APPENDICES

MACKENZIE RIVER BASIN
BILATERAL WATER MANAGEMENT AGREEMENT

Between the

Government of Alberta

And the

Government of Northwest Territories

2014.12.09

STABLE DRAFT FOR REVIEW

Contents

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

Key principles include:

- The nature and intensity of action is commensurate with the nature and intensity of the risks to and uses of a water body;
- Action is based on a mutual understanding of the Ecological Integrity of the Aquatic Ecosystem;
- Bilateral Management builds on the Jurisdictional Water Management actions of each Party as required to achieve the commitments of the Bilateral Water Management 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 Mackenzie River Basin 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 this Bilateral Water Management Agreement. Additional details that guide the implementation of this approach for Surface Water Quantity, Surface Water Quality, Groundwater and the Biological component 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 Management actions commensurate with the class, and establishing a structured and transparent process for Bilateral 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 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, and will be 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

The nature and intensity of Bilateral Management and Jurisdictional Water Management increase from Class 1 to Class 3 (varying levels of learning, Transboundary Objective-setting, monitoring, etc.). Class 4 occurs when Transboundary Objectives are not met, indicating that the Ecological Integrity of the Aquatic Ecosystem may not be being maintained.

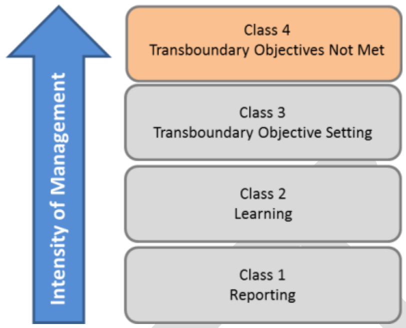

Table 1 provides a high level summary of the four classes, including key commitments at each class, and some considerations for classification. To improve the transparency and consistency of classification, the Appendices of each Bilateral Water Management Agreement may contain more specific criteria 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 Management actions are required in this class. As warranted by increased development/use and other factors, Transboundary Waters will move to higher classes, where Bilateral 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 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. A Trigger is a pre-defined early warning of change that results in confirmation of change and bilateral management oversight, actions and/or jurisdictional planning 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 4.3 j) through n), 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 development activity and share available information on aquatic ecosystems. No additional Bilateral 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 that 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 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 move to Class 2 at a lower level of development/use than other water bodies.
3 Objective Setting	Set objectives or firm conditions that the responsible Party or Parties will meet. Initiate intensive Bilateral 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.	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 condition or trends. As indicated above, some water bodies may move to Class 3 at lower levels of development/use than other water bodies.

Class	Key Commitments	Classification Considerations
	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.	
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 n) 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 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 Management action.

A3. Bilateral Management Actions

Bilateral 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 Management actions include:

- Bilateral 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 Management actions;
- There may be both Jurisdictional Water Management actions (actions undertaken by one Party) and/or Bilateral 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;
- Actions will be designed in recognition of data availability constraints, opportunities and needs (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 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 the Bilateral Water Management 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 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 AB-NWT BWMA is provided in Table 2. 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 water bodies 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 Water 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	-
20	Buffalo River tributaries (Unnamed)	AB to NWT	-114.817 to -114.700	-

[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)
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 area in the upstream jurisdiction that contributes water to the boundary crossing is provided.

Appendix C - Force Majeure

This appendix is intended to clarify the kinds of situations the Parties intend to address with the term "force majeure" in Section 4.3(n) of the Agreement. This term is intended to include situations involving changing natural conditions, as the result of natural processes or influences from outside the basin that are outside the Parties' control and could affect a Party's ability to meet the surface and groundwater quality and quantity and biological commitments under the Agreement. Although it is impossible to identify every related circumstance, the Parties provide this partial list to clarify the nature of the situations involving "changing natural conditions" to which Section 4.3(n) refers and is intended to apply.

Examples of natural processes that might affect surface and groundwater quality and quantity and biological parameters (does not include what can be controlled by the Party):

- Extreme weather events
- Flooding
- Drought
- Extreme (low and high) rainfall/flow events
- Landslides
- Glacial runoff and permafrost melt (i.e., release of legacy contaminants)
- Wildfire
- Earthquakes

Examples of influences from outside of the basin on natural processes that might affect surface and groundwater quality and quantity and biological parameters (does not include what can be controlled by the Party):

- Climate change
- Long – range transport and deposition
- Invasive species
- Volcanic eruptions

Where any of the above are related to human development or activity within a Party's jurisdiction, the Party's obligations are not limited, and the responsible Party will take management actions as required by RIM.

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. No Class 2 Transboundary Waters were 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 include, but are not limited to, the sensitivity of fish species and aquatic habitats, the seasonal flow fluctuations (i.e. winter low flows and spring-summer floods), statistical probabilities of extreme flow rates (i.e. flood and drought frequencies), the average recorded flow rate (i.e. stream size), the annual totals of licensed withdrawals and 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 Appendix H1 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 (D3) and Objectives (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 water body 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 D5.

As described in Appendix A, a Trigger is a pre-defined early warning of change that results in confirmation of change and bilateral management oversight, actions and/or jurisdictional planning 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 bilateral management actions and/or jurisdictional planning that will be determined by the BMC. See D5 for specific Triggers for Hay and Slave Rivers.

D4. Approach to Setting Surface Water Quantity Objectives

This section describes the general approach to setting Transboundary Water Quantity Objectives. Specific Objectives are defined in 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 a 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 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 per section 6.3.

b) **Other Class 3 Rivers**

This 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 DFO, 20132), 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.

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

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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.

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. 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 time of signing and will be added to through the BMC. It includes Water Quantity Triggers from 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 a Transboundary Water not listed in Appendix B	· Transboundary Water will be added to the list in Appendix B. · Water body is classified	· Licensed withdrawals (i.e. allocations) are tracked.
· Transboundary Water is designated as a Class 2	· Learning Plan is developed and implemented. · Tracking Metrics 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 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 ecosystem health (e.g.2010 & 2012 BC Oil and Gas Commission decisions).
· 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 (licensed 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 management
· Actual water consumption exceeds Transboundary Water Quantity Objective	· Clauses in 4.3 j, k, l and m of the Agreement apply. · Transboundary Water may be designated a Class 4	· Class 4 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; no class 2 Transboundary Waters was 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 NWT and Alberta 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 Appendix H1 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; and
- human, biological and ecological receptors.

The Learning Plan is intended to facilitate the development or future development and use of Triggers (E3 and E4) and Objectives (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 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 Appendix H1).

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. Specific Triggers are defined in Appendix E4.

As described in Appendix A, a Trigger is a pre-defined early warning of change that results in confirmation of change and bilateral management oversight, actions and/or jurisdictional planning 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 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) and in accordance with Appendix 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 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 bilateral management and/or jurisdictional planning 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 bilateral management and/or jurisdictional planning.	· 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]). 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 7-10:

- 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 Alta/NWT Boundary) water quality monitoring programs[4] (Tables 7-10; HDR, 2014).

Methods will be explored to develop Triggers for organics (e.g. hydrocarbons, pesticides and herbicides) not already listed in Table 12 during the first Learning Plan.

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[3] HDR, Decision Economics. Site Specific Water Quality Objectives at Six Transboundary Rivers in the Northwest Territories: Technical Report. Prepared for: Water Research and Studies, Water Resources Division, Government of the Northwest Territories, Yellowknife, Northwest Territories. March 2014.

[4] Placeholders have been made for the outstanding routine parameters that will be added-pre-signing. At this time it is uncertain exactly which table they be placed (seasonal, open water/under ice, annual). The data will dictate their placement. For now they have been placed in Tables 7 and 9.

Table 7: Reference Percentiles for Surface Water Quality Triggers for the Slave River at Fitzgerald[5]

Substance	Spring		Summer		Fall		Winter	
	50th	90th	50th	90th	50th	90th	50th	90th
Alkalinity (mg/L)								
Dissolved Oxygen (mg/L)								
pH (pH units)								
Specific Conductance (µS/cm)	219	265	213	259	200	251	210	240
Total Dissolved Solids (mg/L)								
Total Suspended Solids (mg/L)								
Turbidity (NTU)	140	970	81	1208	47	81	15	224
Calcium – dissolved (mg/L)	29	34	29	34	27	31	28	32
Chloride (mg/L)								
Magnesium (mg/L)								
Sodium (mg/L)								
Potassium (mg/L)								
Sulphate (mg/L)								
Ammonia – dissolved (mg/L)								
Nitrate + Nitrite (mg/L)								
Nitrogen – dissolved (mg/L)								
Nitrogen – total (mg/L)								
Organic Carbon – dissolved (mg/L)								
Organic Carbon – particulate (mg/L)								
Phosphorus – dissolved (mg/)	0.016	0.052	0.013	0.035	0.009	0.014	0.007	0.020
Phosphorus – total (mg/L)	0.209	0.722	0.192	1.534	0.067	0.142	0.032	0.393
Aluminum – dissolved (µg/L)								
Aluminum – total (µg/L)								
Antimony– dissolved (µg/L)								
Antimony – total (µg/L)								

[5] Spring: May & June; Summer: July & August; Fall: September & October; Winter: November to April

Substance	Spring		Summer		Fall		Winter	
	50th	90th	50th	90th	50th	90th	50th	90th
Arsenic – dissolved (µg/L)	0.50	1.32	0.50	0.80	0.40	0.50	0.30	0.60
Barium – dissolved (µg/L)								
Barium – total (µg/L)								
Beryllium – dissolved (µg/L)								
Beryllium – total (µg/L)								
Bismuth – dissolved (µg/L)								
Bismuth –total (µg/L)								
Boron – dissolved (µg/L)								
Boron – total (µg/L)								
Cadmium – total (µg/L)	0.400	1.650	0.300	3.984	0.133	0.945	0.129	1.010
Chromium – dissolved (µg/L)								
Chromium – total (µg/L)								
Cobalt – dissolved (µg/L)								
Cobalt – total (µg/L)								
Copper – total (µg/L)	7.05	27.39	5.00	30.48	2.65	5.33	2.30	10.45
Iron – total (µg/L)	4065	15080	5260	93860	1535	5318	522	11900
Lead – dissolved (µg/L)								
Lead –total (µg/L)								
Lithium – dissolved (µg/L)								
Lithium –total (µg/L)								
Manganese – dissolved (µg/L)								
Manganese –total (µg/L)								
Mercury – dissolved (µg/L)								
Mercury –total (µg/L)								
Molybdenum – dissolved (µg/L)								
Molybdenum – total (µg/L)								
Nickel – dissolved (µg/L)								
Nickel –total (µg/L)								
Selenium – dissolved (µg/L)	0.30	0.50	0.40	0.50	0.20	0.50	0.20	0.50

Substance	Spring		Summer		Fall		Winter	
	50th	90th	50th	90th	50th	90th	50th	90th
Silver – dissolved (µg/L)								
Silver –total (µg/L)								
Strontium – dissolved (µg/L)								
Strontium –total (µg/L)								
Thallium – dissolved (µg/L)								
Thallium –total (µg/L)								
Uranium – dissolved (µg/L)								
Uranium –total (µg/L)								
Vanadium – total (µg/L)	5.28	21.40	3.78	36.47	1.77	5.79	0.70	8.85
Zinc – dissolved (µg/L)								
Zinc –total (µg/L)								

Table 8: Reference Percentiles for Annual Surface Water Quality Triggers for the Slave River at Fitzgerald

Substance	50th	90th
Arsenic – total (µg/L)	0.98	3.34
Cadmium – dissolved (µg/L)	n/a: n<30	
Copper – dissolved (µg/L)	n/a: n<30	
Iron – dissolved (µg/L)	n/a: n<30	
Selenium – total (µg/L)	0.23	0.34
Vanadium – dissolved (µg/L)	n/a: n<30	

Table 9: Reference Percentiles for Open Water and Under Ice Surface Water Quality Triggers for the Hay River near the AB/NWT Boundary[6]

Substance	**Open Water**		**Under Ice**	
	50th	**90th**	**50th**	**90th**
Alkalinity (mg/L)				
Dissolved Oxygen (mg/L)				
pH (pH units)				
Specific Conductance (µS/cm)	322	403	584	792
Total Dissolved Solids (mg/L)				
Total Suspended Solids (mg/L)				
Turbidity (NTU)	34	150	12	21
Calcium – dissolved (mg/L)	40	49	73	100
Chloride (mg/L)				
Magnesium (mg/L)				
Sodium (mg/L)				
Potassium (mg/L)				
Sulphate (mg/L)				
Ammonia – dissolved (mg/L)				
Nitrate + Nitrite (mg/L)				
Nitrogen – dissolved (mg/L)				
Nitrogen – total (mg/L)				
Organic Carbon – dissolved (mg/L)				
Organic Carbon – particulate (mg/L)				
Phosphorus – dissolved (mg/)	0.025	0.050	0.027	0.049
Phosphorus – total (mg/L)	0.107	0.259	0.054	0.113
Aluminum – dissolved (µg/L)				
Aluminum – total (µg/L)				
Antimony– dissolved (µg/L)				
Antimony – total (µg/L)				

[6] Open Water: Spring, Summer and Fall; Under Ice: Winter.

Substance	**Open Water**		**Under Ice**	
	50th	**90th**	**50th**	**90th**
Arsenic – dissolved (µg/L)	0.59	0.99	0.40	0.60
Barium – dissolved (µg/L)				
Barium – total (µg/L)				
Beryllium – dissolved (µg/L)				
Beryllium – total (µg/L)				
Bismuth – dissolved (µg/L)				
Bismuth –total (µg/L)				
Boron – dissolved (µg/L)				
Boron – total (µg/L)				
Cadmium – total (µg/L)	0.153	0.545	0.194	0.540
Chromium – dissolved (µg/L)				
Chromium – total (µg/L)				
Cobalt – dissolved (µg/L)				
Cobalt – total (µg/L)				
Copper – total (µg/L)	2.90	6.53	2.10	3.10
Iron – total (µg/L)	1785	6502	2080	3137
Lead – dissolved (µg/L)				
Lead –total (µg/L)				
Lithium – dissolved (µg/L)				
Lithium –total (µg/L)				
Manganese – dissolved (µg/L)				
Manganese –total (µg/L)				
Mercury – dissolved (µg/L)				
Mercury –total (µg/L)				
Molybdenum – dissolved (µg/L)				
Molybdenum – total (µg/L)				
Nickel – dissolved (µg/L)				
Nickel –total (µg/L)				

Substance	Open Water		Under Ice	
	50th	**90th**	**50th**	**90th**
Selenium – dissolved (µg/L)	0.20	0.40	0.20	0.437
Silver – dissolved (µg/L)				
Silver –total (µg/L)				
Strontium – dissolved (µg/L)				
Strontium –total (µg/L)				
Thallium – dissolved (µg/L)				
Thallium –total (µg/L)				
Uranium – dissolved (µg/L)				
Uranium –total (µg/L)				
Vanadium – total (µg/L)	1.60	5.31	0.50	0.87
Zinc – dissolved (µg/L)				
Zinc –total (µg/L)				

Table 10: Reference Percentiles for Annual Surface Water Quality Triggers for the Hay River near AB/NWT Boundary

Substance	50th	90th
Arsenic – total (µg/L)	1.42	2.53
Cadmium – dissolved (µg/L)	n/a: n<30	
Copper – dissolved (µg/L)	n/a: n<30	
Iron – dissolved (µg/L)	n/a: n<30	
Selenium – total (µg/L)	0.24	0.35
Vanadium – dissolved (µg/L)	n/a: 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 for the water quality parameters of concern that have been identified as part of the Learning Plan.

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 knowledge
- Ensure that methods and resulting objectives are based on a weight of evidence approach
- Use best available data and information, and improve / adapt over time
- Consider the ecological significance of trends in water quality and quantity
- Design objectives to protect all uses, including traditional uses
- For the protection of aquatic life, design 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 11). 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 11: Definitions, examples and potential management actions for Transboundary Water Quality Objectives

	Definition	Examples	Potential Management Actions
Objective	· 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 bilateral 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 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 its list of substances subject to 7.3 d).

b) The current list of substances subject to 7.3 d) is shown in Table 12, 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 12. Should an unmonitored substance be detected by another party, this information will be evaluated to determine if the substance (s) 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 12 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[7] 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 on-going 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 technologies that reduce or eliminate the use and release of substances that have been deemed toxic, bioaccumulative and persistent. It is recognized that some of these substances may occur as the result of Force Majeure.

[7] 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 Alta/NWT Boundary (NWT).

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 (e.g. Stockholm Convention on Persistent Organic Pollutants) as well as being responsive to newer emerging contaminants of concern.

Table 12: 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/Border**	**Not Monitored**
Aldrin	✓	✓	✓	
Chlordane	✓	✓	✓	
Dieldrin	✓	✓	✓	
Endosulfan	✓	✓	✓	
Endrin	✓	✓	✓	
Heptachlor	✓	✓	✓	
Hexachlorobenzene	✓	✓	✓	
Hexachlorobutadiene	✓		✓	
Hexachlorcyclohexane (HCH; alpha, beta, gamma)	✓	✓	✓	
Mirex	✓	✓	✓	
DDT, DDD, DDE	✓	✓	✓	
Toxaphene		✓		
PCBs	✓	✓	✓	
Pentachlorobenzene	✓	✓	✓	
Dioxins and Furans				X
1,4-dichlorobenzene **				X
3,3-dischlorobenzidine **				X
Tetrachlorobenzene (1,2,3,4 and 1,2,4,5) **				X
4,4'-methylenebis(2-chloroaniline) **				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

** To be finalized once source is confirmed.

Appendix F - Groundwater

F1. Classification of Hydrogeological Settings

Considering that information on groundwater is limited near the NWT-AB border and that Hydrogeological Settings have not been delineated, all transboundary groundwater will be assigned at a Class 1 at time of signing. The Parties will work towards gathering information and delineating Hydrogeological Settings at the BMC after signing. The Parties will reassess the classification to an appropriate management level as information becomes available.

Watershed boundaries may be used as a surrogate for delineating Hydrogeological Settings at the sub-basin level. Methods may be different for various management classes. Hydrogeological Settings will provide a framework for data collection and synthesis and identification of key information gaps.

The BMC will work to develop a reproducible approach for classification of Transboundary Hydrogeological Settings 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, land use (including assessment of risk from hydraulic fracturing and deep water injection, etc.).

F2. Learning Plans

Learning plans are initiated for Class 2 hydrogeological settings, 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 a transboundary groundwater area.

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; and
- 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 areas 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 Appendix H2: Groundwater Learning Plan.

F3. Triggers and Objectives

The Parties will work towards preventing, better understanding and, potentially, resolving transboundary groundwater issues.

The 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 bilateral management oversight, actions and/or jurisdictional planning to address, the change/trend. Multiple Triggers can be set to invoke additional actions as necessary (e.g. degrading conditions). A Transboundary Groundwater Objective identifies a change in conditions that if exceeded, results in bilateral management action. 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 groundwater areas in accordance with the RIM Approach.

Conditions that could be used to assess if a groundwater area moves from one class 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 in a groundwater area/ aquifer management unit at an established monitoring location.
- 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 indicate 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 to people eating fish well before their concentrations in water indicate there is a problem.

G2. Learning Plans

The Biological component is incorporated into Appendix H1: 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 environment and how it changes over time.

G3. Indicators

Biological indicators are used to track the status/conditions of living organisms in order to inform bilateral 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 which allow 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 measures 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 Table 14 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)

Tracking Metrics will be developed as part of the Learning Plan.

Table 15: List of Interim Biological Indicators and Measurement Methods (where data are available)

Water Body	Indicator	Measurement units/location
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 management. Table 16 describes the general approach to triggers and management actions, which can be applied to any biological indicator.

Table 16: 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 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 objective – 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 4.3 j, k, l, m, n applies	

G4. 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 Class 2 Transboundary Waters. This Table of Contents covers a wide array of possible topics for a Learning Plan, but is not exhaustive. The BMC will decide where to place effort on a case-by-case basis.

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 DemographicsHistory
- 1.2 Existing and proposed development activities (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.

1.0 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 Hydrogeological Settings and, where possible, aquifers
- 1.4 Immediate and proposed development activities and human pressures (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 land and resource use 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, 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.)

7.2 Groundwater vulnerability assessment and mapping

7.0 Triggers and Transboundary Objectives

- 7.1 Approaches to Developing Site-Specific Triggers, Targets and Transboundary Objectives
- 7.2 Recommended Method to Derive Site-Specific Triggers, Targets and Transboundary Objectives
  - 7.2.1 Physical, Chemical and Biological Triggers, Targets and Transboundary Objectives

- 7.3 Data Preparation (cleaning, period of record, outliers)
- 7.4 Trend Assessment (long-term and seasonal)
- 7.5 Derivation of Site-Specific Triggers, Targets and Transboundary Objectives

Appendix I - Monitoring

This Appendix describes the commitments of the Parties for both direct BWMA 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 17 and 18. 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 17 and 18 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 17 and 18).

As part of the Learning Plan for Class 2 and 3 water bodies, 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 BWMA will be based on a scientific and traditional 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 17 summarizes 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 17 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 17 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 SK, 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 SK in basin 07Q that are not listed, in addition to the stations listed in sub-basins 07U and 07P.

Table 17: Present (2014) Status of Major Transboundary Hydrometric Stations in the AB-NWT transboundary basins

	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**

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 18 summarizes 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.

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

To Come: Will be prepared and inserted in final appendix once water quality monitoring list is complete.

Table 18: Present (2014) Status of Transboundary Water Quality Monitoring Sites in the AB-NWT Region[8]

+ *	Station No.	River Reach	Station	Pr ov.	Lat.	Long.	From	To	Ye ars	Sam ples	Latest Frequ
+	NW07NC0004	SLAVE RIVER	AT THE MOUTH (JOSM SL2)	N	61.32	-113.61	2012	2014			12X/yr
+	NW07NC0003	SLAVE RIVER	SLAVE RIVER ABOVE THE MOUTH (JOSM SL1)	N	61.26	-113.46	1982	2014			2X/yr;
*	NW07QA000	SLAVE RIVER	Slave River at Fort Smith (JOSM M11b)	N	60.02	-111.89	1990	2014			12X/yr
*	AL07NB0001	SLAVE RIVER	Slave River at Fitzgerald (JOSM M11a)	AB	59.87	-111.58	1960	2014			12X/yr
+	AL07NA0001	Riviere des	Riviere des Rochers (JOSM M10)	AB	58.92	-111.18	2012	2014			12X/yr
+		Lake Athabasca	Lake Athabasca								
+			JOSM QU1	AB				2014			
+	AB07DD0010	Athabasca River	at Old Fort (JOSM M9a)	AB	58.38	-111.52	1978	2014			12X/yr
+	AL07DD0001	Athabasca River	Athabasca River at Baseline 27 (JOSM M9)	AB	58.17	-111.37	1989	2014			9X/yr
+	AB07DA0980	Athabasca River	Athabasca River above the Firebag River	AB	57.72	-111.38	1989	2014			12X/yr
+		Athabasca River	JOSM M7	AB	57.31	-111.67		2014			12X/yr
+		Athabasca River	JOSM M6	AB	57.22	-111.61		2014			12X/yr
+		Athabasca River	JOSM M5	AB	57.16	-111.63		2014			12X/yr
+		Athabasca River	JOSM M4	AB	57.13	-111.6		2014			12X/yr
+		Athabasca River	JOSM M3	AB	56.84	-111.42		2014			12X/yr
+	AB07CC0030	Athabasca River	Athabasca River u/s Fort McMurray (JOSM	AB	56.72	-111.41	1985	2014			12x/yr
+		Athabasca River	JOSM M1	AB	56.65	-111.61		2014			12X/yr
+	AB07BE0010	Athabasca River	Athabasca River at Athabasca (JOSM M0)	AB	54.72	-113.29	1987	2014			12x/yr
+	AL07AD0110	Athabasca River	Athabasca River u/s of Hinton	AB	53.38	-117.66	1960	2014			12x/yr
+		Athabasca River	Athabasca River at old entrance town site	AB							
+	AL07AA0023	Athabasca River	Athabasca @Hwy 16 below Snaring River	AB	53.04	-118.09	1973	2014			7X/yr
+	AL07AA0015	Athabasca River	Athabasca above Athabasca Falls	AB	52.66	-117.88	1972	2014			7X/yr
+	AL07KC0001	Peace River	at Peace Point (JOSM M12)	AB	59.12	-112.45	1967	2014			6-
+	AB07HF0010	Peace River	at Fort Vermillion	AB	58.4	-116.13	1988	2014			12X/yr
+		Peace River	Peace River at Peace River	AB							
+	AB07FD0135	Peace River	Peace River at Shaftesbury Crossing	AB	56.09	-117.57	2006	2014			12X/yr
+		Peace River	Peace River at Dunvegan Bridge	AB							
+		Peace River	Peace River above Pine River	AB							
*	NW07OB0002	Hay River	near AB/NWT Boundary	N	60	-116.97	1988	2014			6X/yr
+		Hay River	Hay River at Hwy 35 Bridge	N							
+	n/a	Hay River	Hay River at West Channel Bridge	N	60.83	-115.78	1982	2010			2X/yr
+	NW07NB0001	Salt River	at Highway 5 Bridge	N	60.02	-112.35	1982	2010			2X/yr
+	NW07PB0002	Little Buffalo River	at Highway 5 Bridge	N	60.05	-112.77	1982	2010			2X/yr
+	n/a	Buffalo River	at Highway 5 Bridge	N	60.72	-114.91	1982	2010			2X/yr
+	NW07UC0002	Kakisa River	at Highway 1 Bridge	N	60.99	-117.25	1982	2010			2X/yr

[8] Table 18 is not finalized. Additional water quality monitoring sites may be added; table will be in same format at Table 17.

I3 Groundwater

Presently there is no monitoring of shared groundwater resources in AB-NWT aquifers. Monitoring would be established as agreed by the BMC using the RIM process.

I4 Biology

Ecosystem health and diversity is evaluated by monitoring biological indicators, hence the importance of incorporating these in BWMA 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 by Tripp et al. 1981, Paterson et al. 1992, and McCarthy et al. 1997,Culp et al. 2005.

I4.2 Fish

In 1990, the Slave River Environmental Quality Monitoring Program (SREQMP) was developed and measured the baseline condition of the aquatic ecosystem to compare to with future samples (Sanderson et al, 1998[9]). 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

[9] 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.

Peace Rivers. 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 by McCarthy et al. 1995, Sanderson et al. 1998, Jones et al. 2011,Tripp et al. 1981, and Scott and Crossman 1998.

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, a part of the SWEEP program.

Appendix J - Costs to Administer and Implement the Agreement

Clause 13.2 a) states:
The costs to administer and implement this Agreement (as outlined in Appendix J) will be shared appropriately, as determined by the Parties on a case by case basis, and limited by (b), (c) and (d).

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

Costs associated with the BWMAs are anticipated in three categories: Administration, Bilateral Implementation and Jurisdictional Implementation. Tasks may be completed 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]:**
   - Participation on BMC and its technical committees (e.g., staff time, travel, meeting costs, etc.)
   - BWMA documentation and reporting
   - Participation on the SMC (e.g., staff time, travel, meeting costs, etc.) under BMC direction
   - Resources allocated as a Party's share to SMC administration

2. **Bilateral Implementation of Agreement [costs to be shared as appropriate]:**
   - 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 and monitoring Transboundary Objectives
     - other monitoring or research as directed by the BMC or agreed to through the SMC
   - Learning Plans: Costs associated with preparation, development and implementation of Learning Plans (e.g., studies, monitoring, fieldwork, research, analysis)
   - SMC: Resources allocated as a Party's share to SMC support for BWMA implementation
   - Research: Costs associated with research as directed by the BMC or agreed to through the SMC

3. **Jurisdictional Implementation of Agreement [costs to be borne by each jurisdiction separately]:**
   - Consultation
   - Coordination with other jurisdictions (upstream and downstream)
   - Costs associated with information sharing, notification and consultation (e.g. Section 5, 12)
   - Costs associated with on-going assessment of Triggers and Targets
   - Costs associated with meeting Transboundary Objectives:
     - Regulatory actions or changes
     - Policy or planning actions or changes
     - Additional monitoring or studies
     - Mitigation or enhancement activities
     - Financial measures