It can also provide an early warning of change or stress in the aquatic environment. The early warning allows for a proactive and adaptive response to ensure the protection of all uses and to ensure the protection of the health of aquatic organisms, wildlife and humans. In developing biological Indicators, the Parties will apply the following guidelines:

- Biological Indicators and associated measurements will be identified through the use of conceptual models developed for a water body as part of a Learning Plan;
- The number of Indicators and intensity of monitoring will be guided by site-specific needs and risks;

- Biological Indicators apply to all components (i.e., water quality, quantity and Groundwater) and will be used to track conditions and/or monitor Transboundary Objectives for other components;
- Biological Indicators will employ the use of statistical methods to identify when conditions are moving outside of natural variability and/or reference sites; the management framework described in Tables 11 and 12 will apply to biological Indicators and/or be adopted as Transboundary Objectives;
- Methods that will be explored by the BMC for the monitoring of biological Indicators include but are not limited to:
    - Comparison to historical tissue metal concentrations, nutrients and organic compounds and guidelines for large or small bodied fish and benthic invertebrates;
    - Presence/absence of fish compared to historical accounts for large and small-bodied fish;
    - Hepatosomatic Index (**HSI**) and Gonadosomatic Index (**GSI**), weight at age, condition of fish for large-bodied fish;
    - Critical effects size;
    - Benthic invertebrate bio-monitoring (e.g., CABIN protocol, BACI design).

Interim biological Indicators for this Agreement have been identified in Table 11. Tracking metrics will be developed as part of the Learning Plan.

Table 11: List of Interim Biological Indicators and Measurement Methods (where data are available)

Water Body	Indicator	Measurement methods
Slave and Hay River	Large-bodied fish	comparison to historical metals and OCs and guidelines, HSI, GSI, condition of fish; presence/absence of fish compared to historical accounts
	Small-bodied fish	presence/absence when compared to historical accounts
	Invertebrates	comparison to historical contaminant concentrations and guidelines, presence/absence when compared to historical accounts
	Aquatic mammals (muskrat, mink)	comparison to historical metals and OCs (liver, muscle, kidney) and guidelines

The Parties will establish Triggers and associated management actions for biological Indicators. The intent is to be suitably precautionary and protective of the Ecological Integrity of the Aquatic Ecosystem and to proactively initiate appropriate Bilateral Water Management. Table 12 describes the general approach to Triggers and management actions, which can be applied to any biological Indicator.

Table 12: Triggers and Actions for Biological Indicators

Triggers		Management Action	Comments
1	Effect detected (statistically significant change)	The BMC will seek confirmation	Check other biological sampling locations and other Indicators for similar response.
2	Confirmation of effect (statistical change in same direction)	The BMC will investigate to improve understanding of the nature and causes of the effect(s)	Increase spatial/temporal resolution, study source of effect, etc. If the nature and causes are well understood directly or by weight of evidence, the BMC goes to trigger #3b; if not, go to #3a.
3a	Moving toward thresholds, causes not well understood	The BMC will jointly define and implement Bilateral Water Management action, with actions and cost sharing agreed on a case-by-case basis, informed by what is known about the nature and causes of effects and based on a weight-of-evidence approach.	Joint actions could include engaging other Parties, doing research, increasing monitoring, implementing mitigation, changing water management, etc.
3b	Moving toward thresholds, causes and responsibility understood directly or by weight-of-evidence	The BMC will set or revise Transboundary Objectives that the responsible Party or Parties must meet. These may include water quantity, water quality, Groundwater or Biological Objectives. Costs would normally be borne by the responsible party.	Any actions determined by the responsible Party as required to achieve the Transboundary Objectives (e.g., change water management, implement mitigation, etc.). Note that the nature of Transboundary Objectives may vary. They may not always be quantitative; they may refer to trends, qualitative descriptions etc., as appropriate on a case-by-case basis.
4	Objective exceeded	Clauses in sections 4.3 j, k, l, m applies	

G4. Transboundary Biological Objectives

Biological Objectives may be established in the future as deemed necessary and appropriate by the BMC. Biological Objectives would have specific associated management actions. Metrics produced for biological Indicators could be used as Biological Objectives when required, with different associated management actions. There are many international examples of the use of Biological Objectives. These would be reviewed by the BMC as needed.

Appendix H – Learning Plans

H1 Surface Water Learning Plan

This appendix provides a draft Surface Water Learning Plan table of contents for typical class 2 Transboundary Waters. This table of contents is not exhaustive. The BMC will jointly decide where to place effort on a case-by-case basis. The Surface Water Learning Plan will be developed in conjunction with other components, such as Groundwater, to ensure an overall ecosystem approach. Traditional knowledge and use information will be considered in every aspect of the Learning Plan.

1.0 Watershed Profile
- 1.1 Introduction
  - 1.1.1 Climate
  - 1.1.2 Topography
  - 1.1.3 Geomorphology and geology
  - 1.1.4 Vegetation
  - 1.1.5 Demographics
  - 1.1.6 History
- 1.2 Existing and proposed Developments and Activities (e.g., agriculture, forestry, transportation, infrastructure, resource extraction, and industries)

2.0 Water Uses
- 2.1 Water licenses and short-term use approvals
- 2.2 Traditional/cultural use
- 2.3 Aquatic ecosystem & wildlife
- 2.4 Tourism and recreation
- 2.5 Community water supplies
- 2.6 Navigation (including barge traffic)
- 2.7 Other designated uses

3.0 Influences on Water Resources
- 3.1 Licensed water withdrawals and return flows
- 3.2 Point source discharges
- 3.3 Non-point source loadings
- 3.4 Fisheries (commercial and recreational)
- 3.5 Air emissions (local and long-range transport of atmospheric pollutants)
- 3.6 Climate change
- 3.7 Cumulative effects
- 3.8 Future development
- 3.9 Other (e.g., wildfires)

4.0 Ambient Environmental Conditions
- 4.1 Existing traditional knowledge related to aquatic ecological health
- 4.2 Hydrology
  - 4.2.1 Regional and Basin-wide water quantity
    - 4.2.1.1 Trends in total annual and seasonal flows

4.2.2 Frequency and severity of floods and droughts

4.2.2.1 Trends in flood and drought conditions

4.2.3 Flow and water quality

4.2.4 Flow and biology

4.2.5 Groundwater and surface water interactions

4.3 Water Quality

4.3.1 Existing water quality conditions (including comparison to water quality guidelines)

4.3.2 Existing sediment quality conditions (including comparison to sediment quality guidelines)

4.4 Aquatic Ecosystem Structure

4.4.1 Aquatic plants

4.4.2 Zooplankton

4.4.3 Benthic invertebrates

4.4.4 Fish (diversity, abundance, distribution, habitat conditions)

4.4.5 Wildlife

5.0 Conceptual Model

5.1 Point source waste discharges

5.2 Non-point sources of pollution

5.3 Parameters

5.3.1 Environmental fate and pathways analysis

5.3.2 Bioaccumulation/biomagnification risk

5.4 Receptors

5.4.1 Analysis and rationale for human receptors

5.4.2 Analysis and rationale for biological receptors

5.4.3 Analysis and rationale for ecological receptors

5.5 Biological Indicators

5.5.1 Analysis and rationale for biological indicators

6.0 Receptor Risk Assessment

6.1 Risks to water uses

6.2 Risks to aquatic ecosystem structure and components

6.3 Human health

7.0 Knowledge Gaps

8.0 Monitoring

8.1 Monitoring approaches, procedures, methodology

8.2 Monitoring Sites

8.2.1 Hydrometric Monitoring

8.2.2 Water Quality Monitoring

8.2.3 Biological Indicators Monitoring

8.3 Data analysis and reporting

8.3.1 Tracking Metrics

9.0 Triggers and Transboundary Objectives

9.1 Approaches to Developing Site-Specific Triggers and Transboundary Objectives

9.2 Recommended Method to Derive Site-Specific Triggers and Transboundary Objectives

9.3 Data Preparation (cleaning, period of record, outliers)

9.4 Trend Assessment (long term and seasonal)

9.5 Derivation of Site-Specific Triggers and Transboundary Objectives

H2. Groundwater Learning Plan

This appendix further describes the commitments of the Parties to learn about Transboundary Groundwater as defined in section 2.2 and referred to in section 4.3 c) of the Agreement. The following is a draft Groundwater Learning Plan table of contents. This table of contents is not exhaustive; further work will be conducted by the BMC, as required. The Groundwater Learning Plan will be developed in conjunction with other components, such as surface water, to ensure an overall ecosystem approach. Traditional knowledge and use information will be considered in every aspect of the Learning Plan.

Fundamental - hydrologic, geological, and geographic framework

- 1.1 Watershed characteristics (e.g., hydrology, topography, soils, etc.)
- 1.2 Spatial information on surficial and bedrock geological units (to help identify potential aquifers)
- 1.3 Delineation of Groundwater areas and, where possible, aquifers
- 1.4 Immediate and proposed Developments and Activities and human pressures (e.g., agriculture, forestry, urban and rural population distribution, infrastructure, resource extraction, and water demand)

2.0 Estimating Groundwater Uses

- 2.1 Method used to estimate Groundwater use (e.g., licensed withdrawals, number of water wells,)
- 2.2 Summary of current Groundwater pressures/demands
- 2.3 Identify specific areas and aquifers where significant Groundwater use is occurring
- 2.4 Future pressures/demands compared to natural Groundwater flow and aquifer yield

Understanding the Groundwater flow system:

- 2.5 Current state of knowledge of resource, gaps and opportunities for learning
- 2.6 Learning: Assessment and monitoring requirements for Groundwater quantity.

3.0 Reconnaissance Survey - Summary of existing data for Groundwater quantity and quality

4.0 Risks to Groundwater quality

- 4.1 Environmental fate and pathways analysis (identify Developments and Activities and their risks and vulnerable aquifers, etc.,)
- 4.2 Receptor Risk Assessment
  - 4.2.1 Risks to water uses
  - 4.2.2 Risks to aquatic organisms (e.g., aquatic plants, invertebrates, fish, birds, ungulates, habitat)
  - 4.2.3 Human health (e.g., drinking water, plants, fish, wildlife)
- 4.3 Knowledge Gap Analysis for Groundwater Quality

5.0 Assessment and monitoring requirements for Groundwater quantity and quality

- 5.1 Monitoring approaches, procedures, and methodology
- 5.2 Monitoring schedule
- 5.3 Data analysis and reporting
  - 5.3.1 Tracking Metrics

6.0 Groundwater-surface water interaction

- 6.1 Potential for cumulative effects affecting Groundwater quantity or quality (pace and scale of development, proximity of development projects, etc.)

7.0 Groundwater vulnerability assessment and mapping

8.0 Triggers and Transboundary Objectives

- 8.1 Approaches to Developing Site-Specific Triggers and Transboundary Objectives
- 8.2 Recommended Method to Derive Site-Specific Triggers and Transboundary Objectives
    - 8.2.1 Physical, Chemical and Biological Triggers and Transboundary Objectives
- 8.3 Data Preparation (cleaning, period of record, outliers)
- 8.4 Trend Assessment (long-term and seasonal)
- 8.5 Derivation of Site-Specific Triggers and Transboundary

Appendix I – Monitoring

This appendix describes the commitments of the Parties for both direct Agreement implementation monitoring as well as broader regional and Basin-level monitoring as defined in section 10.2 of the Agreement.

I1. Summary of Commitments

Long-term monitoring is critical to understanding whether significant changes are taking place in the natural environment. Long-term datasets reveal important patterns, which allow trends, cycles, and rare events to be identified. This is particularly important for complex, large systems where signals may be subtle and slow to emerge. Long-term datasets are essential to test hypotheses that may have been overlooked at the time the monitoring was started. With increasing variability in hydrological regimes associated with increasing climatic variability, long-term monitoring is critically important.

Transboundary Monitoring includes:

- Stations at which monitoring for Transboundary Objectives will occur;
- Stations that support transboundary management as well as broader regional and Basin-level monitoring network.

The Parties have agreed to continue to support long-term surface water quantity and quality monitoring in the Basin. Existing stations are shown in Tables 13 and 14. Those marked with an asterisk * are considered a priority for long-term monitoring. Those marked with a + are expected to be the stations at which monitoring to assess whether Transboundary Objectives are being met will occur. The Parties have agreed that:

- They will continue to support those stations marked with an * in Tables 13 and 14 for which they are currently responsible, including working with delegate agencies as required;
- They will not make changes to monitoring at the stations marked with * or + without discussion at the BMC during the life of the Learning Plan for the Slave and Hay Rivers (which has not been determined, but has been estimated to be about ten years);
- They will encourage and support the continued surface water monitoring conducted in the Basin by Environment Canada (See Table 13 and 14).

As part of the Learning Plan for class 2 and 3 Transboundary Waters, the Parties will assess monitoring needs and priorities as well as appropriate locations for monitoring Transboundary Waters with regard to surface water quantity and quality, Groundwater quantity and quality, and biology. They may consider the addition of social and/or air monitoring in the future. The identification of long-term monitoring stations for the Agreement will be based on a scientific and traditional and local knowledge assessment. Monitoring stations in unclassified and class 1 water bodies may be included to provide comparisons to background or reference conditions.

I2. Joint Monitoring Arrangements

There are currently several existing hydrometric and water quality agreements currently in place between Alberta, the Northwest Territories and Environment Canada. The applicable agreements include:

- Canada-Alberta Hydrometric Agreement;
- Canada-NWT Hydrometric Agreement;
- Joint Canada-Alberta Implementation Plan for Oil Sands Monitoring

I3. Water Quantity

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. Table 13 and Map 1 summarize key water quantity monitoring sites in the AB-NWT transboundary basins. They include:

- Sites located at or near the border that may be useful for monitoring Transboundary Objectives and ensuring the upstream jurisdiction does not cause unreasonable harm;
- Sites upstream of the border that may provide an early warning of change and/or help to diagnose reasons for changes observed at the border;
- Sites downstream of the border that may provide information about downstream conditions relevant for setting Transboundary Objectives or demonstrating that the downstream jurisdiction is not causing unreasonable harm.

Table 13 summarizes the key hydrometric monitoring stations in the Peace, Athabasca, Slave, Hay and other transboundary basins that record either flow or water level data.

There are currently 309 stations in the Mackenzie River basin within Alberta, and 84 within NWT. Table 13 lists 146 key stations in Alberta, 48 of which are discontinued but they either have long records of historical data, or data from pre-regulation of the Peace River. Also included are 2 key stations in the Hay River basin that are located in NWT. Of the 100 active stations, and as outlined in section I1, those marked with a + are thought to be key for long-term regional and Basin-level monitoring, and those marked with an * are expected to be the stations at which monitoring for Transboundary Objectives will occur. In addition, 4 recommendations are made for additional monitoring in the Hay River basin.

Some additional stations in Saskatchewan, BC, and NWT are listed as "Other Stations". The listed stations within BC are currently included on Alberta's River Basins webpage and are of interest. Current Water Survey of Canada monitoring also includes additional stations in Saskatchewan in the Lake Athabasca sub-basins 07M and 07L, besides the one Lake Athabasca station listed. Current WSC monitoring also includes 17 stations in NWT and Saskatchewan in basin 07Q that are not listed, in addition to the stations listed in sub-basins 07U and 07P.

Snow stations may be added to this Appendix by the BMC after the time of signing.

Table 13: Present (2014) Status of Major Transboundary Hydrometric Stations in the AB-NWT transboundary basin.

	Station No.	Station Name	Status	Prov	Lat.	Long.	Years of Data	From	To	Flow	Level	Operating Schedule	Real-Time	Desig-nation
	07AA001	MIETTE RIVER NEAR JASPER	Active	AB	52.864	-118.107	47	1914	2011	True	False	Continuous	True	F4
+	07AA002	ATHABASCA RIVER NEAR JASPER	Active	AB	52.910	-118.059	61	1913	2011	True	False	Continuous	True	F4
	07AD001	ATHABASCA RIVER AT ENTRANCE	Disc.	AB	53.377	-117.695	33	1915	1974	True	False	Continuous	False	
+	07AD002	ATHABASCA RIVER AT HINTON	Active	AB	53.424	-117.569	51	1961	2011	True	False	Continuous	True	FP2
+	07AE001	ATHABASCA RIVER NEAR WINDFALL	Active	AB	54.208	-116.063	53	1960	2012	True	False	Seasonal	True	C-AB
+	07BE001	ATHABASCA RIVER AT ATHABASCA	Active	AB	54.722	-113.288	93	1913	2011	True	False	Continuous	True	P1
	07BJ002	LESSER SLAVE LAKE AT FAUST	Disc.	AB	55.322	-115.642	71	1923	1995	False	True	Seasonal	False	
	07BJ006	LESSER SLAVE LAKE AT SLAVE LAKE	Active	AB	55.306	-115.772	33	1979	2011	False	True	Continuous	False	FP3
+	07BK001	LESSER SLAVE RIVER AT SLAVE LAKE	Active	AB	55.305	-114.756	50	1915	2011	True	False	Continuous	False	FP3
	07BK006	LESSER SLAVE RIVER AT HIGHWAY NO. 2A	Disc.	AB	55.294	-114.591	27	1962	1988	True	False	Continuous	False	
	07BK010	LESSER SLAVE LAKE AT SAWRIDGE	Disc.	AB	55.300	-114.767	27	1914	1962	False	True	Continuous	False	
	07CC002	ATHABASCA RIVER AT MCMURRAY	Disc.	AB	56.733	-111.375	23	1937	1997	False	True	Seasonal	False	
+	07CD001	CLEARWATER RIVER AT DRAPER	Active	AB	56.685	-111.255	58	1930	2011	True	False	Continuous	True	FP1
	07CD002	CLEARWATER RIVER BELOW WATERWAYS	Disc.	AB	56.719	-111.347	26	1950	1975	False	True	Seasonal	False	
	07CD003	CLEARWATER RIVER AT UPPER WINGDAM	Disc.	AB	56.700	-111.333	15	1960	1974	False	True	Seasonal	False	
	07CD004	HANGINGSTONE RIVER AT FORT MCMURRAY	Active	AB	56.709	-111.356	48	1965	2012	True	False	Continuous	True	FP1
+	07CD005	CLEARWATER RIVER ABOVE CHRISTINA RIVER	Active	AB	56.664	-110.929	46	1966	2011	True	False	Continuous	True	JOSM/P1
+	07CE002	CHRISTINA RIVER NEAR CHARD	Active	AB	55.837	-110.869	31	1982	2012	True	False	Continuous	True	JOSM/FP3
+	07CE005	JACKFISH RIVER BELOW CHRISTINA LAKE	Active	AB	55.674	-111.100	14	1982	1995	True	False			JOSM
	07CE906	CHRISTINA LAKE NEAR WINEFRED LAKE	Active	AB	55.625	-110.773	12	2001	2012	False	True	Continuous	True	C-AB
+	07DA001	ATHABASCA RIVER BELOW MCMURRAY	Active	AB	56.780	-111.402	55	1957	2011	True	False	Continuous	True	F4
+	07DA006	STEEPBANK RIVER NEAR FORT MCMURRAY	Active	AB	56.999	-111.407	41	1972	2012	True	False	Continuous	True	JOSM/FP1
+	07DA007	POPLAR CREEK at Highway 63	Active	AB	56.914	-111.460	15	1972	1986	True	False			JOSM
+	07DA008	MUSKEG RIVER NEAR FORT MACKAY	Active	AB	57.191	-111.570	39	1974	2012	True	False	Continuous	True	JOSM/FP1
+	07DA009	JACKPINE CREEK AT CANTERRA ROAD	Active	AB	57.259	-111.465	19	1975	1993	True	False			JOSM
	07DA010	ELLS RIVER BELOW GARDINER LAKES	Disc.	AB	57.375	-112.561	5	1975	1979	True	False	Continuous	False	
+	07DA011	Big Creek near the Mouth	Active	AB	57.661	-111.520	19	1975	1993	True	False			JOSM
	07DA012	ASPHALT CREEK NEAR FORT MACKAY	Disc.	AB	57.539	-111.677	3	1975	1977	True	False	Continuous	False	
+	07DA013	PIERRE RIVER NEAR FORT MACKAY	Active	AB	57.465	-111.654	3	1975	1977	True	False			JOSM
	07DA014	CALUMET RIVER NEAR FORT MACKAY	Disc.	AB	57.403	-111.683	3	1975	1977	True	False	Continuous	False	
+	07DA015	TAR RIVER NEAR the mouth	Active	AB	57.354	-111.758	3	1975	1977	True	False			JOSM
	07DA016	JOSLYN CREEK NEAR FORT MACKAY	Disc.	AB	57.274	-111.742	19	1975	1993	True	False	Seasonal	False	
+	07DA017	ELLS RIVER NEAR THE MOUTH	Disc.	AB	57.268	-111.714	12	1975	1986	True	False	Continuous	False	
+	07DA018	BEAVER RIVER ABOVE SYNCRUDE	Active	AB	56.945	-111.566	38	1975	2012	True	False	Continuous	True	JOSM/FP1
+	07DB001	MACKAY RIVER NEAR FORT MACKAY	Active	AB	57.210	-111.695	41	1972	2012	True	False	Continuous	True	JOSM/FP1
+	07DB002	DOVER RIVER NEAR THE MOUTH	Active	AB	57.170	-111.794	3	1975	1977	True	False			JOSM
+	07DB003	DUNKIRK RIVER NEAR FORT MACKAY	Active	AB	56.856	-112.711	5	1975	1979	True	False			JOSM
+	07DC001	FIREBAG RIVER NEAR THE MOUTH	Active	AB	57.651	-111.203	42	1971	2012	True	False	Continuous	True	JOSM/FP1
+	07DD001	ATHABASCA RIVER AT EMBARRAS AIRPORT	Active	AB	58.205	-111.390	14	1971	1990	True	False			JOSM, F4
+	07DD002	RICHARDSON RIVER NEAR THE MOUTH	Active	AB	58.360	-111.240	42	1970	2011	True	False	Seasonal	True	FP1
	07DD003	EMBARRAS RIVER BELOW DIVERGENCE	Active	AB	58.422	-111.551	23	1971	2011	True	False	Seasonal	False	FP1

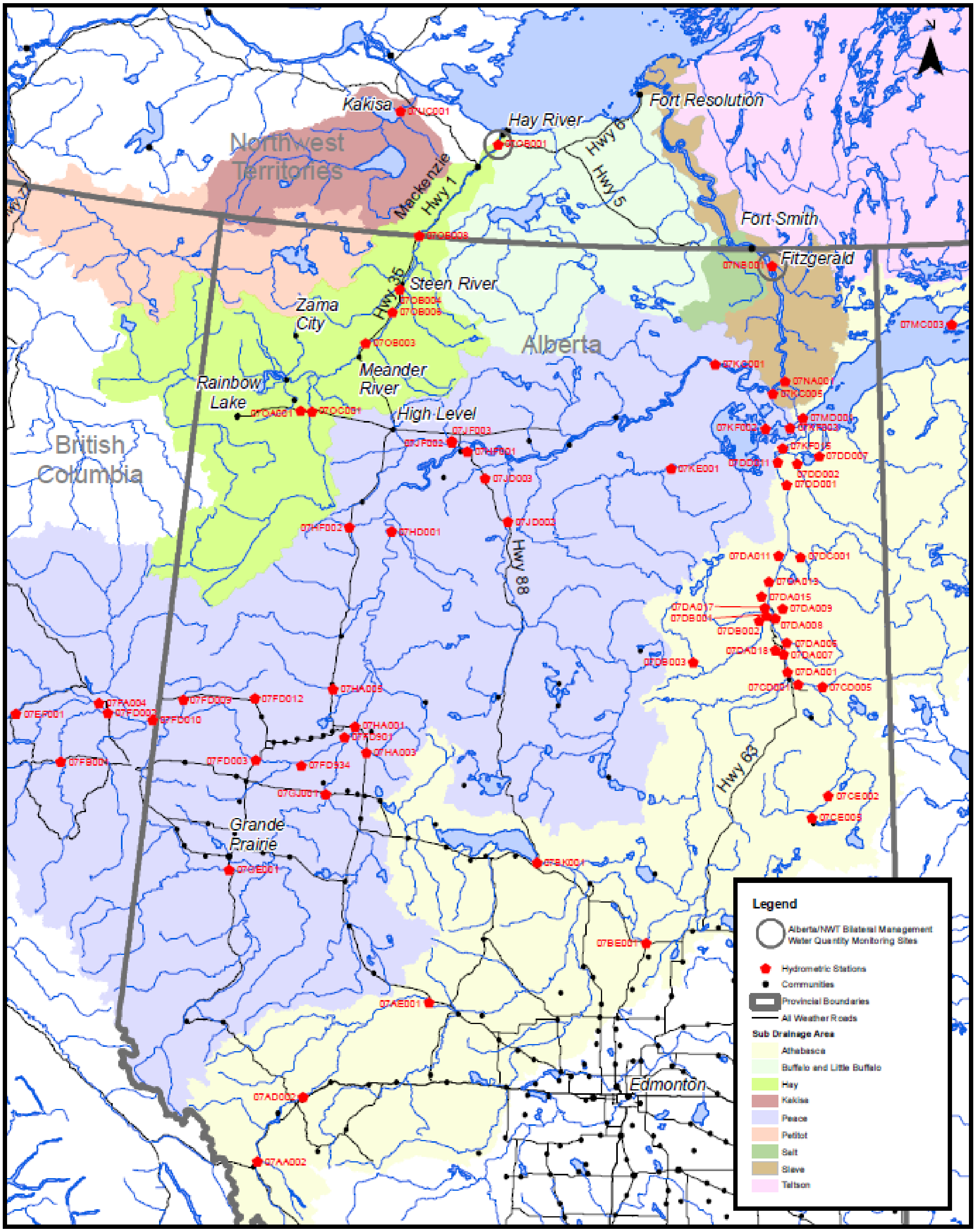
+	07DD007	ATHABASCA RIVER ABOVE JACKFISH CREEK	Active	AB	58.417	-110.917	38	1971	2011	False	True	Continuous	False	C-AB
+	07DD011	ATHABASCA RIVER NEAR OLD FORT	Active	AB	58.374	-111.522	37	1975	2011	False	True	Continuous	False	FP-1
+	07FD003	PEACE RIVER AT DUNVEGAN BRIDGE	Active	AB	55.919	-118.607	48	1960	2011	True	False	Seasonal	True	FP3
	07FD006	SADDLE RIVER NEAR WOKING	Active	AB	55.644	-118.700	45	1967	2011	True	False	Seasonal	False	FP3
+	07FD009	CLEAR RIVER NEAR BEAR CANYON	Active	AB	56.308	-119.681	41	1971	2011	True	False	Seasonal	True	FP3
	07FD011	HINES CREEK ABOVE GERRY LAKE	Active	AB	56.334	-118.265	38	1974	2011	True	False	Seasonal	False	FP3
+	07FD012	MONTAGNEUSE RIVER NEAR HINES CREEK	Active	AB	56.383	-118.712	37	1975	2011	True	False	Seasonal	False	FP3
	07FD013	EUREKA RIVER NEAR WORSLEY	Active	AB	56.453	-119.134	37	1975	2011	True	False	Seasonal	False	FP3
	07FD020	SPIRIT RIVER NEAR SPIRIT RIVER	Active	AB	55.741	-118.837	5	2005	2009	True	False	Seasonal	False	C-AB
+	07FD901	PEACE RIVER ABOVE SMOKY RIVER CONFLUENCE	Active	AB	56.155	-117.443	13	2000	2012	False	True	Continuous	True	P1
	07FD908	GRIMSHAW DRAINAGE NEAR GRIMSHAW	Active	AB	56.167	-117.600	19	1991	2009	True	False	Seasonal	False	C-AB
	07FD910	RYCROFT SURVEY NO. 3 NEAR RYCROFT	Active	AB	55.750	-118.583	28	1982	2009	True	False	Seasonal	False	C-AB
	07FD912	WHITBURN DRAINAGE PROJECT NEAR SPIRIT RIVER	Disc.	AB	55.850	-119.133	22	1988	2009	True	False	Seasonal	False	
	07FD913	YOUNG DRAINAGE PROJECT NEAR SPIRIT RIVER	Disc.	AB	55.812	-118.794	28	1982	2009	True	False	Seasonal	False	
+	07FD934	PEACE RIVER NEAR ELK ISLAND PARK	Active	AB	55.915	-117.986	13	2000	2012	False	True	Continuous	True	P1
	07GA001	SMOKY RIVER ABOVE HELLS CREEK	Active	AB	53.947	-119.161	45	1967	2012	True	True	Seasonal	True	FP2
	07GA002	MUSKEG RIVER NEAR GRANDE CACHE	Active	AB	53.926	-118.816	40	1972	2011	True	False	Seasonal	False	FP3
	07GB001	CUTBANK RIVER NEAR GRANDE PRAIRIE	Active	AB	54.516	-118.963	42	1970	2011	True	False	Seasonal	False	FP3
	07GB002	KAKWA RIVER NEAR GRANDE PRAIRIE	Disc.	AB	54.372	-118.594	20	1975	1994	True	False	Seasonal	False	
	07GB003	KAKWA RIVER AT HIGHWAY NO. 40	Active	AB	54.422	-118.554	18	1994	2011	True	False	Seasonal	True	FP2
	07GC002	PINTO CREEK NEAR GRANDE PRAIRIE	Active	AB	54.842	-119.390	24	1986	2009	True	False	Seasonal	True	C-AB
	07GD001	BEAVERLODGE RIVER NEAR BEAVERLODGE	Active	AB	55.189	-119.437	45	1968	2012	True	True	Seasonal	False	P1
	07GD002	BEAVERTAIL CREEK NEAR HYTHE	Disc.	AB	55.316	-119.643	27	1983	2009	True	False	Seasonal	False	
	07GD004	REDWILLOW RIVER NEAR RIO GRANDE	Active	AB	55.079	-119.702	19	1993	2011	True	False	Continuous	True	P1
+	07GE001	WAPITI RIVER NEAR GRANDE PRAIRIE	Active	AB	55.071	-118.803	54	1917	2011	True	False	Continuous	True	FP3
	07GE002	KLESKUN HILLS MAIN DRAIN NEAR GRANDE PRAIRIE	Active	AB	55.225	-118.462	46	1966	2011	True	False	Seasonal	False	P1
	07GE003	GRANDE PRAIRIE CREEK NEAR SEXSMITH	Active	AB	55.375	-118.916	43	1969	2011	True	False	Seasonal	False	FP3
	07GE004	BEAR LAKE NEAR CLAIRMONT	Disc.	AB	55.233	-118.950	41	1969	2009	False	True	Seasonal	False	
	07GE007	BEAR RIVER NEAR VALHALLA CENTRE	Active	AB	55.400	-119.384	28	1984	2011	True	False	Seasonal	False	P1
	07GF001	SIMONETTE RIVER NEAR GOODWIN	Active	AB	55.140	-118.182	43	1969	2011	True	False	Seasonal	False	FP3
	07GF002	SPRING CREEK NEAR VALLEYVIEW	Disc.	AB	54.918	-117.849	23	1965	1987	True	False	Seasonal	False	
	07GF003	WOLVERINE CREEK NEAR VALLEYVIEW	Disc.	AB	54.921	-117.809	22	1966	1987	True	False	Seasonal	False	
	07GF004	SPRING CREEK (UPPER) NEAR VALLEYVIEW	Disc.	AB	54.929	-117.706	21	1967	1987	True	False	Seasonal	False	
	07GF005	BRIDLEBIT CREEK NEAR VALLEYVIEW	Disc.	AB	54.936	-117.734	32	1967	2003	True	False	Seasonal	False	
	07GF006	ROCKY CREEK NEAR VALLEYVIEW	Disc.	AB	54.935	-117.776	29	1967	2000	True	False	Seasonal	False	
	07GF007	HORSE CREEK NEAR VALLEYVIEW	Disc.	AB	54.922	-117.813	18	1970	1987	True	False	Seasonal	False	
	07GF008	DEEP VALLEY CREEK NEAR VALLEYVIEW	Active	AB	54.430	-117.721	28	1985	2013	True	True	Seasonal	False	ComR
	07GG001	WASKAHIGAN RIVER NEAR THE MOUTH	Active	AB	54.752	-117.206	44	1968	2012	True	True	Continuous	False	FP3
	07GG002	LITTLE SMOKY RIVER AT LITTLE SMOKY	Active	AB	54.740	-117.180	45	1967	2011	True	False	Seasonal	False	FP3
	07GG003	IOSEGUN RIVER NEAR LITTLE SMOKY	Active	AB	54.745	-117.152	44	1969	2012	True	True	Seasonal	False	FP3
	07GH002	LITTLE SMOKY RIVER NEAR GUY	Active	AB	55.456	-117.162	53	1959	2011	True	False	Continuous	True	P1
	07GH003	STURGEON LAKE NEAR VALLEYVIEW	Active	AB	55.118	-117.559	41	1972	2012	False	True	Seasonal	False	P1
	07GH004	PEAVINE CREEK NEAR FALHER	Active	AB	55.629	-117.260	28	1984	2011	True	False	Seasonal	False	FP3
+	07GJ001	SMOKY RIVER AT WATINO	Active	AB	55.715	-117.623	66	1915	2012	True	True	Continuous	True	FP2

+	07HA001	PEACE RIVER AT PEACE RIVER	Active	AB	56.245	-117.314	72	1915	2011	True	False	Continuous	True	F4
+	07HA003	HEART RIVER NEAR NAMPA	Active	AB	56.056	-117.130	49	1963	2011	True	False	Continuous	True	FP3
+	07HA005	WHITEMUD RIVER NEAR DIXONVILLE	Active	AB	56.511	-117.661	41	1971	2011	True	False	Seasonal	False	FP3
	07HB001	CADOTTE RIVER AT OUTLET CADOTTE LAKE	Active	AB	56.488	-116.434	28	1984	2011	True	False	Seasonal	False	FP3
	07HC001	NOTIKEWIN RIVER AT MANNING	Active	AB	56.920	-117.618	51	1961	2011	True	False	Continuous	False	FP3
	07HC002	BUCHANAN CREEK NEAR MANNING	Active	AB	56.895	-117.489	27	1985	2011	True	False	Seasonal	False	FP3
	07HC907	NORTH STAR DRAINAGE NEAR NORTH STAR	Active	AB	56.829	-117.569	19	1991	2009	True	False	Seasonal	False	C-AB
+	07HD001	PEACE RIVER NEAR CARCAJOU	Active	AB	57.742	-117.033	8	1960	2011	True	True	Continuous	False	P1
+	07HF001	PEACE RIVER AT FORT VERMILION	Active	AB	58.388	-116.029	32	1915	2011	True	True	Continuous	False	P1
+	07HF002	KEG RIVER AT HIGHWAY NO. 35	Active	AB	57.746	-117.628	42	1971	2012	True	True	Seasonal	True	FP3
	07JA001	UTIKUMA LAKE NEAR NIPISI	Disc.	AB	55.914	-115.171	41	1969	2009	False	True	Seasonal	False	
	07JA002	SOUTH WABASCA LAKE NEAR DESMARAIS	Active	AB	55.940	-113.805	40	1972	2011	False	True	Seasonal	False	P1
	07JA003	WILLOW RIVER NEAR WABASCA	Active	AB	55.917	-113.921	27	1985	2011	True	False	Seasonal	False	FP3
	07JC001	LAFOND CREEK NEAR RED EARTH CREEK	Active	AB	57.073	-115.097	37	1975	2011	True	False	Seasonal	True	FP3
	07JC002	REDEARTH CREEK NEAR RED EARTH CREEK	Active	AB	56.547	-115.240	25	1987	2011	True	False	Seasonal	False	FP3
	07JD001	WABASCA RIVER ABOVE PEACE RIVER	Disc.	AB	58.292	-115.383	8	1963	1970	True	False	Continuous	False	
+	07JD002	WABASCA RIVER AT HIGHWAY NO. 88	Active	AB	57.875	-115.389	43	1970	2012	True	True	Continuous	False	F4
+	07JD003	JACKPINE CREEK AT HIGHWAY NO. 88	Active	AB	58.193	-115.749	41	1971	2011	True	False	Seasonal	False	P1
	07JD004	TEEPEE CREEK NEAR LA CRETE	Active	AB	58.137	-116.250	31	1981	2011	True	False	Seasonal	False	FP3
+	07JF002	BOYER RIVER NEAR FORT VERMILION	Active	AB	58.449	-116.264	50	1962	2011	True	False	Seasonal	False	P1
+	07JF003	PONTON RIVER ABOVE BOYER RIVER	Active	AB	58.464	-116.256	50	1962	2011	True	False	Seasonal	False	FP3
	07JF004	BOYER RIVER NEAR PADDLE PRAIRIE	Disc.	AB	57.908	-117.613	29	1979	2007	True	False	Seasonal	False	
	07JF005	BOYER RIVER AT PADDLE PRAIRIE	Active	AB	57.948	-117.481	4	2008	2011	True	False	Seasonal	False	FP3
	07KA002	PEACE RIVER AT FIFTH MERIDIAN	Disc.	AB	58.650	-114.022	7	1960	1967	True	False	Seasonal	False	
+	07KC001	PEACE RIVER AT PEACE POINT (ALBERTA)	Active	AB	59.118	-112.437	54	1959	2012	True	True	Continuous	True	F2
+	07KC005	PEACE RIVER BELOW CHENAL DES QUATRE FOURCHES	Active	AB	58.900	-111.583	39	1972	2011	False	True	Continuous	False	F1
+	07KE001	BIRCH RIVER BELOW ALICE CREEK	Active	AB	58.325	-113.065	45	1967	2011	True	False	Seasonal	True	F1
	07KF001	CHENAL DES QUATRE FOURCHES AT QUATRE FOURCHE	Disc.	AB	58.647	-111.289	20	1960	1991	False	True	Seasonal	False	
+	07KF002	LAKE CLAIRE NEAR OUTLET TO PRAIRIE RIVER	Active	AB	58.633	-111.697	42	1970	2011	False	True	Continuous	False	F1
+	07KF003	MAMAWI LAKE CHANNEL AT OLD DOG CAMP	Active	AB	58.633	-111.333	41	1971	2011	False	True	Continuous	False	F1
	07KF004	CHENAL DES QUATRE FOURCHES ABOVE PEACE RIVER	Disc.	AB	58.878	-111.603	2	1960	1971	False	True	Seasonal	False	
	07KF005	BARIL LAKE AT CENTRE OF LAKE	Disc.	AB	58.783	-111.683	1	1971	1971	False	True	Seasonal	False	
	07KF006	CHENAL DES QUATRE FOURCHES BELOW FOUR FORKS	Disc.	AB	58.651	-111.297	10	1971	1981	False	False	Seasonal	False	
	07KF007	CHENAL DES QUATRE FOURCHES AT RANGER'S CABIN	Disc.	AB	58.794	-111.478	1	1971	1971	False	True	Seasonal	False	
	07KF008	CHENAL DES QUATRE FOURCHES AT HIGH ROCK TOWE	Disc.	AB	58.814	-111.558	1	1971	1971	False	True	Seasonal	False	
	07KF010	MAMAWI LAKE CHANNEL AT DOG CAMP	Disc.	AB	58.647	-111.311	7	1971	1980	False	False	Seasonal	False	
	07KF013	PRAIRIE RIVER AT FISH STUDY CAMP	Disc.	AB	58.621	-111.636	1	1971	1971	False	True	Seasonal	False	
	07KF014	PRAIRIE RIVER NEAR LAKE CLAIRE	Disc.	AB	58.624	-111.681	8	1971	1981	False	False	Miscellaneous	False	
+	07KF015	EMBARRAS RIVER BREAKTHROUGH TO MAMAWI LAKE	Active	AB	58.480	-111.444	24	1987	2011	True	False	Seasonal	False	F1
+	07MD001	LAKE ATHABASCA AT FORT CHIPEWYAN	Active	AB	58.711	-111.147	76	1930	2011	False	True	Continuous	False	F1
	07MD002	LAKE ATHABASCA AT BUSTARD ISLAND	Disc.	AB	58.782	-110.778	21	1975	1995	False	True	Continuous	False	
+	07NA001	RIVIERE DES ROCHERS ABOVE SLAVE RIVER	Active	AB	58.992	-111.400	43	1960	2011	False	True	Continuous	False	F1
	07NA002	RIVIERE DES ROCHERS AT BEN HOULE'S CABIN	Disc.	AB	58.819	-111.275	11	1971	1981	False	False	Miscellaneous	False	
	07NA003	RIVIERE DES ROCHERS ABOVE REVILLON COUPE	Disc.	AB	58.842	-111.267	12	1971	1985	False	True	Continuous	False	

	07NA004	REVILLON COUPE BELOW RIVIERE DES ROCHERS	Disc.	AB	58.853	-111.269	10	1971	1981	False	False	Miscellaneous	False	
	07NA005	REVILLON COUPE AT RANGER'S CABIN	Disc.	AB	58.897	-111.400	1	1971	1971	False	True	Seasonal	False	
	07NA007	RIVIERE DES ROCHERS EAST OF LITTLE RAPIDS	Active	AB	58.915	-111.175	39	1960	2011	False	True	Continuous	False	F1
	07NA008	RIVIERE DES ROCHERS WEST OF LITTLE RAPIDS	Active	AB	58.926	-111.204	34	1960	2011	False	True	Continuous	False	F1
*	07NB001	SLAVE RIVER AT FITZGERALD (ALBERTA)	Active	AB	59.872	-111.583	64	1921	2012	True	True	Continuous	True	F2
	07NB004	SLAVE RIVER ABOVE MOUNTAIN RAPIDS	Disc.	AB	59.961	-111.758	3	1952	1954	False	True	Seasonal	False	
	07NB005	SLAVE RIVER BELOW MOUNTAIN RAPIDS	Disc.	AB	59.961	-111.758	3	1952	1954	False	True	Seasonal	False	
	07NB006	BENCH MARK CREEK NEAR FORT SMITH	Disc.	AB	59.814	-111.963	17	1967	1983	True	False	Continuous	False	
	07NB007	SALT RIVER BELOW PEACE POINT HIGHWAY	Disc.	AB	59.833	-111.969	8	1973	1980	True	False	Continuous	False	
	07NB008	DOG RIVER NEAR FITZGERALD	Disc.	AB	59.876	-111.521	23	1972	1994	True	False	Continuous	False	
+	07OA001	SOUSA CREEK NEAR HIGH LEVEL	Active	AB	58.591	-118.491	42	1970	2011	True	False	Seasonal	True	FP3
*	07OB001	HAY RIVER NEAR HAY RIVER	Active	NT	60.743	-115.860	50	1963	2012	True	True	Continuous	True	FT
+	07OB008	HAY RIVER NEAR ALTA/NWT BOUNDARY	Active	NT	60.004	-116.972	22	1986	2012	False	True	Seasonal	True	T
+	07OB003	HAY RIVER NEAR MEANDER RIVER	Active	AB	59.149	-117.636	38	1974	2011	True	False	Seasonal	False	FP2
+	07OB004	STEEN RIVER NEAR STEEN RIVER	Active	AB	59.581	-117.197	38	1974	2011	True	False	Seasonal	False	FP2
	07OB005	MEANDER RIVER AT OUTLET HUTCH LAKE	Disc.	AB	58.771	-117.385	19	1975	1995	True	False	Seasonal	False	
+	07OB006	LUTOSE CREEK NEAR STEEN RIVER	Active	AB	59.406	-117.281	35	1977	2011	True	False	Seasonal	False	FP2
	07OB007	HUTCH LAKE TRIBUTARY NEAR HIGH LEVEL	Disc.	AB	58.718	-117.241	10	1977	1986	True	False	Seasonal	False	
+	07OC001	CHINCHAGA RIVER NEAR HIGH LEVEL	Active	AB	58.597	-118.334	43	1969	2011	True	False	Continuous	True	FP3
		Additional lake levels at Zama Lakes area	Recommended	AB										
		Additional tributary inflows to Zama Lakes area	Recommended	AB										
		Upgrade HAY RIVER NEAR MEANDER RIVER	Recommended	AB								Continuous		
		Upgrade HAY RIVER NEAR ALTA/NWT BOUNDARY	Recommended	NT						True		Continuous		
Other Stations outside of AB and NWT														
	07PA001	Buffalo River at Hwy 5	Disc.	NT	60.712	-114.903		1968	1991					
	07PA002	WHITESAND RIVER NEAR ALTA/NWT BOUNDARY	Disc.	NT										
	07PB001	GREAT SLAVE LAKE AT FORT RESOLUTION	Disc.	NT										
	07PB002	Little Buffalo River below Hwy 5	Disc.	NT	60.050	-112.698		1965	1994					
	07PC001	BUFFALO RIVER NEAR ALTA/NWT BOUNDARY	Disc.	NT										
+	07UC001	Kakisa River at Outlet of Kakisa Lake	Active	NT	60.940	-117.422	31	1962	2014					
	07UC002	KAKISA LAKE NEAR KAKISA VILLAGE	Disc.	NT										
+	07MC003	Lake Athabasca near Crackingstone Point	Active	SK	59.384	-108.894		1956						
+	07FA004	Peace River above Pine River	Active	BC										
	07FA006	Halfway River near Farrell Creek	Active	BC										
+	07FB001	Pine River at East Pine	Active	BC										
	07FB008	Moberly River near Fort St. John	Active	BC										
+	07FD010	Peace River above Alces River	Active	BC										
+	07FD002	Peace River near Taylor	Active	BC										
+	07EF001	Peace River at Hudson Hope	Active	BC										

F1--Federal Departmental Programs	**FP1--Federal-Provincial Agreements**	**ComR--Commercial Revenue**
F2--Interprovincial Waters	**FP2--River Basin Management**	**C-AB--Alberta ESRD Contributed Data**
F3--International Waters	**FP3--Regional Water Quantity Inventory**	**FT--Operational Costs, Federal-Territorial**
F4--National Water Quantity Inventory	**P1--Provincial Departmental Programs**	**T--Operational Costs, Territorial**

Map 1. Present (2014) Location of Transboundary Water Quantity Sites within AB-NWT Transboundary Basins



I4. Water Quality

The primary goals of monitoring Transboundary Waters are to track changes in water quality over time, determine anthropogenic and natural drivers for changes in water quality, and ensure that water quality is protected for all water uses. Table 14 and Map 2 summarize key water quality monitoring sites in the AB-NWT transboundary basins. They include:

- Sites located at or near the border that may be useful for monitoring Transboundary Objectives and ensuring the upstream jurisdiction does not cause unreasonable harm;
- Sites upstream of the border that may provide an early warning of change and/or help to diagnose reasons for changes observed at the border;
- Sites downstream of the border that may provide information about downstream conditions relevant for setting Transboundary Objectives or demonstrating that the downstream jurisdiction is not causing unreasonable harm.

Among the 275 water quality monitoring sites in listed in Table 14, 265 sites are located in Alberta and 9 sites are within NWT. The water quality monitoring sites marked with a "*" will be used for assessment related to Transboundary Objectives. The sites marked with a "+" are key for long-term regional and basin level monitoring and will inform transboundary conditions. The Table also lists some water quality monitoring sites that have been discontinued but they were included due to their long-term historical data records. One additional site located in BC is also included given its special interest to the Board and downstream jurisdictions. This site is marked with a "-".

Table 14: Present (2014) Status of Water Quality Monitoring Sites in the AB-NWT Transboundary Region.

Class	Station No.	River Reach	Water Quality Monitoring Site	Prov.	Lat.	Long.	From	To	Years of Data	# of Samples	Latest Frequency
*	NW07OB0002	HAY RIVER	NEAR AB/NWT BOUNDARY	NWT	60.004	-116.969	1988	2014	26	>104	6X/yr
*	NW07QA0004	SLAVE RIVER	SLAVE RIVER AT FORT SMITH (JOSM M11B)	NWT	60.016	-111.890	1982	2014	32	>96	12X/yr
*	AL07NB0001	SLAVE RIVER	SLAVE RIVER AT FITZGERALD (JOSM M11A)	AB	59.872	-111.583	1960	2014	54	>230	12X/yr
+	AB07DD0010	ATHABASCA RIVER	AT OLD FORT (JOSM M9A)	AB	58.383	-111.518	1987	2014	28	255	12X/yr
+	AB07DA0980	ATHABASCA RIVER	ABOVE THE FIREBAG RIVER (JOSM M8)	AB	57.724	-111.379	1989	2014	14	97	12X/yr
+	AB07CC0030	ATHABASCA RIVER	U/S FORT MCMURRAY, ABOVE HORSE R. (JOSM M2)	AB	56.720	-111.406	1960	2014	39	369	12X/yr
+	AB07BE0010	ATHABASCA RIVER	ABOVE TOWN OF ATHABASCA (JOSM M0)	AB	54.722	-113.286	1957	2014	51	524	12X/yr
+	AB07AD0110	ATHABASCA RIVER	U/S OF HINTON, 0.2 KM U/S OF MUSKUTA CREEK	AB	53.380	-117.656	1960	2003	7	65	12X/yr
+	AB07AD0100	ATHABASCA RIVER	AT OLD ENTRANCE TOWN SITE	AB	53.368	-117.723	1985	2014	18		12X/yr
+	AL07DD0001	ATHABASCA RIVER	AT BASELINE 27 (JOSM M9)	AB	58.173	-111.370	1989	2014			9X/yr
+	AL07DD0007	ATHABASCA RIVER	BELOW ELLS RIVER (JOSM M7)	AB	57.314	-111.672	2012	2014	3		12X/yr
+	AL07DD0009	ATHABASCA RIVER	BELOW MACKAY RIVER (JOSM M6)	AB	57.215	-111.612	2011	2014	4		12X/yr
+	AL07DD0005	ATHABASCA RIVER	ABOVE MACKAY RIVER (JOSM M5)	AB	57.157	-111.627	2011	2014	4		12X/yr
+	AL07DD0004	ATHABASCA RIVER	ABOVE MUSKEG RIVER (JOSM M4)	AB	57.127	-111.602	2011	2014	4		12X/yr

Class	Station No.	River Reach	Water Quality Monitoring Site	Prov.	Lat.	Long.	From	To	Years of Data	# of Samples	Latest Frequency
+	AL07DD0008	ATHABASCA RIVER	6.5 KM BELOW WSC GAUGE 07DA001 (JOSM M3)	AB	56.839	-111.416	2011	2014	4		12X/yr
+	--	ATHABASCA RIVER	OIL SANDS BIOMONITORING STATION (JOSM M1)	AB	56.650	-111.609	2011	2014	4		12X/yr
+	AL07AA0023	ATHABASCA RIVER	ATHABASCA @HWY 16 BELOW SNARING RIVER	AB	53.042	-118.087	1973	2014			7X/yr
+	AL07AA0015	ATHABASCA RIVER	ABOVE ATHABASCA FALLS	AB	52.664	-117.881	1972	2014			7X/yr
+	--	BUFFALO RIVER	AT HWY #5 BRIDGE	NWT	60.716	-114.907	1982	2010	28	56	2X/yr
+	--	HAY RIVER	HAY RIVER AT WEST CHANNEL BRIDGE	NWT	60.825	-115.779	1982	2010	28	56	2X/yr
+	AB07OB0010	HAY RIVER	AT HWY 35 NEAR MEANDER RIVER	AB	59.133	-117.633	1987	1987	1	2	
+	NW07UC0002	KAKISA RIVER	AT HWY #1 BRIDGE	NWT	60.986	-117.245	1982	2010	28	56	2X/yr
+	AB07MD0040	LAKE ATHABASCA	7 KM SE OF CYPRESS POINT	AB	59.153	-110.136	1987	1993		40	
+	NW07PB0002	LITTLE BUFFALO RIVER	AT HWY #5 BRIDGE	NWT	60.047	-112.771	1982	2010	28	56	2X/yr
+	WSC 07KF003	MAMAWI LAKE CHANNEL	SOUTHERN MAMAWI LK CHANNEL (JOSM QU1)	AB	58.633	-111.333	2012	2014	3		12X/yr
+	AL07KC0001	PEACE RIVER	AT PEACE POINT (JOSM M12)	AB	59.122	-112.452	1967	2014			12X/yr
+	AB07HF0010	PEACE RIVER	AT FORT VERMILION	AB	58.404	-116.128	1988	2014	27	349	12X/yr
+	AB07HA0030	PEACE RIVER	AT PEACE RIVER, ABOVE HEART RIVER	AB	56.224	-117.300	1970	1983	7	21	
+	AB07FD0135	PEACE RIVER	U/S SMOKY RIVER NEAR SHAFTESBURY FERRY	AB	56.093	-117.566	2008	2014	7	74	12X/yr

Class	Station No.	River Reach	Water Quality Monitoring Site	Prov.	Lat.	Long.	From	To	Years of Data	# of Samples	Latest Frequency
+	AB07FD0090	PEACE RIVER	AT DUNVEGAN BRIDGE	AB	55.920	-118.606	1958	1978	14	51	
+	AL07NA0001	RIVIERE DES ROCHERS	RIVIÈRE DES ROCHER BELOW LITTLE RAPIDS (JOSM M10)	AB	58.922	-111.183	2012	2014	3		12X/yr
+	NW07NB0001	SALT RIVER	AT HWY #5 BRIDGE	NWT	60.021	-112.351	1982	2010	28	56	2X/yr
+	NW07NC0004	SLAVE RIVER	AT THE MOUTH (JOSM SL2)	NWT	61.321	-113.611	2012	2014	3	12	12X/yr
+	NW07NC0003	SLAVE RIVER	SLAVE RIVER ABOVE THE MOUTH (JOSM SL1)	NWT	61.260	-113.459	1982	2014	32	64	12X/yr
-	BC07FD0005	PEACE RIVER	PEACE RIVER ABOVE ALCES	AB	56.126	-120.056	1984	2014	21	>481	12X/yr
	AB07BJ0030	ASSINEAU RIVER	NEAR CONFLUENCE WITH LESSER SLAVE LAKE	AB	55.388	-115.196	1990	2008	5	16	
	AB07DD0150	ATHABASCA RIVER	EMBARRAS RIVER NEAR LAKE ATHABASCA	AB	58.652	-111.046	1976	2008	6	27	
	AB07DD0360	ATHABASCA RIVER	BIG POINT CHANNEL OUTLET - DELTA SITE	AB	58.640	-110.774	1976	1984	9	54	
	AB07DD0220	ATHABASCA RIVER	GOOSE ISLAND CHANNEL NEAR LAKE ATHABASCA	AB	58.621	-110.834	1976	2008	5	24	
	AB07DD0230	ATHABASCA RIVER	BIG POINT CHANNEL NEAR LAKE ATHABASCA	AB	58.607	-110.807	1987	2008	10	43	
	AB07DD0110	ATHABASCA RIVER	U/S OF CONFLUENCE OF FLETCHER CHANNEL	AB	58.453	-111.089	1989	1994	6	7	
	AB07DD0105	ATHABASCA RIVER	D/S OF DEVILS ELBOW AT WINTER ROAD CROSSING	AB	58.447	-111.186	1997	2014	18	66	
	AB07DD0040	ATHABASCA RIVER	AT EMBARRAS AIRPORT	AB	58.205	-111.390	1968	1990	11	63	
	--	ATHABASCA RIVER	ATR-DD	AB	57.446	-111.605	≤2011	2014	≥4		4X/yr

Class	Station No.	River Reach	Water Quality Monitoring Site	Prov.	Lat.	Long.	From	To	Years of Data	# of Samples	Latest Frequency
	AB07DA0860	ATHABASCA RIVER	5.0 KM D/S OF BITUMOUNT	AB	57.431	-111.642	1984	1997	11	34	
	AB07DA1550	ATHABASCA RIVER	BELOW CONFLUENCE WITH THE TAR RIVER	AB	57.366	-111.662	1976	1983	6	51	
	AB07DA0680	ATHABASCA RIVER	AT FORT MACKAY	AB	57.194	-111.608	1968	1976	5	13	
	AB07DA1540	ATHABASCA RIVER	AT FORT MACKAY - AOSERP	AB	57.188	-111.624	1976	1984	9	126	
	AB07DA0400	ATHABASCA RIVER	U/S OF THE CONFLUENCE WITH MUSKEG RIVER	AB	57.130	-111.605	1976	1997	9	116	
	AB07DA1520	ATHABASCA RIVER	SITE 6 - MILEAGE 29.8 - AOSERP	AB	57.076	-111.533	1976	1984	5	57	
	AB07DA0170	ATHABASCA RIVER	ABOVE SUNCOR	AB	56.986	-111.438	1989	1995	7	16	
	AB07DA0180	ATHABASCA RIVER	AT TAR ISLAND	AB	56.985	-111.403	1964	1989	14	60	
	AB07DA1500	ATHABASCA RIVER	SITE 4 - MILE 19 - AOSERP	AB	56.939	-111.443	1976	1984	6	74	
	--	ATHABASCA RIVER	ATR-DC W/E/M	AB	56.827	-111.409	≤2011	2014	≥4		4X/yr
	AB07CC0170	ATHABASCA RIVER	U/S OF BOILER RAPIDS	AB	56.520	-112.611	1989	1996	8	18	
	AB07CC0150	ATHABASCA RIVER	ABOVE CONFLUENCE OF BUFFALO CREEK	AB	56.518	-112.599	1989	1996	7	17	
	AB07CC0130	ATHABASCA RIVER	ABOVE GRANDE RAPIDS	AB	56.310	-112.591	1989	1996	8	19	
	AB07CB0760	ATHABASCA RIVER	ABOVE CONFLUENCE OF HOUSE RIVER	AB	56.196	-112.511	1989	1996	8	33	
	AB07CB0710	ATHABASCA RIVER	1.7 KM U/S OF CONFLUENCE WITH PELICAN R.	AB	55.823	-112.629	1989	1996	8	26	

Class	Station No.	River Reach	Water Quality Monitoring Site	Prov.	Lat.	Long.	From	To	Years of Data	# of Samples	Latest Frequency
	AB07CB0700	ATHABASCA RIVER	11.7 KM D/S OF CONFLUENCE WITH DUNCAN CRK	AB	55.418	-112.729	1989	1996	8	28	
	AB07BE0020	ATHABASCA RIVER	D/S OF THE LESSER SLAVE RIVER AT SMITH	AB	55.168	-114.043	1989	1994	6	12	
	AB07BD0100	ATHABASCA RIVER	ABOVE SMITH D/S OF RAILWAY BRIDGE	AB	55.161	-114.056	1955	1984	20	75	
	AB07CB0660	ATHABASCA RIVER	3 KM D/S OF CALLING RIVER	AB	55.116	-112.864	1991	1998	7	44	
	AB07BD0050	ATHABASCA RIVER	ABOVE TOWN OF SMITH AT HWY #2 BRIDGE	AB	55.071	-114.093	1985	2003	18	128	
	AB07BE0310	ATHABASCA RIVER	45 KM ABOVE TOWN OF ATHABASCA	AB	55.033	-113.478	1984	1996	11	32	
	AB07CB0580	ATHABASCA RIVER	0.5 KM U/S OF CONFLUENCE WITH LABICHE R.	AB	55.010	-112.733	1989	1996	8	26	
	AB07BD0020	ATHABASCA RIVER	0.5 KM U/S OF CONFLUENCE WITH PEMBINA R.	AB	54.741	-114.288	1989	1996	8	21	
	AB07BD0010	ATHABASCA RIVER	AT VEGA FERRY (KLONDYKE)	AB	54.431	-114.461	1989	1996	5	8	
	AB07AH0370	ATHABASCA RIVER	NEAR FORT ASSINIBOINE	AB	54.317	-114.788	1960	1999	13	115	
	AB07AE0130	ATHABASCA RIVER	NEAR WINDFALL 1.5 KM D/S OF TWO CREEK	AB	54.248	-116.239	1988	1993	6	17	
	AB07AH0320	ATHABASCA RIVER	5.0 KM D/S FIVE MILE ISLAND	AB	54.238	-115.023	1989	1996	8	24	
	AB07AE0160	ATHABASCA RIVER	AT WINDFALL BRIDGE	AB	54.208	-116.060	1960	2005	18	120	
	AB07AH0130	ATHABASCA RIVER	3 KM D/S OF MCLEOD RIVER CONFLUENCE	AB	54.165	-115.660	1988	1996	6	20	
	AB07AH0220	ATHABASCA RIVER	10 KM D/S MCLEOD RIVER CONFLUENCE	AB	54.159	-115.550	1988	2000	12	35	

Class	Station No.	River Reach	Water Quality Monitoring Site	Prov.	Lat.	Long.	From	To	Years of Data	# of Samples	Latest Frequency
	AB07AH0280	ATHABASCA RIVER	AT BRIDGE NORTH OF BLUE RIDGE	AB	54.159	-115.391	1988	1996	7	37	
	AB07AH0255	ATHABASCA RIVER	14 KM D/S MCLEOD RIVER CONFLUENCE	AB	54.159	-115.508	1999	2005	7	33	
	AB07AE0040	ATHABASCA RIVER	AT KNIGHT BRIDGE ON HWY #947	AB	54.153	-116.593	1980	1996	6	12	
	AB07AE0360	ATHABASCA RIVER	AT WHITECOURT AT HWY #43 BRIDGE	AB	54.149	-115.721	1955	1996	32	157	
	AB07AE0020	ATHABASCA RIVER	BELOW CONFLUENCE OF BERLAND RIVER	AB	54.010	-116.837	1989	1994	5	8	
	AB07AD0570	ATHABASCA RIVER	BEFORE CONFLUENCE OF BERLAND RIVER	AB	54.002	-116.844	1959	1996	11	49	
	AB07AD0530	ATHABASCA RIVER	6.2 KM D/S OF OLDMAN CREEK	AB	53.795	-117.184	1988	1995	5	13	
	AB07AD0460	ATHABASCA RIVER	50 KM BELOW HINTON AT EMERSON L. BRDGE	AB	53.703	-117.163	1974	1986	6	19	
	AB07AD0490	ATHABASCA RIVER	5 KM U/S OF CONFLUENCE OF OLDMAN CREEK	AB	53.701	-117.161	1986	1996	8	26	
	AB07AD0440	ATHABASCA RIVER	AT OLD OBED FERRY	AB	53.625	-117.202	1960	1996	15	69	
	AB07AD0360	ATHABASCA RIVER	AT OBED MOUTAIN COALS BRIDGE	AB	53.524	-117.363	1960	2005	22		
	AB07AD0320	ATHABASCA RIVER	BELOW HINTON 2.3 KM. D/S OF TRAIL CREEK	AB	53.485	-117.463	1985	1996	7	13	
	AB07AD0280	ATHABASCA RIVER	BELOW HINTON 1.7 KM D/S OF CENTRE CREEK	AB	53.454	-117.503	1957	1996	15		
	AB07AD0240	ATHABASCA RIVER	BELOW HINTON AT BRIDGE, WELDWOOD HAUL RD	AB	53.430	-117.557	1957	1991	11	75	
	AB07AD0260	ATHABASCA RIVER	BELOW HINTON AT BRIDGE, CHAMPION HAUL RD	AB	53.429	-117.556	1984	1993	5	16	

Class	Station No.	River Reach	Water Quality Monitoring Site	Prov.	Lat.	Long.	From	To	Years of Data	# of Samples	Latest Frequency
	AB07AD0120	ATHABASCA RIVER	U/S OF PULP MILL WATER INTAKE	AB	53.413	-117.588	1970	1995	8	35	
	AB07AD0160	ATHABASCA RIVER	0.1 KM U/S OF HINTON PUMPHOUSE	AB	53.411	-117.588	1956	1999	27	319	
	--	ATHABASCA RIVER	ATR-SR	AB	26.192	-120.183	≤2011	2014	≥4		1X/yr
	AB07GE0190	BEAR RIVER	AT CONFLUENCE WITH WAPITI RIVER	AB	55.108	-118.472	1989	1998	5	13	
	--	BEAVER RIVER	BER-1	AB	57.120	-111.600	≤2011	2014	≥4		1X/yr (fall)
	--	BEAVER RIVER	BER-2	AB	56.944	-111.567	≤2011	2014	≥4		1X/yr (fall)
	AB07GB0105	BEAVERDAM CREEK	2KM D/S OF SMOKY RIVER COALS POND 12S-5	AB	54.064	-119.307	2009	2014	16	72	4X/yr
	AB07GD0020	BEAVERLODGE RIVER	U/S OF BEAVERTAIL CREEK	AB	55.338	-119.640	1994	2007	6	30	
	AB07GD0040	BEAVERLODGE RIVER	U/S OF BEAVERLODGE	AB	55.201	-119.482	1994	2007	6	31	
	AB07GD0070	BEAVERLODGE RIVER	AT GRAVEL PIT	AB	55.113	-119.335	1994	2007	6	31	
	AB07GD0030	BEAVERTAIL CREEK	AT THE MOUTH	AB	55.318	-119.635	1995	2007	5	29	
	AB07AC0010	BERLAND RIVER	BEFORE CONFLUENCE WITH ATHABASCA RIVER	AB	54.004	-116.847	1984	1996	11	42	
	AB07AF0230	BERRY'S CREEK	NEAR CONFLUENCE WITH GREGG RIVER	AB	53.094	-117.447	1985	2008	7	19	
	--	BIRCH CREEK	BRC-1	AB	55.615	-111.124	2013	2014	2		4X/yr
	--	BIRCH RIVER	BI1	AB	58.315	-113.069	2013	2014	2		12X/yr

Class	Station No.	River Reach	Water Quality Monitoring Site	Prov.	Lat.	Long.	From	To	Years of Data	# of Samples	Latest Frequency
	AB07DA1440	BRIDGE CREEK DIVERSION	AT HWY #63	AB	57.121	-111.625	1976	1980	5	36	
	AB07GF0230	BRIDLEBIT CREEK	NEAR VALLEYVIEW AT WSC GAUGE	AB	54.936	-117.734	2000	2004	5	300	
	AB07CB0620	CALLING LAKE INLET	LAKE INLET	AB	55.291	-113.405	1987	1996	8	20	
	AB07CB0640	CALLING RIVER	NEAR CONFLUENCE WITH ATHABASCA RIVER	AB	55.090	-112.883	1984	1996	10	29	
	--	CALUMET	CAR-2	AB	57.438	-111.754	≤2011	2014	≥4		1X/yr (fall)
	--	CALUMET	CA1/CAR-1	AB	57.406	-111.673	≤2011	2014	≥4		1X/yr (fall)
	AB07KF0060	CHENAL DES QUATRE	6.5 KM D/S FROM FOUR FORKS SITE 75	AB	58.665	-111.357	1977	1983	7	36	
	--	CHRISTINA LAKE	CHL-1	AB	55.632	-111.044	≤2011	2014	≥4		4X/yr
	--	CHRISTINA RIVER	CH1/CHR-1	AB	56.667	-111.066	≤2011	2014	≥4		12X/yr
	--	CHRISTINA RIVER	CHR-4	AB	55.888	-111.543	≤2011	2014	≥4		4X/yr
	--	CHRISTINA RIVER	CHR-2	AB	55.886	-110.802	≤2011	2014	≥4		12X/yr
	--	CHRISTINA RIVER	CHR-3	AB	55.719	-111.220	≤2011	2014	≥4		4X/yr
	AB07CD0100	CLEARWATER RIVER	NEAR WATERWAYS	AB	56.701	-111.329	1973	1997	14	54	
	AB07CD0210	CLEARWATER RIVER	3 KM ABOVE WATERWAYS	AB	56.689	-111.318	1970	1981	7	54	
	--	CLEARWATER RIVER	CL3/CLR-2	AB	56.669	-111.064	≤2011	2014	≥4		12X/yr

Class	Station No.	River Reach	Water Quality Monitoring Site	Prov.	Lat.	Long.	From	To	Years of Data	# of Samples	Latest Frequency
	AB07BK0105	DRIFTWOOD RIVER	ABOVE CONFLUENCE WITH LESSER SLAVE R.	AB	55.254	-114.239	1999	2007	5	16	
	--	ELLS RIVER	EL1/ELR-1/ELLS RIFF 3	AB	57.308	-111.679	≤2011	2014	≥4		12X/yr
	AB07DA0750	ELLS RIVER	AT THE MOUTH	AB	57.304	-111.676	1972	1996	12	36	
	--	ELLS RIVER	EL2/ELLS/RIFF 2/ELR-2/ELLS RIFF 2	AB	57.245	-111.737	≤2011	2014	≥4		12X/yr
	--	ELLS RIVER	ELR-2A (RAMP)	AB	57.233	-111.754	≤2011	2012	≥2	≥2	
	--	ELLS RIVER	ELLS/RIFF 5/ELLS RIFF 5	AB	57.228	-111.959	2013	2014	2		12X/yr
	--	ELLS RIVER	ELR-3 (RAMP)	AB	57.221	-111.989	2013	2014	2		4X/yr
	AB07AF0380	EMBARRAS RIVER	NEAR CONFLUENCE WITH MCLEOD RIVER	AB	53.459	-116.617	1984	2006	10	57	
	AB07AF0255	FALLS CREEK	NEAR CONFLUENCE WITH GREGG RIVER	AB	53.101	-117.471	1998	2008	5	11	
	--	FIREBAG RIVER	FI1	AB	57.743	-111.351	2012	2014	3		12X/yr
	--	FIREBAG RIVER	FI WSC	AB	57.651	-111.202	≤2011	2014	≥4		12X/yr
	--	FIREBAG RIVER	FI2/FIR-2/FIR UPPER	AB	57.335	-110.476	≤2011	2014	≥4		1X/yr (fall)
	--	FORT CREEK	FOC-1	AB	57.409	-111.640	≤2011	2014	≥4		1X/yr (fall)
	--	GARDINER LAKE	GAL-1	AB	57.537	-112.510	2014	2014	1		4X/yr
	AB07AH0410	GOOSE LAKE INFLOW	LAKE INFLOW	AB	54.324	-115.158	1992	1996	5	65	

Class	Station No.	River Reach	Water Quality Monitoring Site	Prov.	Lat.	Long.	From	To	Years of Data	# of Samples	Latest Frequency
	AB07GE0940	GRANDE PRAIRIE CREEK	NW OF SEXSMITH ON HWY #59	AB	55.374	-118.914	1999	2007	9	116	
	AB07AF0330	GREGG RIVER	8 KM U/S CONFLUENCE WITH MCLEOD RIVER	AB	53.252	-117.359	1984	2000	6	33	
	AB07AF0262	GREGG RIVER	9.5 D/S OF SPHINX CREEK	AB	53.185	-117.506	2001	2014	14	76	4X/yr
	AB07AF0260	GREGG RIVER	NEAR HWY #40 AND D/S FALLS CREEK	AB	53.102	-117.471	1984	1998	5	22	
	AB07AF0210	GREGG RIVER	ABOVE LUSCAR VALLEY (CRC) MINE	AB	53.059	-117.451	1985	2014	21	95	4X/yr
	--	GREGOIRE LAKE	GRL-1	AB	56.449	-111.127	≤2011	2014	≥4		4X/yr
	--	GREGOIRE RIVER (LOWER)	GRR-1	AB	56.484	-110.835	2014	2014	1		4X/yr
	AB07BF0050	GROUARD CHANNEL	AT HWY #750 BRIDGE	AB	55.514	-116.165	1990	2008	6	24	
	AB07CD0110	HANGINGSTON E CREEK	AT HWY #63	AB	56.705	-111.356	1976	1983	8	73	
	--	HANGINGSTON E RIVER	HAR-1A	AB	56.708	-111.358	2013	2014	2		1X/yr (fall)
	--	HANGINGSTON E RIVER	HAR1	AB	56.632	-111.350	2013	2014	2		1X/yr (fall)
	AB07DA1090	HARTLEY (JACKPINE) CREEK	3 KM ABOVE CONFLUENCE WITH MUSKEG R.	AB	57.238	-111.415	1976	2008	5	21	
	--	HIGH HILLS RIVER	HIHI1/HHR-1/HIGH HILLS	AB	56.743	-110.511	≤2011	2014	≥4		4X/yr
	AB07FD1390	HINES CREEK	ABOVE GERRY LAKE NW OF GRIMSHAW	AB	56.334	-118.263	1999	2007	9	129	
	AB07CB0770	HOUSE RIVER	BEFORE CONFLUENCE WITH ATHABASCA RIVER	AB	56.200	-112.496	1984	1996	10	37	

Class	Station No.	River Reach	Water Quality Monitoring Site	Prov.	Lat.	Long.	From	To	Years of Data	# of Samples	Latest Frequency
	--	ISADORE'S LAKE	ISL-1	AB	57.230	-111.607	≤2011	2014	≥4		1X/yr (fall)
	--	IYINIMIN CREEK	IYC-1	AB	57.250	-111.175	≤2011	2014	≥4		1X/yr (fall)
	--	JACK PINE RIVER	TR3.1/JAC-1	AB	57.239	-111.414	≤2011	2014	≥4		12X/yr
	--	JACK PINE RIVER	TR3.2	AB	57.206	-111.390	2012	2014	3		12X/yr
	--	JACK PINE RIVER	JA2/JAC-2	AB	57.067	-111.329	≤2011	2014	≥4		1X/yr (fall)
	--	JACKFISH RIVER (OUTLET OF CHRISTINA L.)	JAR-1	AB	55.672	-111.098	2012	2014	3		4X/yr
	AB07DA0600	JACKPINE (HARTLEY) CREEK	0.4 KM ABOVE CONFLUENCE WITH MUSKEG R.	AB	57.259	-111.465	1976	2014	17	156	12X/yr
	--	JOHNSON LAKE	JOL-1	AB	57.657	-110.389	≤2011	2014	≥4		4X/yr
	--	KEARL LAKE	KL1/KEL-1	AB	57.298	-111.251	≤2011	2014	≥4		1X/yr (fall)
	AB07GE0930	KLESKUN HILLS MAIN DRAIN	NEAR GRANDE PRAIRIE NEAR HWY #34	AB	55.225	-118.460	1999	2007	9	80	
	AB07CA0040	LA BICHE RIVER	BEFORE CONFLUENCE WITH ATHA. RIVER	AB	55.016	-112.726	1984	1996	10	35	
	AB07BK0010	LESSER SLAVE RIVER	AT BRIDGE NEAR OUTFLOW	AB	55.306	-114.760	1988	2008	18	121	
	AB07BK0020	LESSER SLAVE RIVER	BELOW WEIR, NEAR OUTFLOW	AB	55.305	-114.753	1988	2007	6	23	
	AB07BK0030	LESSER SLAVE RIVER	AT MITSUE BRIDGE	AB	55.293	-114.589	1989	2007	11	29	

Class	Station No.	River Reach	Water Quality Monitoring Site	Prov.	Lat.	Long.	From	To	Years of Data	# of Samples	Latest Frequency
	AB07BK0070	LESSER SLAVE RIVER	U/S OF THE OTAUWAU RIVER	AB	55.281	-114.419	1989	2007	6	14	
	AB07BK0100	LESSER SLAVE RIVER	0.5 KM U/S OF DRIFTWOOD RIVER	AB	55.254	-114.246	1989	2007	11	24	
	AB07BK0120	LESSER SLAVE RIVER	14.5 KM U/S CONFLUENCE WITH ATHA. R.	AB	55.229	-114.148	1965	1984	6	24	
	AB07BK0125	LESSER SLAVE RIVER	9.5 KM U/S OF ATHA. R. CONFLUENCE	AB	55.207	-114.123	1996	2014	17	99	6X/yr
	AB07BK0130	LESSER SLAVE RIVER	AT CONFLUENCE WITH ATHABASCA RIVER	AB	55.166	-114.062	1985	2007	15	123	
	AB07GH0050	LITTLE SMOKY RIVER	RIVER NEAR THE MOUTH	AB	55.680	-117.592	1989	1998	5	19	
	AB07GH0020	LITTLE SMOKY RIVER	5 M D/S OF ROAD 669 BRIDGE	AB	55.083	-117.129	1990	1996	7	15	
	--	LOWER BUCKTON	BU2	AB	58.128	-111.889	2013	2014	2		12X/yr
	AB07AF0088	LUSCAR CREEK	D/S HWY #40 BRIDGE	AB	53.062	-117.301	1998	2014	17	85	4X/yr
	AB07AF0065	LUSCAR CREEK	ABOVE LUSCAR VALLEY (CRC) MINE	AB	53.052	-117.421	1998	2014	17	80	4X/yr
	--	MACKAY RIVER	MA1/PC MA2/MAR-1	AB	57.176	-111.656	≤2011	2014	≥4		12X/yr
	AB07DB0060	MACKAY RIVER	AT HWY #63	AB	57.168	-111.640	1976	1997	6	42	
	--	MACKAY RIVER	MAR-2A (RAMP)	AB	57.021	-111.828	≤2011	2014	≥4		1X/yr (fall)
	--	MACKAY RIVER	MA2/PC MA5/MAR-2	AB	56.967	-111.908	≤2011	2014	≥4		12X/yr
	AB07AE0030	MARSH HEAD CREEK	NEAR CONFLUENCE WITH ATHA. R.	AB	54.152	-116.596	1989	1996	8	25	

Class	Station No.	River Reach	Water Quality Monitoring Site	Prov.	Lat.	Long.	From	To	Years of Data	# of Samples	Latest Frequency
	AB07BG0020	MARTEN CREEK	AT HWY #88	AB	55.533	-114.890	1990	2008	5	18	
	--	MCIVOR RIVER	MC1	AB	58.059	-111.905	2013	2014	2		12X/yr
	--	MCLEAN CREEK	MCC-1	AB	56.897	-111.416	≤2011	2014	≥4		1X/yr (fall)
	--	MCLELLAND LAKE	MCL-1	AB	57.491	-111.278	≤2011	2014	≥4		1X/yr (fall)
	AB07AG0390	MCLEOD RIVER	AT WHITECOURT - HWY #43 BRIDGE	AB	54.136	-115.696	1955	2014	43	223	4X/yr
	AB07AG0260	MCLEOD RIVER	D/S OF ROSEVEAR FERRY	AB	53.700	-116.156	1986	2006	10	43	
	AB07AG0045	MCLEOD RIVER	SOUTH OF EDSON	AB	53.531	-116.482	1998	2006	9	42	
	AB07AF0350	MCLEOD RIVER	U/S CONFLUENCE WITH EMBARRAS RIVER	AB	53.458	-116.621	1984	2001	7	40	
	AB07AF0340	MCLEOD RIVER	BELOW CONFLUENCE WITH GREGG RIVER	AB	53.307	-117.268	1984	2014	16	74	4X/yr
	AB07AF0200	MCLEOD RIVER	U/S CONFLUENCE WITH THE GREGG RIVER	AB	53.290	-117.279	1984	2000	5	28	
	AB07AF0100	MCLEOD RIVER	3.5 KM D/S OF LUSCAR CREEK	AB	53.071	-117.278	1985	2001	5	13	
	AB07AF0050	MCLEOD RIVER	U/S OF CADOMIN	AB	53.010	-117.332	1985	1998	5	18	
	AB07AF0045	MCLEOD RIVER	0.1 KM U/S OF CADOMIN CREEK	AB	52.990	-117.333	1998	2014	17	69	4X/yr
	AB07AF0041	MCLEOD RIVER	0.1 KM U/S OF WHITEHORSE CREEK	AB	52.984	-117.336	2009	2014	6	25	4X/yr
	AB07AF0010	MCLEOD RIVER	U/S OF MOUNTAIN PARK	AB	52.899	-117.277	1995	2014	12	51	4X/yr

Class	Station No.	River Reach	Water Quality Monitoring Site	Prov.	Lat.	Long.	From	To	Years of Data	# of Samples	Latest Frequency
	--	MONDAY CREEK	MOC-1	AB	55.585	-110.823	2013	2014	2		4X/yr
	AB07DA2755	MUSKEG CREEK	AT CONFLUENCE WITH MUSKEG RIVER	AB	57.308	-111.389	2008	2014	7	61	
	AB07DA0440	MUSKEG RIVER	11 KM U/S STANLEY CREEK	AB	57.417	-111.221	2008	2014	12	106	12X/yr
	AB07DA0475	MUSKEG RIVER	U/S STANLEY CREEK	AB	57.353	-111.336	2003	2014	12	107	12X/yr
	--	MUSKEG RIVER	MUR-6	AB	57.344	-111.131	≤2011	2014	≥4		4X/yr
	--	MUSKEG RIVER	M7	AB	57.332	-111.120	2012	2014	3		12X/yr
	AB07DA2750	MUSKEG RIVER	D/S OF STANLY CREEK	AB	57.331	-111.374	1996	2002	6	27	
	AB07DA2754	MUSKEG RIVER	ABOVE CONFLUENCE WITH MUSKEG CREEK	AB	57.307	-111.394	2010	2014	5	58	12X/yr
	AB07DA0595	MUSKEG RIVER	U/S OF JACKPINE (HARTLEY) CREEK	AB	57.264	-111.473	1998	2014	14	143	12X/yr
	--	MUSKEG RIVER	MU1/M2/MU1 WSC	AB	57.192	-111.573	≤2011	2014	≥4		12X/yr
	AB07DA0610	MUSKEG RIVER	AT WSC GAUGE D/S OF KEARL LAKE ROAD	AB	57.192	-111.568	≤2011	2014	23	290	12X/yr
	AB07DA0620	MUSKEG RIVER	NEAR THE MOUTH	AB	57.135	-111.602	1972	2002	21	71	
	--	MUSKEG RIVER	MU0/MUR-1	AB	57.134	-111.601	2013	2014	2		12X/yr
	--	NAMUR LAKE	NAL-1	AB	57.436	-112.650	2014	2014	1		4X/yr
	--	NORTH MUSKEG RIVER	NM1/MUC-1	AB	57.284	-111.316	≤2011	2014	≥4		1X/yr (fall)

Class	Station No.	River Reach	Water Quality Monitoring Site	Prov.	Lat.	Long.	From	To	Years of Data	# of Samples	Latest Frequency
	--	NORTH STEEPBANK	NSR-1	AB	57.064	-111.043	≤2011	2014	≥4		1X/yr (fall)
	AB07MA0020	OLD FORT RIVER	NEAR MOUTH	AB	58.592	-111.167	1988	2004	7	14	
	AB07BB0060	PADDLE RIVER	AT BRIDGE NEAR ANSELMO	AB	53.858	-115.363	1993	2008	14	245	
	AB07KC0010	PEACE RIVER	NEAR PEACE POINT- 8 KM BELOW BOYER RAPIDS	AB	59.164	-112.533	1988	1993	5	15	
	AB07HC0030	PEACE RIVER	6.3 KM ABOVE SOUTH MOUTH OF BUCHANAN CRK	AB	56.862	-117.322	1988	1994	7	62	
	AB07HA0230	PEACE RIVER	1.5 KM ABOVE CONFLUENCE OF WHITEMUD R.	AB	56.656	-117.147	2010	2014	5	28	6X/yr
	AB07FD0060	PEACE RIVER	AT DUNVEGAN 1.5 KM U/S OF BRIDGE	AB	55.926	-118.629	1989	1994	6	41	
	AB07CB0720	PELICAN RIVER	NEAR CONFLUENCE WITH ATHABASCA RIVER	AB	55.836	-112.644	1989	1996	8	28	
	AB07BC0070	PEMBINA RIVER	NEAR CONFLUENCE WITH ATHABASCA RIVER	AB	54.756	-114.267	1988	1996	9	42	
	AB07BC0050	PEMBINA RIVER	APPROX 4 KM SOUTH EAST OF FLATBUSH	AB	54.667	-114.201	1971	2003	9	45	
	AB07BC0010	PEMBINA RIVER	AT ROSSINGTON	AB	54.167	-114.080	1971	2003	10	37	
	AB07BB0030	PEMBINA RIVER	D/S OF SANGUDO	AB	53.882	-114.901	1969	2002	6	8	
	AB07BB0020	PEMBINA RIVER	AT PEMBINA RIVER PROVINCIAL PARK	AB	53.609	-115.000	1981	2002	6	16	
	--	PIERRE RIVER	PIR-1	AB	57.448	-111.628	≤2011	2014	≥4		4X/yr
	--	POPLAR CREEK	PO1/POC-1	AB	56.922	-111.444	≤2011	2014	≥4		12X/yr

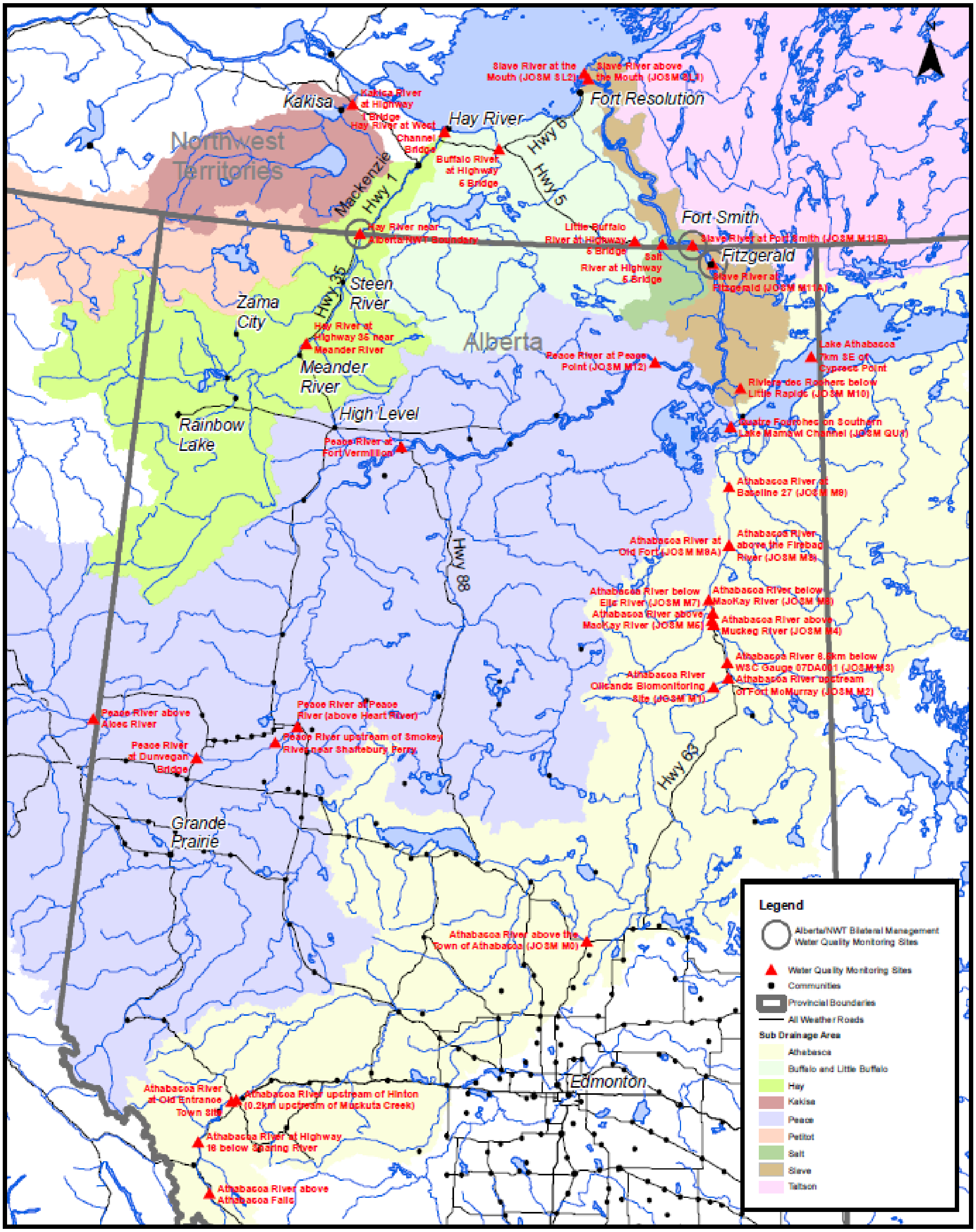
Class	Station No.	River Reach	Water Quality Monitoring Site	Prov.	Lat.	Long.	From	To	Years of Data	# of Samples	Latest Frequency
	AB07DA0110	POPLAR CREEK	21.6 KM NORTH OF FORT MCMURRAY VIA HWY #63	AB	56.914	-111.458	1976	1996	10	73	
	--	RED CLAY	RCC-1	AB	57.697	-111.405	≤2011	2014	≥4		4X/yr
	AB07CA0020	RED DEER CREEK	BEFORE ENTERING LAC LA BICHE LAKE	AB	54.768	-111.994	1985	1999	7	40	
	AB07DD0120	RICHARDSON RIVER	AT THE MOUTH	AB	58.363	-111.237	1989	1996	8	28	
	--	RICHARDSON RIVER	RI1	AB	58.360	-111.241	2012	2014	3		12X/yr
	AB07NA0030	RIVIERE DES ROCHERS	150 M U/S OF REVILLION COUPE	AB	58.845	-111.259	1976	1991	13	80	
	AB07AH0010	SAKWATAMAU RIVER	NEAR THE CONFLUENCE WITH ATHA. R.	AB	54.158	-115.722	1990	1997	8	79	
	--	SAWBONES CREEK (NORTH	SAC-1	AB	55.650	-110.818	2012	2014	3		4X/yr
	AB07BK0025	SAWRIDGE CREEK	AT HWY #88 BRIDGE	AB	55.285	-114.758	1999	2007	5	15	
	--	SHIPYARD LAKE	SHL-1	AB	56.961	-111.435	≤2011	2014	≥4		1X/yr (fall)
	AB07GF0090	SIMONETTE RIVER	NEAR THE MOUTH	AB	55.159	-118.255	1989	1998	5	18	
	AB07GJ0260	SMOKY RIVER	AT MOUTH	AB	56.159	-117.348	1983	1998	6	18	
	AB07GA0010	SMOKY RIVER	U/S OF MCINTYRE PORCUPINE MINES	AB	55.919	-119.183	1971	1975	5	17	
	AB07GJ0010	SMOKY RIVER	AT WATINO	AB	55.716	-117.622	1976	2014	35	444	12X/yr
	AB07GJ0110	SMOKY RIVER	0.1 KM U/S OF PUSKWASKAU RIVER CONFLUENCE	AB	55.484	-118.159	1989	1998	5	16	

Class	Station No.	River Reach	Water Quality Monitoring Site	Prov.	Lat.	Long.	From	To	Years of Data	# of Samples	Latest Frequency
	AB07GJ0080	SMOKY RIVER	AT BEZANSON BRIDGE, HWY #34	AB	55.237	-118.257	1966	1998	17	45	
	AB07GF0050	SMOKY RIVER	U/S OF WAPITI RIVER	AB	55.135	-118.298	1989	1997	5	17	
	AB07GA0020	SMOKY RIVER	D/S OF MCINTYRE PORCUPINE MINES	AB	54.833	-119.167	1971	1975	5	16	
	AB07GB0125	SMOKY RIVER	AT WANYANDIE FLATS EAST	AB	54.070	-118.895	2002	2006	5	16	
	AB07BF0020	SOUTH HEART RIVER	AT HIGH PRAIRIE	AB	55.529	-116.517	1990	1996	7	17	
	AB07AF0250	SPHINX CREEK	NEAR CONFLUENCE WITH GREGG RIVER	AB	53.119	-117.496	1985	2008	6	14	
	--	STANLEY CREEK	STC-1	AB	57.352	-111.376	≤2011	2014	≥4		1X/yr (fall)
	AB07DA0260	STEEPBANK RIVER	AT THE MOUTH	AB	57.025	-111.460	1972	1997	7	16	
	--	STEEPBANK RIVER	ST1/ST1/STR-1/STB RIFF 1	AB	57.023	-111.476	≤2011	2014	≥4		12X/yr
	AB07DA1000	STEEPBANK RIVER	7KM U/S FROM THE MOUTH	AB	57.005	-111.415	1976	1980	5	39	
	--	STEEPBANK RIVER	ST WSC	AB	56.999	-111.407	2012	2014	3		12X/yr
	--	STEEPBANK RIVER	STRIFF7/STB RIFF 7	AB	56.980	-111.299	2012	2014	3		12X/yr
	--	STEEPBANK RIVER	STR-2 (RAMP)/STB RIFF 20	AB	56.927	-111.233	≤2011	2014	≥4		12X/yr
	AB07DA2720	STEEPBANK RIVER	6 KM D/S OF NORTH STEEPBANK RIVER	AB	56.870	-111.146	1996	2001	5	25	
	--	STEEPBANK RIVER	STRIFF10/STB RIFF 10	AB	56.869	-111.143	2013	2014	2		12X/yr

Class	Station No.	River Reach	Water Quality Monitoring Site	Prov.	Lat.	Long.	From	To	Years of Data	# of Samples	Latest Frequency
	--	STEEPBANK RIVER	ST2/STR-3	AB	56.846	-111.082	2014	2014	1		1X/yr (fall)
	--	STEEPBANK RIVER	STR-3/STB RIFF 11	AB	56.821	-110.991	≤2011	2013	≥3	≥3	
	--	SUNDAY CREEK (INLET TO CHISTINA L.)	SUC-1	AB	55.584	-110.893	2012	2014	3		4X/yr
	--	SUNDAY CREEK (UPPER)	SUC-2	AB	55.553	-111.095	2013	2014	2		4X/yr
	AB07CE0040	SURMONT CREEK	APPROX 2 MILES ABOVE GREGOIRE LAKE	AB	56.450	-111.063	1978	1983	6	48	
	--	TAR RIVER	TA1/TAR-2	AB	57.394	-111.992	≤2011	2014	≥4		1X/yr (fall)
	--	TAR RIVER	TAR-1	AB	57.323	-111.683	≤2011	2014	≥4		1X/yr (fall)
	AB07BB0110	THUNDER LAKE - INFLOW (DIVERSION)	AT STAFF GAUGE U/S OF DAIRY FARM	AB	54.151	-114.810	1992	1996	5	52	
	--	UNNAMED CREEK (BIG CREEK)	UN1/BIC-1	AB	57.631	-111.474	≤2011	2014	≥4		1X/yr (fall)
	--	UNNAMED CREEK (EAST OF CHRISTINA L.)	UNC-2	AB	55.619	-110.717	2013	2014	2		4X/yr
	--	UPPER BUCKTON	BU1	AB	57.979	-111.772	2013	2014	2		12X/yr
	AB07BC0540	WABASH CREEK	NEAR PIBROCH NW OF WESTLOCK	AB	54.224	-113.924	1999	2008	10	114	
	--	WAPASU CREEK	WA1	AB	57.378	-111.292	2014	2014	1		12X/yr

Class	Station No.	River Reach	Water Quality Monitoring Site	Prov.	Lat.	Long.	From	To	Years of Data	# of Samples	Latest Frequency
	--	WAPASU CREEK	WAC-1	AB	57.346	-111.161	≤2011	2014	≥4		1X/yr (fall)
	AB07GJ0030	WAPITI RIVER	ABOVE CONFLUENCE WITH SMOKY RIVER	AB	55.137	-118.308	1983	2014	27	297	12X/yr
	AB07GE0180	WAPITI RIVER	0.1 KM U/S OF BEAR RIVER CONFLUENCE	AB	55.107	-118.471	1989	1998	6	32	
	AB07GE0030	WAPITI RIVER	75 M D/S HWY #40 BRIDGE	AB	55.082	-119.821	1990	1996	7	17	
	AB07GE0170	WAPITI RIVER	10 KM D/S G.P. PULP MILL EFFLUENT	AB	55.081	-118.536	1989	1998	6	20	
	AB07GE0060	WAPITI RIVER	5.0 KM D/S GRANDE PRAIRIE STP EFFLUENT	AB	55.078	-118.727	1989	1998	5	12	
	AB07GE0020	WAPITI RIVER	AT HWY #40 BRIDGE	AB	55.072	-118.805	1966	2014	38	317	12X/yr
	AB07GE0070	WAPITI RIVER	D/S OF G.P. PULP MILL HAUL ROAD	AB	55.068	-118.705	1989	1998	6	23	
	AB07GB0110	WEST BEAVERDAM CREEK	NEAR CONFLUENCE WITH BEAVERDAM CREEK	AB	54.095	-119.322	1999	2014	16	71	4X/yr

Map 2: Present (2014) Location of Transboundary Water Quality Sites within AB-NWT Transboundary Basins



I5 Groundwater

Presently there is no monitoring of Transboundary Groundwater. Monitoring would be established as agreed by the BMC using the RIM process.

I6 Biology

Ecosystem health and diversity is evaluated by monitoring biological Indicators, hence it is important to incorporate these in this Agreement and regional and Basin-level monitoring programs.

Some biological monitoring has taken place in the AB-NWT border region as summarized below. Additional biological monitoring may have occurred in the region. Further research on past and current monitoring will be done as part of the Hay River and Slave River Learning Plans at the BMC after signing.

I4.1 Benthic Invertebrates

Until recently, benthic invertebrates monitoring has been very limited in the NWT-AB border region to date. Under the Slave Watershed Environmental Effects Program (SWEEP) benthic invertebrate sampling began in 2013. Led by Dr. Lorne Doig (University of Saskatchewan) and the Slave River and Delta Partnership (SRDP), this sampling is examining animal abundance, taxa/species richness, evenness of species abundance, and undertaking spatial comparisons across the Slave River and Delta. Sites were established in and around the Slave River Delta in 2013-14, and additional sites will be established on the river main stem, near Fort Smith, in 2014.

Additional benthic sampling, including a focus on genetic biodiversity analysis, is currently underway in the Slave River watershed. This work is being led by Dr. Donald Baird (Environment Canada/University of New Brunswick).

Studies involving comparison to historical contaminant concentrations and guidelines, presence/absence when compared to historical accounts have also been undertaken[6].

I4.2 Fish

In 1990, the Slave River Environmental Quality Monitoring Program (SREQMP) was established and measured the baseline condition of the aquatic ecosystem to compare to with future samples[7]. The program provided baseline data on contaminant levels in Slave River fish, water and suspended sediment to ensure that any present hazards were known and to support transboundary water negotiations. The program gave special attention to contaminants likely to result from development activities upstream in Northern Alberta. In 2010 and 2011, Dr. Paul Jones (University of Saskatchewan) collaborated with ENR-GNWT and the Department of Fisheries and Oceans (SWEEP) to undertake a regional fish health study, which included sampling locations on the Athabasca, Slave and Peace Rivers.

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[6] Tripp et al. 1981, Paterson et al. 1992, McCarthy et al. 1997, Culp et al. 2005

[7] Sanderson, J., C. Lafontaine and K. Robertson. Slave River Environmental Quality Monitoring Program: Final Five Year Study Report (1990-1995). Water Resources Division, Department of Indian Affairs and Northern Development (DIAND). 1997.

The fish health study is continuing under the SWEEP program, with focus on sampling locations in the Slave River and Slave River Delta.

Studies involving comparison to historical metals and OCs and guidelines, HSI, GSI, condition of fish; presence/absence of fish compared to historical accounts has also been undertaken[8].

I4.3 Biomonitoring Indicators and Locations

The Parties acknowledge the importance of monitoring biological components and agree that it will be considered when developing a monitoring program at the regional and Basin-wide level. Biological Indicators and sampling locations will be further assessed as part of the Hay River and Slave River Learning Plans at the BMC after signing. The work on the Joint Oil Sands Monitoring Program will also inform this work.

The SRDP undertook monitoring of key furbearer species in 2011-2012. The study focused on population distribution, abundance and health of beaver, mink, muskrat and hare. Building on this work, monitoring of wildlife and wildlife habitat began in summer of 2014 as a part of the SWEEP program.

[8] McCarthy et al. 1995, Sanderson et al. 1998, Jones et al. 2011, Tripp et al. 1981, Scott and Crossman 1998.

Appendix J – Costs to Administer and Implement the Agreement

Section 13.2 of this Agreement states:

The Parties agree that the costs to administer and implement this Agreement (as described in Appendix J) are subject to each Party's appropriation, allocation of resources, and the 3-5-year work plan approved under section 13.1.2 f) of this Agreement.

Although it is impossible to identify every cost that may arise, the Parties provide this partial list to clarify the nature of envisioned costs.

For the purpose of this Agreement, associated costs are anticipated in three categories: administration, bilateral implementation, and jurisdictional implementation. Tasks may be completed by a Party with either in-kind effort or direct resourcing (allocated from within a Party) or externally sub-contracted services, and may involve both capital and operating costs. The following is provided for illustration of anticipated costs:

1. Administration of Agreement [costs to be borne by each jurisdiction separately]

Each Party is responsible for payment of its:

- Participation on the BMC and its technical committees (e.g., staff time, travel, meeting costs, etc.);
- Documentation and reporting with respect to this Agreement;
- Participation on any related committees as might be convened by the BMC or the Board(e.g., staff time, travel, meeting costs, etc.) under BMC direction;
- Share of resources for administration of any committees convened by the BMC or the Board.

2. Bilateral Implementation of Agreement

The Parties agree to share bilateral implementation costs equally (50/50), with modifications on a case-by-case basis.

As required by this Agreement or as determined by the BMC in accordance with section 13.2 of the Agreement, costs will be shared as required for the following:

- Monitoring: Capital and operating costs associated with the maintenance of existing or purchase, installation and operation of new monitoring and gauging stations related to:
    - developing and implementing Learning Plans;
    - setting, monitoring, and revising (as required) Transboundary Objectives;
    - other monitoring or research as directed by the BMC or agreed to through any technical committee of the Board;
- Learning Plans: Costs associated with preparation, development and implementation of Learning Plans (e.g., studies, monitoring, fieldwork, research, analysis);
- Board: Resources allocated as a Party's share to support any technical committee of the Board, under BMC direction, for Agreement implementation;

- Research: Costs associated with research as directed by the BMC or agreed to through a technical committee of the Board.

3. Jurisdictional Implementation of Agreement [costs to be borne by each jurisdiction separately]

Each party is responsible for the cost of implementing its jurisdictional commitments under this Agreement, including costs associated with:

- Consultation;
- Coordination with other jurisdictions (upstream and downstream);
- Information sharing, notification and consultation (i.e., section 5 and 12 of this Agreement);
- On-going assessment of Triggers;
- Meeting Transboundary Objectives:
  - Regulatory actions or changes;
  - Policy or planning actions or changes;
  - Additional monitoring or studies;
  - Mitigation, enhancement or other conciliative measures as prescribed in section 4.3 k) and m) of this Agreement.