

North Saskatchewan River Basin Water Management Roadmap – Terms of Reference

Updated July 17, 2025

The North Saskatchewan River Basin (NSRB) Water Management Roadmap Terms of Reference (ToR) is considered a living document and will be reviewed and amended throughout the project as needed. Changes will be made based on feedback from the Working Group (WG), Steering Committee (SC), and Project Leadership Team (Team). Changes will be approved by the Team before a new version of the ToR is issued to the WG and SC, to ensure project scope and objectives are maintained.

1. Project Scope

This Water Management Roadmap project will enhance the understanding and trust in water management in the NSRB. Through the project a custom decision support tool (Tool) will be developed in collaboration with stakeholders, which will incorporate surface water quantity and quality data and will align with regulatory frameworks and stakeholder knowledge of basin operations. The Tool will couple geospatial (land cover and terrain) data, historical weather observations, and future climate projections with a process-based hydrological model that includes water management operations. This collaborative watershed Tool will provide a comprehensive, flexible, and data-driven platform that can explore scenarios with differing land cover, climate, and water management configurations and drive collaborative watershed decision making. A collaborative process will be used to assess water management adaptation options in the basin and to understand the impacts of future economic and municipal development, while supporting safe and secure drinking water and healthy aquatic ecosystems (Figure 1). A publicly available Roadmap will be developed to better guide water management within the NSRB.



Figure 1: Goals of Collaborative Watershed Modeling.

A Roadmap provides a solid foundation on which to determine, refine and implement appropriate actions; adapt plans; and invest in the science needed to better prepare the NSRB’s water management system to respond when new challenges arise. By first exploring the capabilities of today’s infrastructure and management, then considering additional strategies available now and in the future, a Roadmap is useful for the adaptive management approach to develop a resilient and adaptive capacity to respond to various situations. It also raises social awareness of potential flood and drought risks to support development of appropriate water management arrangements in place now. Adaptive water management involves implementing and regularly revisiting the Roadmap as demands and this dynamic river basin continues to change. To build resilience and sustainability in the face of climatic and environmental change and increased economic growth, a layered approach is required, as no single solution can address this broad challenge.

WaterSMART, MacHydro, and the North Saskatchewan Watershed Alliance (NSWA) will be working with key stakeholders and water users across the NSRB to develop a collaborative watershed Tool (Figure 2). This will allow for:

- Engagement of water users and managers across the entire basin.
- Better understanding of current and projected future water availability, which is critical information for municipalities and governments to create realistic growth plans.
- Shared understanding of projected future water availability, leading to a more favourable investment climate.
- Shared exploration of mitigation, adaptation, and management opportunities in response to changes throughout the basin, with consideration of cumulative effects.
- Robust evaluation of the benefits and implications of water management planning and instream flow needs development, to confirm the best path forward.

- Creative solutions to current and future water management problems, with the potential for reduced costs and improved environmental and economic outcomes.

The WG will advise the project SC, which will provide project oversight and direction.

2. Methodology – Collaborative Process

Key to the completion of this project is the implementation of the collaborative modeling process.

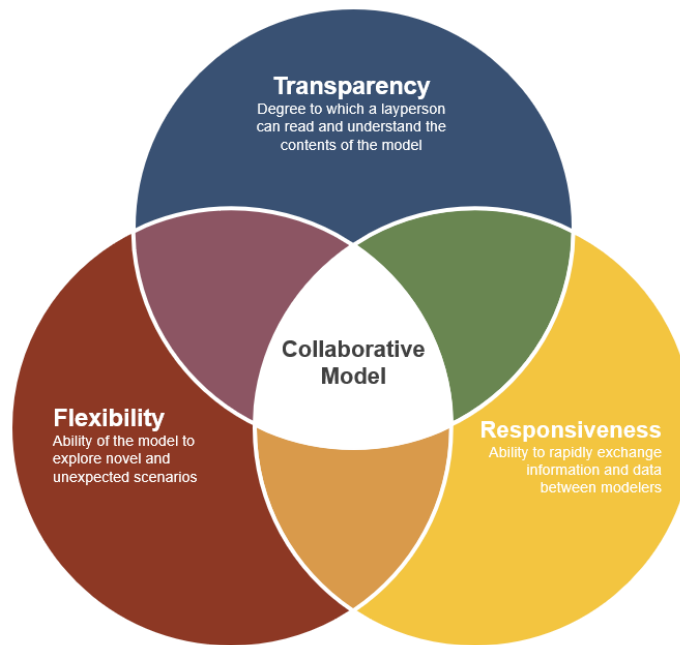


Figure 2: Requirements for Collaborative Modelling.

This process consists of ongoing engagement with water managers. The project will utilize a collaborative watershed decision support tool to support this process.

2.1 Model Development

Surface water quantity will be simulated across the NSRB using a process-based hydrological model that includes water management functionality and constraints (water licencing, in-stream flow needs, dam operations) and incorporates land cover and climate. This Tool will be built to provide surface water quantity outputs (including streamflow, water level, water use, and demand) at a daily timestep at key points along the North Saskatchewan River (NSR), at outlets of major tributaries, and other key points of interest as identified by the Team and WG. The Tool will allow the project to be completed, rather than a standalone outcome of the project. This tool will be developed with input from the WG to ensure that the Tool leverages the best available information to reflect the conditions and operations in the basin. The

modelling team welcomes data and feedback on model inputs from the WG; modelling methods and validation will be presented and documented to the WG. The collaborative process aims to ensure that project participants understand the methods, assumptions, and limitations of the model, gain trust in model outputs, and to provide scientific transparency.

2.2 Roadmap Development

The primary objective of the project is the development of a Roadmap for the NSRB, which will be developed through engagement with water managers in the basin and supported through modeling. The WG will be encouraged to bring forward water management ideas to be tested in a collaborative space. This will allow for a science-based approach to understanding the benefits and tradeoffs of different management options in the basin.

The WG will be able to review and refine ideas and options and determine whether they are promising and should be included in the Roadmap. One of the goals of this is that WG members will have a shared understanding of how the basin can support ongoing growth and development.

3. Objectives

- Develop a Roadmap for sustainable water management in the NSRB informed by the Tool.
- Develop a process-based hydrological model that includes water management operations for the NSRB to support strategic planning and decision making and has the ability to be coupled with existing water quality models.
- Understand the degree to which economic development can be pursued while protecting drinking water for humans and ensuring healthy aquatic ecosystems.
- Develop an understanding of the amount of water that is available in the NSRB and how it is currently managed with the infrastructure and processes in place.
- Demonstrate economic opportunities for industry and municipal and Indigenous community growth that will continue to increase efficiency in water use.
- Understand the projected impacts of climate change on water supply and quality risks and identify climate adaptation opportunities.
- Identify complementary and mutually beneficial water management opportunities across the NSRB.
- Identify potential projects for further development that provide water management or economic opportunities for the NSRB (e.g., additional built or natural infrastructure).

4. Working Group Meetings and Project Deliverables

Throughout this project several WG meetings will be held and a number of key deliverables will be generated. These include:

- WG Meetings
 - Slide Deck: A copy will be provided to all project participants after each WG meeting.
 - Summary/Synthesis: After each WG meeting the Team will generate a synthesis of what was discussed and key points from each WG meeting. This will be provided to all project participants after each WG meeting.
 - Working Group Meeting #1 (June 12th, 2024): This meeting is designed to align on project goals, review the collaborative modelling process, and discuss key performance measures. It will delve into the decision support tool concept and introduce its components. The agenda includes a series of breakout exercises to understand key concerns, identify water management opportunities, and consider Performance Measures (PMs). Participants will also engage in scenario planning, discussing what-if situations such as changes in reservoir operations and increased municipal water demand.
 - Working Group Meeting #2 (October 1st, 2024): This meeting is focused on exploring the Tool, understanding its construction and capabilities, reviewing PMs, and discussing potential water management adaptation options. Before delving into the Tool, there will also be an education session to foster a shared understanding of the basin. The WG will also be introduced to the economic analysis process.
 - Working Group Meeting #3 (November 13th – 14th, 2024): The two-day meeting will delve into both the current basin conditions and look at climate change scenarios. The WG will use the Tool to explore water management adaptations through live modelling exercises, validate growth scenario assumptions, and discuss how tradeoffs should be assessed and valued, in support of the economic analysis.
 - Working Group Meeting #4 (February 25th – 26th 2025): This meeting will focus on live modelling and refinement of water management adaptations under potential growth scenarios in the basin. The meeting will also include a review of the draft Roadmap and results from the economics assessment.
 - Working Group Meeting #5 (May 6, 2025): The meeting aims to present the final Roadmap and economics analysis, summarizing the work done to date, and discussing the final Roadmap and recommendations. A breakout exercise will facilitate a discussion on the Roadmap, focusing on its representation, structure, clarity, and completeness.
- Sub-Committee Meetings
 - Each of these meetings will be recorded and sent to the WG.
 - Model Subgroup #1 (September 11, 2024): The meeting's primary goal is to ensure alignment around the Tool, focusing on the components, methodologies,

limitations and assumptions. Preliminary PMs will also be presented and reviewed.

- Climate Subgroup (October 23rd, 2024): The primary objective of this meeting is to delve into a variety of climate change scenarios in order to ensure that the right scenarios are carried forward through the project. The potential impacts these scenarios may have on the basin will be examined. Additionally, there will be an opportunity for in-depth discussions to further understand these topics.
 - Economic Subgroup (January 22nd, 2025): This meeting primarily aims to probe the methodology for economic assessment and review preliminary economic and EcoMetrics™ results. It also seeks to identify potential benefits and costs for industry, municipalities, the environment and Indigenous communities, and discuss strategies to boost water use efficiency.
 - Roadmap Subgroup (April 16th, 2025): This meeting aims to virtually review the updated Roadmap, incorporating and discussing comments from Working Group #4.
 - Model Subgroup #2 (April 29th, 2025): This meeting aims to review modelling assumptions and results in advance of Working Group #5.
- Interim Deliverables
 - Model Development Memorandum: Memo will be provided in draft to all project participants detailing the hydrological and water management model, data sources, methods, validation, and key considerations related to capabilities and limitations. The final memo will be appended to the project report.
 - Climate Change Scenarios Memorandum: Memo will be provided in draft to all project participants detailing the climate change scenario selections used in the project including a summary of the scenarios evaluated and selection criteria. The final memo will be appended to the project report.
 - Economics
 - Description of the economics methodology will be provided to all project participants in advance of the WG discussions related to economic modeling. This will include a description of the EcoMetrics™ process.
 - Final Roadmap and Report
 - Roadmap: A draft of the Roadmap will be circulated to the WG in advance of the related WG meeting and will be discussed in a breakout session to obtain WG feedback. The updated draft will be recirculated to the WG and the SC to solicit further feedback prior to finalization.
 - Report: A draft of the project report will be circulated to all project participants for review and feedback. This report will include a number of appendices including the

Model Development and Climate Change Scenarios Memorandums, the EcoMetrics™ Report and other appendices as needed. The final report will be issued to all project participants and made publicly available.

5. Exclusions and Limitations

Throughout the project, there will be some exclusions and limitations. These can be organized in terms of data (i.e., the hydrological model and its development), the Roadmap, and the process of the project itself.

Through the collaborative process for the development of the Roadmap, there may be some identified opportunities that cannot be modelled. The Tool is purpose-built, developed to provide regional (i.e. approximately at the HUC8 level) surface water quantity simulations at a daily resolution and identify and evaluate water management opportunities. Identified opportunities that do not fit with the spatial or temporal resolution of the model, lack the information needed to accurately represent the opportunity, or fall outside the stated goals of the model, may not be suited to be included in the modelling work. The Team will make professional judgments into what opportunities can and cannot be modelled. The Roadmap will include all identified, and agreed upon, strategies from the WG members whether the opportunity can be modelled or not to ensure that all strategies are put forward. For those strategies that are not modelled, the Team will work with the WG to provide qualitative discussion in the report.

While the Tool will be developed to follow the best available science and integrate the best available information to reflect the current NSRB conditions as closely as possible, assumptions and simplifications will be required in some cases. This could include consumptive water use, dam operations and other infrastructure, and land cover change. The modelling team will apply professional judgement to ensure that these assumptions are realistic and appropriate and will clearly highlight them in reporting.

The Roadmap developed for the NSRB will provide water management opportunities that can be relayed to the government, water users, and water managers within the NSRB. The Roadmap will consider all identified opportunities put forth by the WG, however, the Roadmap will be limited to strictly water management opportunities. Linkages can be made where possible to water quality and groundwater models, where the Tool could provide inputs to existing developed tools in the NSRB. These water management opportunities will provide a high-level analysis of the benefits to the environment, economy and water users. The success and results of the Roadmap will depend on the participation and collaboration of the WG members to build a robust, actionable Roadmap for the NSRB. The product will be used as a starting point to further conversations, explore opportunities, and highlight work that has been done and continues to be done, as well as coordinate water management actions and sustainability measures amongst participating stakeholders.

Another project limitation is the number of participating organizations involved in the development of the project and the Roadmap. Careful planning and consideration of a wide variety of organizations to be involved in the project were taken to provide a breadth of knowledge and understanding of the operations of the basin. The size of the WG has also been considered for efficient collaboration and facilitation of WG sessions to ensure the development of the model and the Roadmap.

6. Scope of the Working Group

6.1 Working Group Members

WG Members are those organizations and entities that are active water managers and regulators in the NSRB and will be called upon to provide data related to actual current operations, future plans, and overall water management by their organization. This data will be used to create the Tool that will be used throughout the project. Any confidentiality concerns can be brought forward to the Team and discussed on a case-by-case basis. WG Members will work collaboratively to interrogate the Tool to ensure it reflects actual basin conditions, provide input to growth scenarios, develop PMs, and assess potential adaptations and basin changes from both a hydrologic and economic perspective.

The Government of Alberta (GoA) plays a role as both funder and WG Member in this project. The Ministry of Environment and Protected Areas (EPA) is a project funder and has a regulatory role in the basin, and Alberta Agriculture and Irrigation (AGI) has an operational role in the basin through the management of infrastructure and water licences. Both departments will have active participants in the WG as they will be called upon to provide subject matter expertise and data.

All WG Members will be invited to share ideas for water management and actively participate in the discussions around results and tradeoffs.

For this project the WG will include members from a variety of sectors including:

- Municipalities
- Agriculture
- Industry
- Indigenous Communities
- Academia
- ENGOs
- Economic Development Organizations
- Government including EPA, AGI, Alberta Innovates (AI) and Prairies Economic Development Canada (PrairiesCan)

The WG will convene throughout the project and use their basin expertise to:

- Identify existing models and datasets to inform the hydrological and water management models.
- Provide input and recommendations on the user interface of the collaborative watershed Tool
- Identify, model and test potential new strategies that use water, adjust existing operations, or identify management opportunities for economic development in the context of future climate change scenarios.

- Provide input and recommendations to support a Roadmap for the NSRB that can be used to form the basis of a comprehensive water management strategy.
- Provide technical advice and recommendations.
- Provide input and recommendations to support stakeholder engagement activities.

6.2 Success Metrics

The following success metrics align with the requirements and metrics of key funding organizations.

Table 1: Project success metrics.

Metric	Project Target
Develop the Decision-Support Tool	Tool Created
Collaborators	20+
Knowledge Mobilization	20+
Advance Community-Based projects	4
Number of Economic Analysis Conducted	1
Indigenous Engagement	To be Defined

7. Scope of the Steering Committee

A project SC will be established to review the project workplan and discuss and provide direction and project oversight. The SC will advise and provide direction on key issues referred to the committee by the Team. Issues could include engagement concerns, funding, or overall project trajectory. WaterSMART will deliver regular budget updates for the SC to provide fiscal budgetary oversight throughout the project. The SC, comprised of key project funders, will meet quarterly and will be chaired by the NSWA.

The SC comprises of: NSWA, AI, PrairiesCan, GoA, EPCOR, City of Edmonton, and Results Driven Agriculture Research (RDAR)

8. Project Governance

The SC, chaired by the NSWA, will provide direction for the WG and project oversight.

WaterSMART will chair and facilitate WG meetings.

The meetings will be governed as per the following:

- Proposed meeting dates will be set according to the project schedule.
- The WG and SC meetings will be by invitation only.

- Regarding communication and confidentiality, participants in WG meetings are free to use the information received, however, please do not reveal the identity nor the affiliation of the speaker(s).
- Meeting summaries will be prepared and distributed to members for review before being considered final.

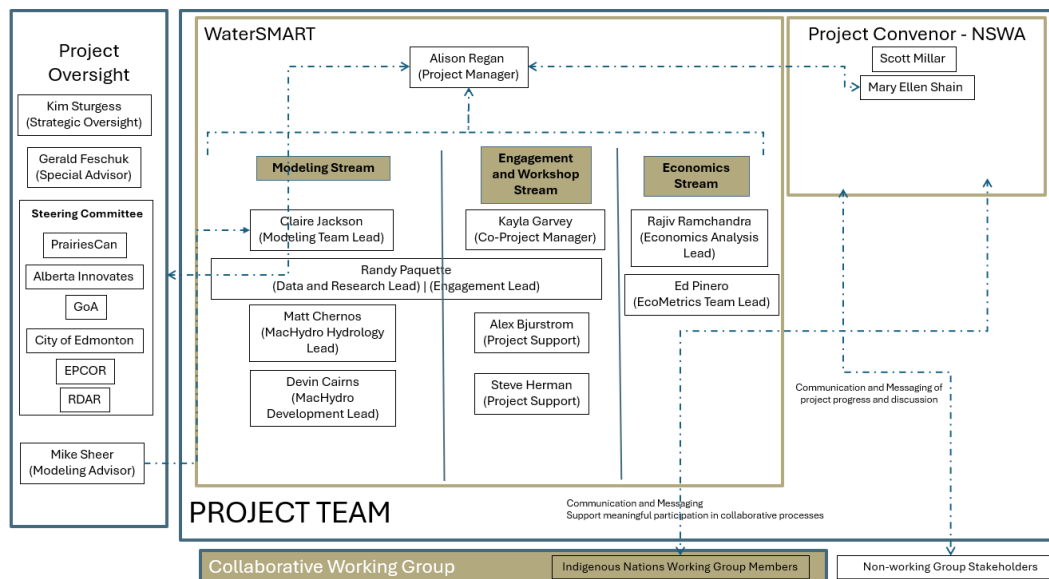


Figure 3: Project Governance Structure.

9. Project Assumptions and Risks

9.1 Project Assumptions

- Surface water quantity will be the focus of the hydrological and water management model.
 - Water quality will be considered in the context of quantity, such as concentration and dilution, where suitable data and/or developed models are available and accessible.
 - Groundwater information will be considered where available, but the hydrological model does not explicitly model deep groundwater (i.e. aquifers). The Team will work with the Alberta Geological Survey and others to develop a means of accessing groundwater information.
- The project will use existing data sets, with no requirement to generate or collect new project inputs. However, if additional data is released throughout the course of the project every effort will be made to incorporate it where practical, given timelines and budget.
- The geographical extent of the work will include the NSRB, including all tributaries and the mainstem.

- The hydrological and water management model will be developed using, when possible, publicly available data, including terrain, land cover, climate, streamflow/water levels, and water licences.
 - Some private data may be included to best represent control structures or operations; conditions for the availability of this data will be governed by the owner.

9.2 Project Risks

Project risks may include a lack of engagement and a lack of available data.

- Lack of engagement: This project requires interest and capacity for participation from important water users. This will be mitigated through leveraging existing relationships to foster engagement, promoting the importance of collaborative management, and showcasing successes in other basins to highlight the value of participation.
- Lack of available data: Rule curves or other management constraints for key water management infrastructure in the NSRB (i.e. major dams and cities), could improve the accuracy of the hydrological model simulations. If this data is not made available, this risk can be mitigated through assumptions made from historical public data.

10. Project Schedule

The project schedule below provides a rough guide for the project timeline.

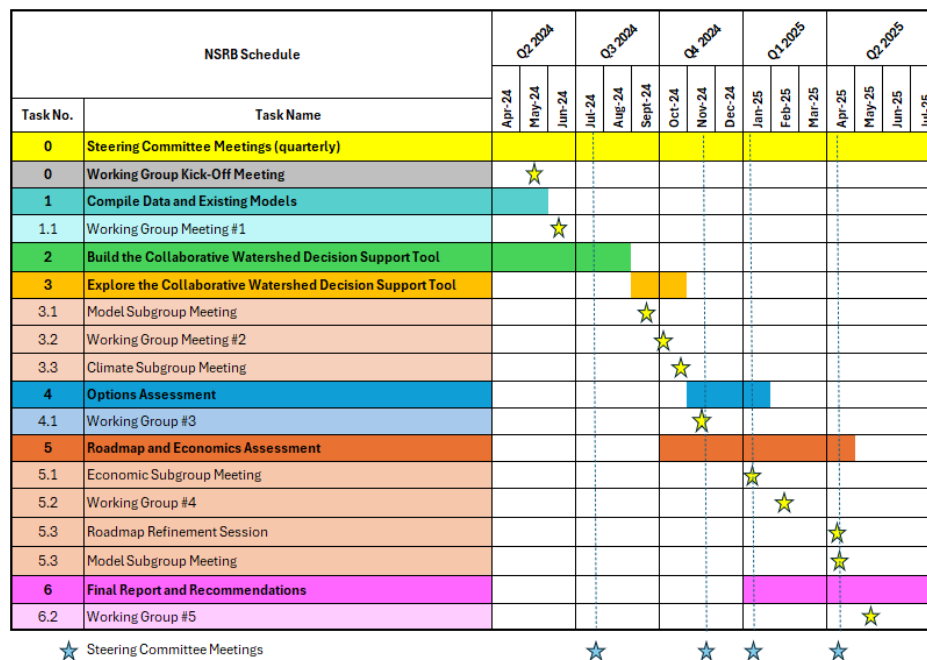


Figure 4: Draft Project Schedule.