



SOURCE WATER PROTECTION PHASE I: RISK ASSESSMENT TOOLS AND DATA

Final Report

May 2026

About the Alberta Water Council

The Alberta Water Council (AWC) is a collaborative multi-sector partnership that provides leadership, expertise, and sector knowledge and perspectives to help governments, industry, and non-governmental organizations to advance the stewardship outcomes of *Water for Life*. The AWC identifies opportunities and approaches that support shared responsibility for effective water management through each member's policies, practices, and tools.

Since its establishment as a not-for-profit society in 2007, AWC has developed and followed multi-year business plans to guide its work in providing advice on subjects of provincial significance and on topics that affect multiple sectors across Alberta's watersheds. AWC has released more than 25 major reports with information, advice, and recommendations directed to its members and other participants who are involved in managing Alberta's water. The outputs of the AWC generally have the consensus support of its members and are given serious consideration in informing members' approaches for managing water in Alberta.

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Acronyms

AI	Alberta Innovates
API	Application Programming Interface
AWC	Alberta Water Council
DWSP	Drinking Water Safety Plan
EPA	Alberta Environment and Protected Areas
GIS	Geographic Information System
GoA	Government of Alberta
Greenland	GREENLAND® International Consulting Ltd.
NGO	Non-Government Organization
SoO	Statement of Opportunity
SWP	Source Water Protection
SWPP	Source Water Protection Plan(ning)
THREATS	The Healthy River Ecosystem Assessment System™
ToR	Terms of Reference
WPAC	Watershed Planning and Advisory Council

Executive Summary and Recommendations

This project developed an online centralized inventory of tools and data, and a suite of associated educational resources within an existing online web tool, The Healthy River Ecosystem Assessment System™ (THREATS),¹ to improve water-related data access, analysis, and visualization to support source water protection (SWP) planning. The intent was to facilitate quick and convenient analysis which would support multiple uses, such as assisting drinking water providers to enhance their source water risk assessment and collaboration efforts, and supporting Watershed Planning and Advisory Councils (WPACs) to develop State of the Watershed reports. This project builds on the work of a previous Alberta Water Council (AWC) project team that developed guidance on protecting sources of drinking water in Alberta.

Engagement on the tool was conducted to gather feedback on its use from potential end users, which included webinars and workshops. Feedback from these sessions included that the user interface needed improvement and communications about the tool and SWP were missing.

In response to this feedback, a webpage (with general information on source water protection and the web tool) was created for the AWC website, the consultant redesigned the THREATS user interface, and a user-aimed educational tutorial was created in THREATS to help users navigate and understand the data and functions available.

The following recommendations were developed based on the outcomes and learnings of the project.

Recommendation 1: Form a “Source Water Protection Phase II” working group to scope a project with the goals of communicating about the tool to potential users and to teach municipalities, Indigenous communities, WPACs, and other relevant groups how to use THREATS.

AWC should form a working group including appropriate groups (e.g., WPACs, municipalities, Alberta Environment and Protected Areas, Indigenous communities, other AWC members) to plan and implement an education-focused project to raise awareness about THREATS, to build understanding of how THREATS can support source water protection risk assessments and planning, and train targeted potential users on how to use THREATS. The target audience includes private utilities, WPACs, and other potential users.

¹ <https://threats3.greenlandgroup.ca/>

Recommendation 2: Form a source water protection “data committee.”

Following project completion, AWC should immediately circulate a call for members to establish a SWP “data committee” which would meet on an interim basis (i.e., a few times per year). The committee would:

- Compile and manage data requests and needs for the THREATS tool and pass these requests on to Greenland, the developer of the tool for consideration and implementation.
- Reach out to and encourage others who have water data to upload it to DataStream² so that it can be used in THREATS.
- Identify and apply for grants, develop partnerships, or secure other funding sources to cover ongoing web tool maintenance costs.

Recommendation 3: AWC to write a letter to Alberta Environment and Protected Areas (EPA) to support their initiative to connect the Water Quality Data Portal to DataStream.

Following project completion, the AWC should immediately submit a letter to EPA to support their plans to make their water quality data accessible by DataStream, and in turn, THREATS. The letter should be submitted as soon as possible after project completion to allow the initiative to proceed in a timely manner, and should come from the AWC board, representing its entire membership to demonstrate broad support.

2 <https://gordonfoundation.ca/initiatives/datastream/>

1. Introduction

Source water is untreated, raw water from surface or groundwater sources prior to treatment for drinking water or other uses. Source water protection (SWP) is a risk management process designed to maintain or improve conditions (quality and quantity) of water through proactive and collaborative identification, assessment, and management of risk.

Having access to safe and secure drinking water sources is important for the health and well-being of Albertans, as stated in the Government of Alberta's *Water for Life* strategy. Many factors, including a growing population, climate change, aging infrastructure, and increasing development have increased the need for a more integrated approach to protecting sources of drinking water in Alberta. Protecting these sources can reduce public health risks and disruption in public services and strengthen natural ecosystems.

SWP plans are complementary to drinking water safety plans, which have a similar method of assessing risks to drinking water. Drinking water safety plans are a regulatory requirement for waterworks overseen by Alberta Environment and Protected Areas (EPA).

For additional general information about source water protection, visit the Alberta Water Council's (AWC) website.³

1.1 Context

This project builds on a previous AWC project, "Protecting Sources of Drinking Water in Alberta",⁴ completed in 2019. The goal of that project was to provide guidance on protecting sources of drinking water in Alberta. It included surveying drinking water providers and assessing SWP practices, processes, risks, and initiatives in Alberta. Results of the project supported development of the Protecting Sources of Drinking Water in Alberta: Guide to Source Water Protection Planning report (the Guide), and the Protecting Sources of Drinking Water in Alberta Companion Document (Companion Document). The Guide lays out six steps to help drinking water providers develop SWP plans in collaboration with other key groups in their source water area. The Companion Document summarizes information to be considered when protecting public, private, and individual drinking water sources in Alberta.

The idea for this project, "Source Water Protection Phase 1: Risk Assessment Tools and Data", was brought forward by EPA as a statement of opportunity (SoO) to the AWC in 2019 and in 2020 the board approved striking a working group to scope terms of reference for a project. The purpose was to develop a web tool and educational resources that would address gaps identified by the previous source water protection planning team to support the first two steps in the Guide:

³ <https://www.awchome.ca/projects/source-water-protection/>

⁴ <https://www.awchome.ca/projects/protecting-sources-drinking-water-alberta-2/>

1) involve key groups and create a vision, and 2) characterize your source water area. These steps involve collaboration with stakeholders, including all levels of government (local, provincial, federal, and Indigenous), and information gathering to identify and assess risks. The board approved terms of reference (Appendix A) and struck the project team in early 2021.

Considerations for Indigenous Communities

Numerous Indigenous communities within Alberta and across Canada have developed SWP plans, but it has been previously reported that many communities face barriers to developing new plans, including difficulty identifying and accessing the proper datasets, a lack of technical expertise, and a shortage of financial and human resources.⁵ The web tool and associated instructional resources developed for this project aim to provide additional support for these challenges.

The focus of this project was to create an accessible tool using publicly available datasets. These data are by and large all relevant and useful and comprise most of what an Indigenous community would need to complete a SWP risk assessment. However, there may be complementary datasets, Traditional Knowledge, or other information or considerations which may be relevant to include in their SWP plan but are not publicly available. Such private or protected information and data was excluded from the scope of this project and is not included in the web tool or discussed in this report.

For communities that have data that can be shared and made publicly available currently or in the future, they can upload their data to DataStream⁶ for use in the web tool at any time.

1.2 Purpose

As outlined in the SWP project team's terms of reference, the project had the following goals:

“To develop increasing access to a web platform and educational tools and resources to assist drinking water providers and local decision makers in Alberta to understand and assess risks to their drinking water sources. This work will also support the integration of SWP approaches and to enable greater collaboration between drinking water providers and stakeholders to ensure alignment with local priorities, statutory and non-statutory watershed management initiatives, and regional plans. Finally, this project will include the development of recommendations for an implementation phase to support mitigation of risks and a future strategy for SWP in Alberta.”

5 <https://www.nswa.ab.ca/public/download/files/242830>

6 <https://datastream.org/en-ca/documentation/upload-data>

The project objectives were as follows:

1. Users and other stakeholders understand the need for SWP risk assessments and the benefits of collaborative SWP approaches and are aware of the SWP web platform.
2. Create an inventory of SWP data sources, risk assessment tools, and procedures.
3. Capabilities and limitations of the web platform are understood and inform the next steps of the project.
4. Develop a web platform that provides access to data to support the risk assessment process as well as educational resources to support collaboration efforts for SWP planning.
5. Incorporate feedback from end users and other stakeholders on the web platform, tools, and educational resources to improve user experience.
6. Complete a final report on the web platform, resources, lessons learned, and recommendations for an implementation phase and a future strategy for SWP in Alberta.
7. Effective communication around the project work and deliverables.

2. Deliverables

The primary deliverables were enhancements to an existing online web tool, The Healthy River Ecosystem Assessment System™ (THREATS),⁷ hosting two webinars and two workshops to showcase and gather feedback on project materials, and development of communications and educational materials which provide information on source water protection and how to use THREATS. The team also prepared a plan for communicating the project outcomes after the project is complete (Appendix B). The following sections describe the deliverables and the process to achieving them.

2.1 Scoping the tool and selecting a consultant

The team's initial tasks were to prepare a scope for the web tool and to select a consultant to develop it.

Through several discussions early in the project, the team determined that the aim was to develop a user-friendly, web-based tool that provides access to data to support the risk assessment process of source water protection planning (SWPP) that can be regularly updated. The tool should be a geospatial, visualization tool that amalgamates land use, water quality, and water quantity data and assesses current and future source water risks. The tool would amalgamate publicly available data, include the ability for data and analysis tools to be added over time, and be publicly available.

⁷ <https://threats3.greenlandgroup.ca/>

For this project, the “risks” to drinking water sources were based on the information required to address the risk assessment step for SWP planning laid out in the Guide to Source Water Protection Planning in Alberta (Step 2: Characterize Your Source Water Area).⁸ Additional risks were added based on the Alberta Drinking Water Safety Plan template,⁹ as well as the experience and expertise of the project team members. In THREATS, there are tables available for download that list the risks and the datasets in the system that can be used for assessment.

The team prepared a request for proposals, which was posted publicly for bid. GREENLAND® International Consulting Ltd. (Greenland)¹⁰ was retained to work under the guidance of the project team to leverage the existing THREATS platform.

With more than 10 years of development, testing, and refinement, THREATS addressed many of the project requirements already and the team saw opportunity to leverage the functionality of a tool already in existence.

2.2 Securing support for the web tool

Upon hiring a consultant to develop the tool, it was determined that additional funding was required beyond what was initially anticipated by the working group to carry out the tasks, as well as securing funding for ongoing maintenance costs, so the team then focused on gathering support for developing the tool to assist with fundraising efforts.

Two webinars were held to showcase and gather support for the THREATS tool (September 27 and October 12, 2022). These webinars were open to the public with 49 total participants.

The two webinars were identical and had three objectives:

1. To educate potential users and stakeholders on the presence and functionality of the existing tool
2. To gather feedback on the tool
3. To gauge potential interest, need for the tool, and support for potential development of such a tool for all of Alberta

8 https://www.awchome.ca/_projectdocs/?file=0a5a74e0ad3f5403

9 <https://environment.alberta.ca/apps/regulateddwq/DWSP.aspx>

10 <https://www.grnland.com/>

The webinars included an overview of modules and data sets within the platform that aid in the development of source water protection and watershed management plans; they also demonstrated use of the following modules and data and how they relate to reporting:

- Global Land Data Assimilation System Historic Climate Module
- Spatial Analysis Module
- Water Hazard and Hydrograph Module
- Water Quality Module

A case study focused on Rocky Mountain House, Alberta, was used to show how THREATS increases the efficiency of accessing and analyzing large amounts of data and the vision of making it available across Alberta and elsewhere. Comparison was made with SWP planning done for the North Saskatchewan River Basin upstream of Edmonton.

A recording of one of these webinars is available online.¹¹

Electronic surveys were sent to webinar participants to gather information on their affiliation, whether they would use the tool for their work, how they might use the tool, any barriers to its use, and ways it could be improved.

In brief, most of the survey participants (72%) were from either non-government organizations (NGOs) or industry, 17% were municipalities, and the remaining were Government of Alberta (GoA) staff or consultants (11%); 96% of participants said they would use the tool for their work. Cost (if applicable) and staff expertise to use the tool were identified as the main barriers to its uptake. A range of uses were identified that generally encompassed watershed planning (SWP planning, trend analysis, riparian management) and land use planning (impacts of land use, development, etc.).

Survey results are presented in Appendix C.

In communicating and engaging on the tool, the team also sought out letters of support to assist with grant funding applications. Two letters of support were received, one from Alberta Municipalities and one from the Water North Coalition, demonstrating an audience for the tool; the letters are included in Appendix D.

The information on the audience for the tool, potential uses for it, and the letters of support were collectively used to apply for funding through the Alberta Innovates Water Innovation Program. The application was successful, and a \$199,425 grant was awarded to support the project's software development tasks. More information about the project award can be found on the Alberta Innovates website.¹²

11 [AWC Source Water Protection Risk Assessment Tool Demonstration](https://www.youtube.com/watch?v=Zr5kgr1Nmk0)
— <https://www.youtube.com/watch?v=Zr5kgr1Nmk0>

12 <https://albertainnovates.ca/projects/source-water-protection-phase-i-risk-assessment-tools-and-data/>

The funding from Alberta Innovates would allow the AWC to set aside its project funding to support ongoing web tool maintenance for two years following project completion. More information on the project budget is in the project terms of reference (Appendix A).

2.3 Tool development

Greenland undertook a series of tasks to enhance THREATS under the project team's direction. Their focus was to build upon existing features to address the anticipated increase in users and to improve and enhance the platform to create a more fluid user experience with new functionality and resources.

The following sections describe THREATS in the context of and purpose in which it was developed for this project – to support source water protection planning. There are many other use cases for THREATS; examples of alternative uses are listed in Appendix C but are not described further in this report.

The screenshots and descriptions in this section represent the THREATS interface at the time of the final report's writing. At that time, Greenland was still actively revising the interface, and the new version appears materially different. For more information on the interface changes, see Section 2.4.2. For the most recent information on the tool, visit Greenland's website.¹³

About THREATS

THREATS is a multifaceted platform for exploring and analyzing environmental data, including timeseries and spatial data. Its overall aim is to allow users to evaluate cumulative environmental effects through exploration of land use and land-based risk factors such as industry, contaminant release, agriculture, and mining alongside environmental monitoring data. A description of THREATS is available on Greenland's website,¹⁴ and the THREATS tool is publicly accessible online.¹⁵

Catchment Delineation and Flow Trace Function

Delineating the source water area, which includes the watershed upstream of a point of interest, is typically the first step in developing a SWP plan. Often, these boundaries are unique to a drinking water provider and do not follow other defined watershed boundaries. In some cases, the information will be available through a WPAC that is local to the water intake area, but otherwise, the watershed boundary must be created using a geographic information system (GIS) program and a digital elevation model.

13 <https://www.grnland.com/Intelligent-Software/THREATS.html>

14 <https://www.grnland.com/Intelligent-Software/THREATS.html>

15 <https://threats3.greenlandgroup.ca/>

THREATS can generate catchment delineations at specific outlets where data is available (Figure 1). Pre-defined catchment areas can also be loaded. For this project, the functionality was developed for all of Alberta using the provincial 25-metre resolution digital elevation model; parts of British Columbia and Saskatchewan within the Peace and Athabasca watersheds were also included. User-delineated catchment areas are available for use in the Spatial Analysis Module as areas of interest to clip and aggregate metrics for other spatial data sets.

A flow trace function was also added, which shows the path of a given watercourse upstream and downstream from a specified location.

An example screenshot of this functionality is shown below.

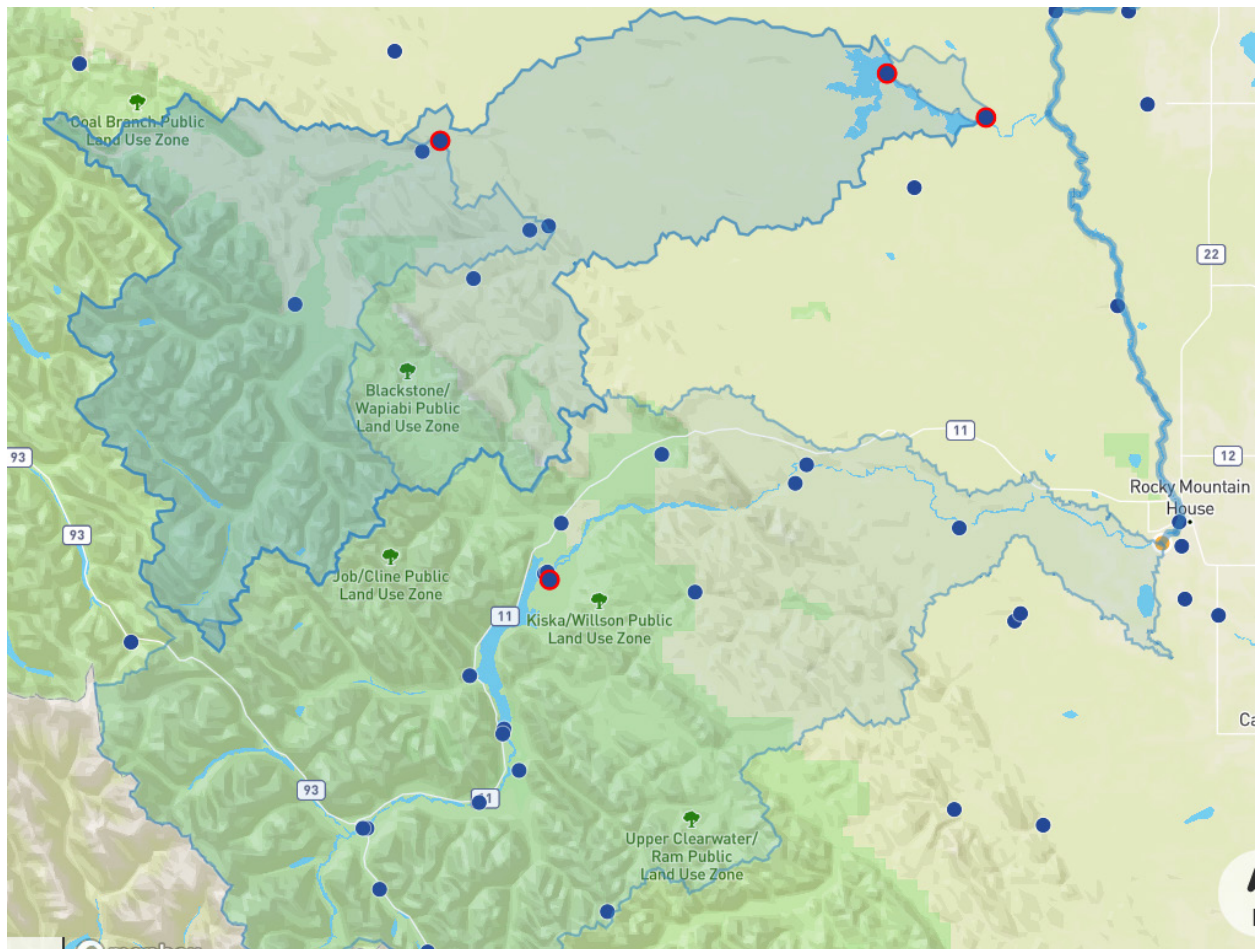


Figure 1: Catchment delineated from user-specified point and Water Survey of Canada and Alberta Environment and Protected Areas hydrometric station.

Land Use Mapping

The next step in evaluating risks to source water is to characterize activities that are occurring or have occurred in the landscape that affect water quality in the source water body. This may include parks and protected areas, roads, pipelines, agricultural practices, and other land cover classes (e.g., wetlands, forests) (Figure 2). Mapping these features allows users to determine the cumulative impact of activities for risk assessment purposes.

Manually compiling the required spatial data layers, synthesizing them into useful maps, and completing data analysis can be a challenging process; it often requires access to the relevant information and technical expertise (or funding for a consultant). By compiling spatial data layers into a single location and providing associated analytical tools, THREATS significantly reduces the time and cost needed to complete a risk assessment.

Many of the spatial layers required for this project were previously available in THREATS. Greenland maintains a tile server that enables responsive map loading of large, detailed spatial data layers. The attributes of these layers are maintained in corresponding tables to enable spatial analysis queries. The following additional spatial data sets were added to the THREATS tile server as part of this project:

- 2021 National Pollutant Release Inventory
- Wildfire burn area database (national database)
- 2021 Census of Agriculture
- Indigenous communities and Treaty Area boundaries
- Alberta reported well locations

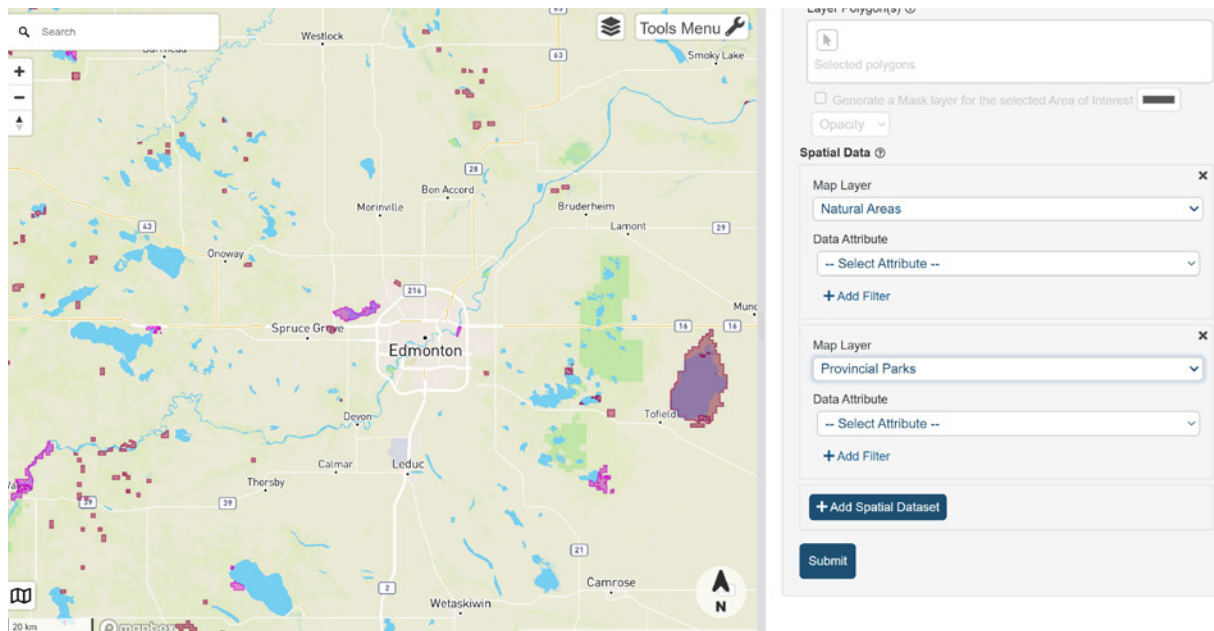


Figure 2: Viewing spatial data layers – natural areas and provincial parks.

Many data sets are large and previously were slow to load into the web map environment. Automated scripts for tiling of spatial data and scheduled updates for tiling of specific data sets were completed, which greatly increased the speed that spatial data are rendered. This was done by reducing the resolution of features when zoomed out and increasing the resolution of smaller areas when zoomed in.

Another new feature was to allow multiple data sets to be added and analyzed together in batches with filtering capability. This analysis can quantify density of a given feature such as roads, pipelines, landfills, or mines within one or more areas of interest. It also allows users to assess changes that have occurred over time where data are available from different time periods, such as with land cover or livestock numbers.

Water Quality and Quantity

SWP planning also requires gathering data to assess water quality and quantity.

Much of the historical water quality monitoring of rivers and streams was completed by EPA. Historical sampling programs may not have been designed to characterize water quality in a source water area and data can be sparse (especially for tributaries). Additional data is often available through Environment Canada (mainstem rivers), approval holders, other water utilities (intakes), stewardship groups, or municipalities who have a source water monitoring program. An added challenge is compiling the data and ensuring data quality. For example, there are various laboratory analytical methods used and different detection limits which may preclude comparability or may require a water quality expert to interpret the data.

Many of the same challenges apply to water quantity. Water Survey of Canada (WSC) and EPA maintain many hydrological stations, but there are gaps in monitoring; one may not be established in a source water area of interest. Ideally, long-term monitoring programs and research partnerships would be established to evaluate source water and effluent impacts and to understand contaminants of concern. But this can be a large undertaking, even for large municipalities or drinking water providers. It is advisable to accomplish monitoring and research goals through partnerships, like the approach for mapping. For example, drinking water providers could partner with WPACs in their community-based monitoring efforts.

THREATS provides a convenient means of assessing and undertaking water quality data analysis across Canada for data included in the Gordon Foundation's DataStream database.¹⁶ Having data in DataStream is essential for ensuring availability for use in THREATS and should be made part of standard organizational procedures where possible.

¹⁶ <https://gordonfoundation.ca/initiatives/datastream/>

For water quality, the THREATS Water Quality Module accesses water quality data from DataStream and hydrometric flow data from WSC and GoA. The module allows the user to:

- visualize water quality data (Figure 3)
- filter water stations according to available water quality parameters
- filter water quality parameters according to selected station locations
- group nearby stations to increase the size of available datasets
- compare concentrations between upstream and downstream locations or between tributaries
- conduct flux analysis
- perform trend analysis (Mann-Kendal, seasonal decomposition, remainder, and others)

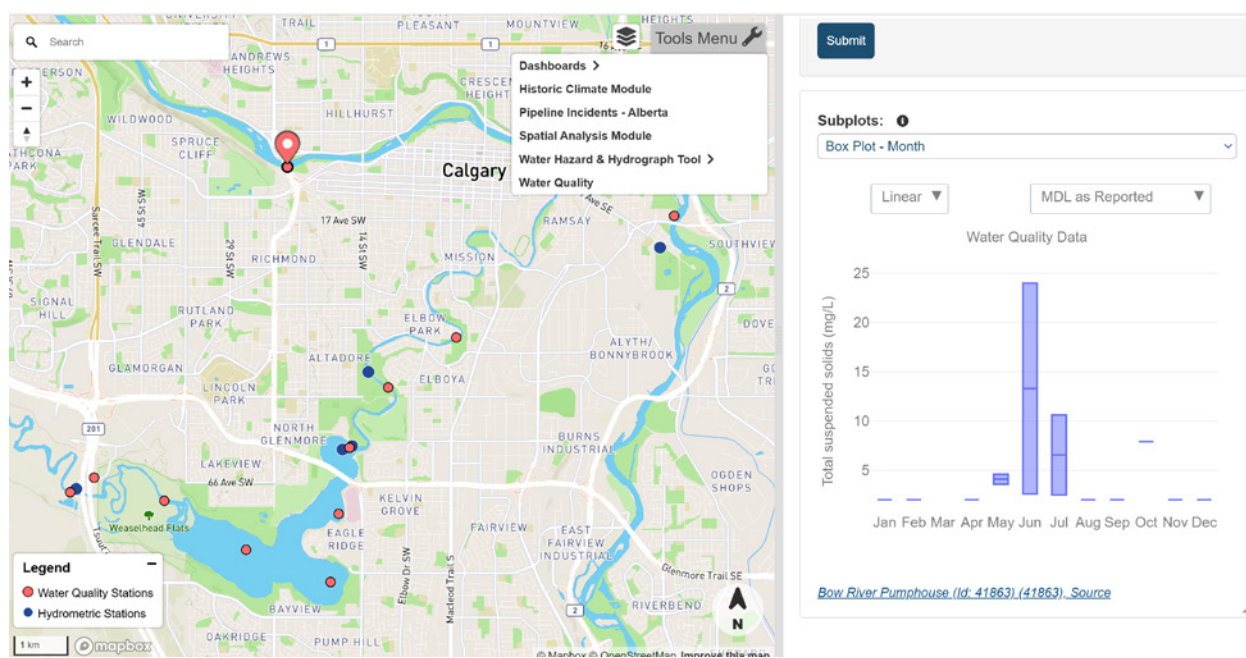
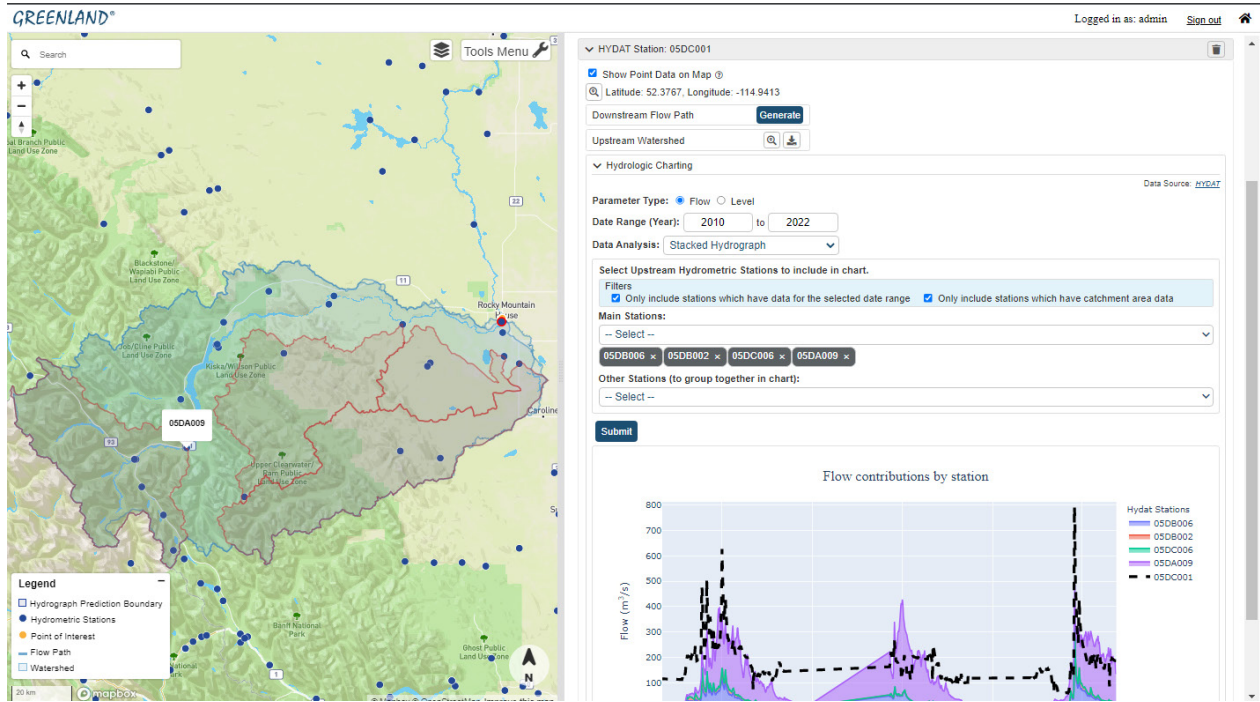


Figure 3: Creating water quality graphs.

For water quantity, the Hydrometric Analysis module in THREATS provides access to WSC and EPA hydrometric station data, historic and real-time, and is equipped with a series of statistical analysis functions to evaluate long-term flow statistics and trends. The module allows users to:

- calculate water yield by catchment area
- determine daily flow and compare against long-term normal and statistical return period calculations
- view trends in water yield (Figure 4)



Flow contributions by station

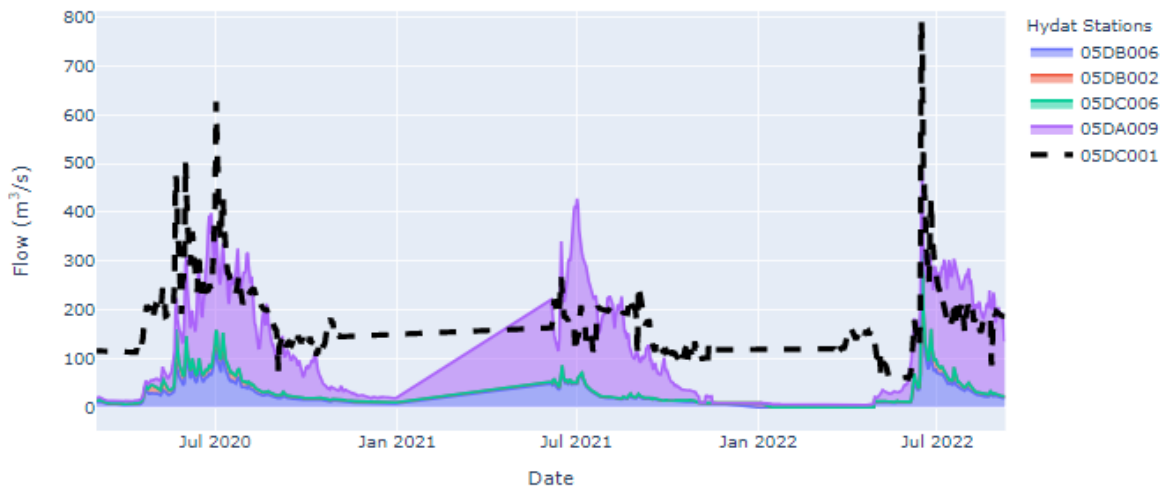


Figure 4: Viewing water yield by sub-basin.

This project completed several improvements to various modules of the platform:

- Water quantity
 - Adding a new data application programming interface (API) that was released by WSC into THREATS to improve reliability of hydrometric station data access.
 - Updates to the data retrieval mechanism to improve stability.
 - Tiling of hydrometric stations to improve the speed of the platform in showing points on the map (previously was rendering geoJSON files).
- Water quality
 - Caching a large portion of the DataStream database on the THREATS server to improve query efficiency and responsiveness.
 - Improvements to the flux analysis function to improve stability and identify errors or inconsistencies in input data.
 - Addition of a map query function to allow users to find relevant data more quickly and streamline analysis setup. It is now possible to quickly identify stations according to geographic area, availability of specific chemicals, minimum number of samples, and period of record. Once stations are identified, only chemicals available at those stations are visible to include in the analysis.
 - An addition of a “top 20” and “top 50” chemicals option when making selections for analysis to reduce the list of chemicals to those with the largest number of samples.
 - Tiling of water quality stations to improve the speed of the platform in showing points on the map (previously was rendering geoJSON files).

Climate Data Module

As a final step in SWP risk assessment, an evaluation of potential future changes in climate and how those could impact a source water area is conducted.

THREATS uses an API to access data from Open-Meteo¹⁷ which provides access to historical and real-time climate data. Distribution analysis of historic data from a user-specified interval can be analyzed into quartiles that can be used as a reference against daily or hourly time series data to identify extreme events. It might also be useful in identifying trends and frequency or severity of extreme events or conditions at user-defined locations.

The new module will eventually include ensemble climate change forecast data that offers geographically-specific insights into future climate parameters.

¹⁷ <https://open-meteo.com/>

The primary update through this project was to replace a previous Global Land Data Assimilation System module for accessing historic climate data with the new data source provided by Open Meteo.

Remote Sensing Data Analysis Module

Through this project, Greenland began developing a Remote Sensing Data Analysis module, which will access publicly available satellite data for a user-specified location of interest. The intent of the new module is to greatly reduce the level of effort involved in accessing and using satellite data.

The software will automatically select the appropriate data bands from the best available satellite and apply normalization indexes or other algorithms to process the data. The technology has been advanced to enable evaluation of the spatial extent of water-covered areas such as flooding, lakes, and reservoirs, and to monitor lake and reservoir water levels.

The module has been launched on the THREATS development site and is currently undergoing testing. The flood area mapping functionality has been developed, but there are data availability issues and conflicts with snow cover that put constraints on its use. If flooding aligns with the satellite swath this may prove useful, but the return frequency of the Sentinel satellite is on the order of 12 days, making it difficult to acquire imagery specific to flood events that occur and recede quickly.

This is an active area of research with many new satellites coming online in recent years, but there are very limited means for watershed scientists to access and use this type of data in practice without extensive work to access and process very large data sets.

Tasks completed included:

- interface design and development for integration with THREATS
- research and experimentation with satellite imagery processing and analysis
- automation of processing steps to simplify analysis for users
- developing code to pass analysis results into the THREATS database and enable further analysis with the spatial analysis module

Other Enhancements

Other administrative enhancements were made to THREATS, including:

- new platform infrastructure to enable users to automatically create new user accounts with personal usernames and passwords (Figure 5)

The screenshot shows a web interface for user login and registration. At the top, there are two buttons: 'Login' (dark blue) and 'Register' (light grey). Below these are two input fields: 'Username or Email' and 'Password'. The 'Password' field has a small icon of an eye with a slash through it, indicating a toggle for password visibility. Below the input fields is a 'Disclaimer' section with a title 'Disclaimer:' and a scrollable text area containing two bullet points. Below the disclaimer is a checkbox with the text 'I acknowledge that I have read and understand the above disclaimer'. At the bottom left is a 'Sign in' button, and at the bottom right is a link 'Not a member? Register'.

Figure 5: THREATS user account and login page.

- Creation of a dashboard, where upon login a sidebar appears providing background information on the project along with a list of associated resources (Figure 6). It includes:
 - background information on how to undertake SWP planning
 - links to tutorial / workshop presentation materials
 - risk assessment tables from drinking water safety plans, with links to datasets available in THREATS that are used to address the risks
 - the dashboard also includes links to other third-party web applications to access these tools in separate browser tabs where existing tools could not be integrated directly into the THREATS environment¹⁸

¹⁸ Outreach to GoA staff was undertaken to investigate the potential to integrate existing groundwater tools but it was determined that GoA's tools do not have application programming interfaces that would enable them to be used in THREATS.

Figure 6: THREATS interface and dashboard.

2.4 Communications

Following completion of a draft of the web tool, the next step was to communicate about the tool with potential users and gather their feedback on it.

2.4.1 Workshops

Two workshops were held in late 2024 and one in early 2025 with the intent of showcasing the tool and gathering feedback from participants.

One workshop was a virtual session intended for a multi-stakeholder audience. The agenda included background information on SWP, a guided exercise for participants to use THREATS, and an opportunity for participants to provide feedback on their experience.

There were two in-person sessions: a pre-conference workshop for the Alberta Water and Wastewater Operators Association¹⁹ (AWWOA)²⁰ Annual Water Week Conference held on November 12, 2024, and a workshop for the 2025 Aquatera Water | Earth | Innovation conference in Grande Prairie, Alberta on February 7, 2025.

19 <https://www.awwoa.ca/>

20 AWWOA is a member-run source for expert information and training designed for Alberta's 2,700 utility system operators. AWWOA is dedicated to providing the essentials in education, networking, promotion, and ongoing support that operators need to proudly supply Alberta communities with safe drinking water and a protected environment.

There were 48 operators from utilities across the province at the November 2024 workshop. The agenda for this session included background information about source water protection and the project, an overview of the elements of a SWP plan, and how to use THREATS to complete a source water protection plan risk assessment.

The February 2025 workshop included a basic overview of SWP and general information on the modules available in THREATS and how they relate to SWP. The goal of the conference was to provide learning and training opportunities to water and wastewater owners and operators in northern Alberta.

There were approximately 100 participants between the three workshops. While there were technical issues with THREATS experienced by some users during the sessions, monitoring of THREATS confirmed that servers operated without experiencing overloading and almost all database queries were executed successfully.

Proceedings for the virtual workshop are provided in Appendix E – Workshops, including a summary of the workshop, results from monitoring of the tool during the session, feedback gathered from both workshops, and a list of participants.

Feedback from the workshops noted areas for improvement related to user experience and instruction on how to use the tool and is summarized in Appendix E – Workshops.

A recording of the virtual workshop is available online.²¹

2.4.2 Incorporating participant feedback

The next step for the team was to address feedback from participants heard in the workshops, which focused on:

- providing clearer information on how and why to undertake source water protection
- developing visual enhancements to make the tool more accessible and user-friendly
- developing clear instructions on how to use the tool

The team addressed this feedback by updating information and resources related to SWP on AWC's website, improving the user interface, and integrating help functions into THREATS.

Two webpages were prepared for the AWC website: one focused on general information about source water protection²² and one focused on the web tool.²³

Feedback on the platform noted a need to improve flow-through, provide more guidance and increase consistency across various functions, and to improve the intuitive nature of the design.

21 <https://www.youtube.com/watch?v=TmEp5ywZ9m4>

22 <https://www.awchome.ca/projects/source-water-protection/>

23 <https://www.awchome.ca/projects/source-water-protection/swp-web-tool/>

There were also reports of delays, poor responsiveness, and errors from some users that were difficult to reproduce internally by the development team.

Greenland retained a third-party software reviewer and design specialist to provide recommendations which confirmed and expanded upon user comments and provided some options for improvement.

Upon compiling the comments, Greenland decided to pursue a redesign of the THREATS user interface while retaining as much of the backend system and functionality as possible. This also included the development of a tutorial and help tour that shows users how to navigate the tool and explanations of the functions (e.g., what the hydrometric analysis module can do).

At the time of writing this report, importing the existing functionality into the new tool was still in progress, but the previous interface was fully functional and set to remain active until the new interface is completed.

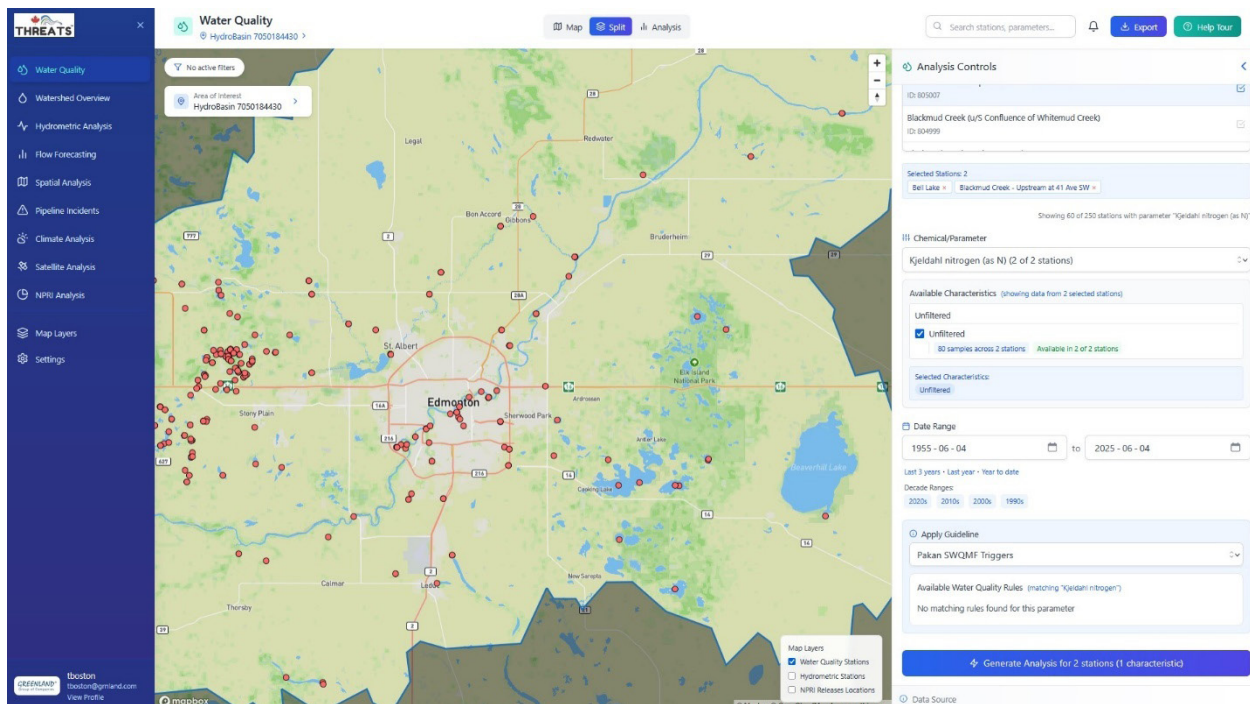


Figure 7: Updated THREATS user interface.

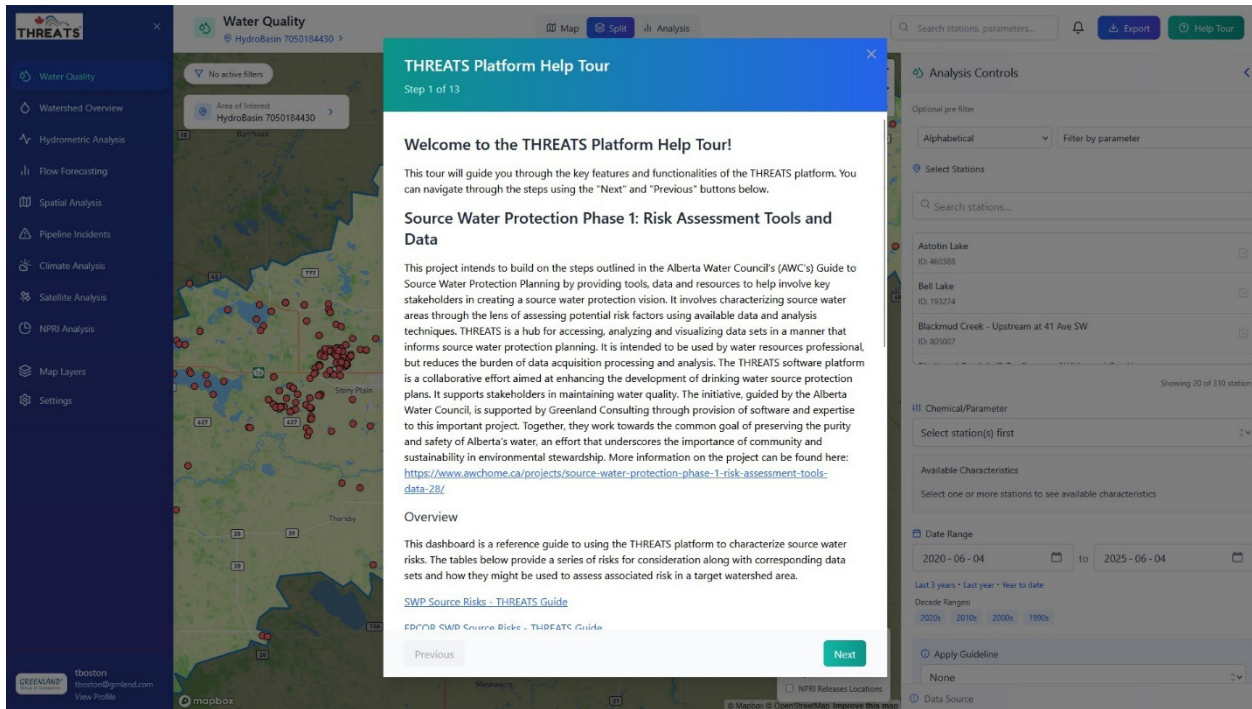


Figure 8: Screenshot of the THREATS tutorial.

3. Project Team Recommendations

The project team developed three recommendations informed by outcomes of the work.

RECOMMENDATION 1: Form a “Source Water Protection Phase II” working group to scope a project with the goals of communicating about the tool to potential users and to teach municipalities, Indigenous communities, WPACs, and other relevant groups how to use THREATS.

AWC should immediately circulate a call for members to establish a SWP Phase II working group, including appropriate groups (e.g., WPACs, municipalities, Alberta Environment and Protected Areas, Indigenous communities, and other AWC members) to plan and implement an education-focused project on how to use THREATS and communicate and engage about the tool, targeted at municipalities, WPACs, and other potential users.

Rationale

This project is intended to be the first phase of an ongoing SWP initiative focused on developing the tool, gathering input on its functionality, and creating some initial resources to help users learn more about it and navigate the various functions. Further work is required to raise

awareness about the tool and how it can be used to support SWP risk assessments and planning, and train potential users.

The potential audience for the tool is large. Few municipalities, or other groups, in Alberta have developed SWP plans. AWC is aware of approximately only a dozen such plans having been completed. These cover some of the major population centres in the province, but there are hundreds of small urban and rural municipalities that could benefit from the tool, primarily through using it to support development of mandatory Drinking Water Safety Plans. The registry of Alberta Municipalities and Rural Municipalities of Alberta Chief Executive Officers and Chief Administrative Officers (CAOs) has over 500 officials listed who would benefit from at least basic awareness and knowledge of THREATS.

Through this project, the team worked with a CAO from the Town of Spirit River who, for one of the team's webinars, informed the team of some of the water-related challenges their community was facing. The team and Greenland used THREATS to gather some information to address those issues; the CAO found the information so relevant to them that they invited a Town Councillor to attend the webinar to learn more. Similar learning sessions and benefits might be available for the hundreds of remaining small urban and rural municipalities that would have their own water issues to address.

Considerations

Elements that should be considered by the working group in developing terms of reference for the SWP Phase II project are below, including further details on the scope of work, audiences, and potential partners.

Engagement

- The working group for the SWP Phase II project should develop an engagement and outreach strategy, outlining:
 - who will be engaged (i.e., target audiences)
 - the goals and objectives of engagement
 - criteria for identifying priorities
 - appropriate engagement channels
 - guidance for tailored messaging and training for different target audiences
 - resources required to launch and maintain engagement efforts
 - metrics to evaluate the impact of efforts
 - timelines
 - other elements as required

- Engagement tasks to implement the engagement strategy would be identified by the working group, but may include:
 - planning the training sessions with WPACs (agenda, desired outcomes, materials)
 - identifying opportunities for collaboration (e.g., watershed planning)
 - informing the proposed SWP “data committee” (Recommendation 2) of any opportunities for funding or other support to keep the tool maintained and for potential enhancements to the tool

Training sessions

- The SWP Phase II project should develop training materials for subsequent training sessions. This might include video tutorials, written instructions, or other materials as determined by the working group and project team.
- Similar to what was done for the AWC’s Building Resiliency to Multi-Year Drought Resiliency Guide, a “train the trainer” model could be used to maximize training efficiency. AWC staff would train selected WPAC representatives, who would then gather other WPACs and teach them and municipalities in their watershed how to use the tool, and effectively translate the outputs into actionable insights.
- Training drinking water providers should be undertaken primarily by WPACs, though AWC and EPA could help plan and host initial sessions. EPA’s Drinking Water Operations Specialists may be able to support the WPACs and drinking water providers. Drinking Water Operations Specialists supported similar risk management projects in the past, including supporting the implementation of the Drinking Water Safety Plans which have a SWP component.
- Similar past sessions with operators have been better attended when those within operators’ existing networks also attend; focusing on specific geographical areas would maximize turnout and potentially increase opportunities for regional collaboration.

Communication

- The purpose of the SWP Phase II project would be to develop and undertake an awareness campaign for THREATS, with the following goals:
 - Increasing knowledge on:
 - SWP planning and its benefits
 - the elements of a SWP plan
 - how THREATS can be used to complete a risk assessment for a SWP plan
 - other benefits of THREATS (e.g., time and cost savings, improved environmental and public health)
 - Sharing information on recently completed and ongoing projects or actions related to source water protection

- The following groups at a minimum should be engaged in planning:
 - AWC members who have an interest in increasing uptake of SWP planning
 - WPACs
 - Alberta Municipalities and Rural Municipalities of Alberta
 - Indigenous communities
 - EPA's drinking water and wastewater group
- The group planning the communications should include the following target audiences and tailor the communications accordingly:
 - water and wastewater operators (including Regional Services Commissions and Municipally Controlled Corporations)
 - municipalities (urban, rural)
 - WPACs
 - Indigenous communities
 - operations leads
 - bylaw/land use planners
 - EPA approvals and inspectors
 - members of the Alberta Agriculture Farm Water Program
- Existing communications channels should be used to share messaging to improve reach and uptake, including organizational newsletters, social media posts, and presentations at conferences and events.

AWC funding would be needed to:

- host in-person training sessions and possible communication events
- pay honoraria for team members or others who may be attending in-person events
- develop printed or other materials for training or communications sessions
- provide financial support to those who need it to attend training sessions

A standard project length is suggested for this work (1–2 years).

RECOMMENDATION 2: Form a source water protection “data committee”

Following project close, AWC should immediately circulate a call for members to establish a SWP “data committee” who would meet on an interim basis (i.e., a few times per year). The committee would:

- compile and manage data requests and needs for the THREATS tool and pass these requests on to Greenland for consideration and implementation.

- reach out to and encourage others who have water data to upload it to DataStream²⁴ so that it can be used in THREATS
- identify and apply for grants, develop partnerships, or secure other funding sources to cover ongoing web tool maintenance costs

Rationale

Currently, the only method to have data added to THREATS is to contact Greenland directly or to submit a feedback request through the tool. Instead of one-off requests and having Greenland determine priorities, it is proposed that data requests would be compiled and prioritized by an AWC-led data committee. Data gaps would be identified via a range of sources, including by the committee membership, through data requests submitted electronically within THREATS, and other initiatives that involve data holders who would use the tool (e.g., training sessions under Recommendation 1). One current data gap that is actively being addressed is the addition of lakes as a spatial data layer in THREATS, which are being used as drinking water supplies.

In addition to identifying data gaps, there are opportunities for data to be added from a range of groups (e.g., municipalities, Indigenous communities) who do not have their data shared in open sources (DataStream). Anyone who wants to share data can add it to DataStream,²⁵ and these data can then be made available for use in THREATS. The committee would take an additional step to contact groups to discuss the benefits of having their data available via open sources, including having their data be usable in THREATS.

In developing the web tool, AWC agreed to support the ongoing costs for maintaining it for two years from this project's completion, but funding would be needed for ongoing maintenance beyond this. The proposed committee would also identify and secure funding to pay for maintenance costs, which would go to Greenland and be used for basic maintenance such as periodic updating of Python packages and libraries, and periodic updating of servers, operating systems, and databases for security and optimal operation, on a strategic prioritized basis.

AWC has funding to support the maintenance costs for approximately two years, but there are many factors which can affect the costs, such as changes in the USD/CAD exchange rate (cloud computing costs are charged in USD). Additional data, tools, platform functionality, and user support would incur further costs that would need to be agreed upon in advance.

The project team proposes a committee be formed for this scope of work as opposed to a project team as the expected workload of the committee is low and the scope is straightforward; a committee could be formed immediately without the need for a working group scoping stage.

24 <https://gordonfoundation.ca/initiatives/datastream/>

25 <https://datastream.org/en-ca/documentation/upload-data>

It is proposed that a call for members be circulated promptly after this project is approved so that the committee can begin immediately, as some of the committee's tasks will take significant time to carry out (particularly, identifying and securing funding and partnerships). Delays could result in the current funds set aside for maintenance costs being spent before additional funding is identified.

Considerations

- Membership
 - Members outside the AWC, or those who should be specifically contacted to participate on the committee include:
 - Data providers, particularly the Alberta Biodiversity Monitoring Institute, due to their involvement in collecting land use data. They may also be able to provide support in identifying data gaps and funding opportunities.
 - Indigenous communities, who may have Traditional Knowledge and perspectives to share.
 - WPACs, as they play a central role in watershed reporting and would have data to add, may be aware of potential data gaps, and would have contacts for those who might have data.
 - Rural Municipalities of Alberta and Alberta Municipalities, as they represent many of the potential users and would be useful in spreading awareness of the data that is available. They could also encourage their members to add data to the tool.
 - Other GoA ministries that are not represented on the AWC board might have relevant data or interest in the outcomes, specifically Alberta Forestry and Parks, Energy and Minerals, Tourism and Sport, and Primary and Preventative Health Services.
 - Engaging Greenland as early as possible would be beneficial to ensure their active involvement with the committee.
- Funding
 - The committee would pursue sources of funding for the ongoing web tool costs. A list of possible funding sources is found below; the committee would identify, apply for, or otherwise carry out the full cycle of securing funding.
 - Grants, such as:
 - Alberta Real Estate Foundation Development Grant²⁶
 - Royal Bank of Canada Community Investment grant²⁷

²⁶ <https://www.aref.ab.ca/funding/development-grants>

²⁷ <https://www.rbc.com/our-impact/apply-for-funding/community-investments-canada.html>

- TD Bank Group Friends of the Environment Foundation Grant²⁸
- A list of grants is also available on the Canada WaterPortal website²⁹
- Support from drinking water and wastewater operator associations, including:
 - Alberta Water and Wastewater Operators Association³⁰
 - Canadian Water and Wastewater Association³¹
 - Western Canada Water³²
- Partnerships (sharing cost through new projects with other partners), including:
 - Academics
 - Canada Water Agency³³
 - Federation of Canadian Municipalities³⁴
 - Alberta Innovates³⁵
 - WPACs³⁶
- Project funding is not expected to be needed for the committee; however, honoraria should be made available for committee members who need it.
- Timeline
 - As a desired outcome of this committee would be to secure support for ongoing costs, it is recommended that the committee be stood up indefinitely. However, the committee would meet only a few times per year, therefore the overall workload is expected to be low.

28 <https://www.td.com/ca/en/about-td/ready-commitment/funding/fef-grant>

29 <https://waterportal.ca/research-and-project-grants/>

30 <https://www.awwoa.ca/>

31 <https://cwwa.ca/>

32 <https://www.wcwwa.ca/>

33 <https://www.canada.ca/en/canada-water-agency.html>

34 <https://fcm.ca/en>

35 <http://albertainnovates.ca/>

36 <https://www.alberta.ca/watershed-planning-and-advisory-councils>

RECOMMENDATION 3: AWC to write a letter to Alberta Environment and Protected Areas (EPA) in support of their initiative to provide Water Quality Data Portal datasets to DataStream, and to further enhance the Water Quality Data Portal

Following project close, the AWC should immediately submit a letter of support to EPA to support their plans to make their water quality data accessible by DataStream and, in turn, THREATS. The letter should be submitted as soon as possible after project completion to allow the initiative to proceed in a timely manner and should come from the AWC board, representing its entire membership to demonstrate broad support.

AWC understands that EPA has been working with DataStream to integrate their datasets, allowing them to be used in DataStream and, in turn, THREATS. For example, EPA developed an API that enables automatic updates of the North Saskatchewan River (NSR) Tributary Monitoring Network (TMN) and Long Term River Network (LTRN) datasets from the Water Quality Data Portal (WQDP) to DataStream. EPA is currently adding TMN and LTRN datasets from other basins to DataStream. AWC encourages EPA to continue with this initiative.

Rationale

GoA and its partners conduct surface water quality monitoring across the province; the WQDP is a map-based tool to search, view, and download data from surface water quality monitoring stations. However, the WQDP does not have built-in tools to visualize data and calculate trends. Both DataStream and THREATS have visualization and analytical tools available; the API developed by EPA allows WQDP data to be accessible in THREATS, resulting in more efficient workflows and the use of standard analytical tools.

AWC is encouraged by EPA's agreements with DataStream to access data. A letter of support for continued development of the Water Quality Data Portal would be helpful when EPA seeks approval for continued enhancements.

A copy of the letter is in Appendix F.

Acknowledgements and Project Team Membership

The Alberta Water Council acknowledges the contributions of the following project team members and alternates who volunteered their time and expertise on this project, along with their member organizations for supporting their participation. The project meetings also had many observers and supporters who are not listed.

Name	Organization
Abdi Siad-Omar	Alberta Environment and Protected Areas
Adam Norris	Mighty Peace Watershed Alliance
Al Corbett	Battle River Watershed Alliance
Amber Link	Rural Municipalities of Alberta
Angela Crowe	Primary and Preventative Health Services
Che-Wei Chung	Alberta Municipalities
Cheri Funke	Town of Sundre
Dan Moore	Alberta Forest Products Association
Eric Camm	City of Calgary
Hannah Williamson	City of Calgary
Jen Pouliotte	City of Calgary
Kris Samraj	Alberta Municipalities
Michael Wagner	Alberta Forestry and Parks
Morna Hussey	Alberta Environment and Protected Areas
Morris Nesdole	Athabasca Watershed Council
Nina Wang	Primary and Preventative Health Services
Norma Ruecker	City of Calgary
Paul McLaughlin	Rural Municipalities of Alberta
Rosey Radmanovich	First Nations Technical Services Advisory Group
Steph Neufeld	Alberta Lake Management Society
Steve Meadows	Bow River Basin Council
Trevor Kent	Alberta Environment and Protected Areas
Warren Noga	Rural Municipalities of Alberta

Project Managers and AWC Staff: Alec Carrigy, Anuja Hoddinott, Jacqueline Noga, Katie Duffett, Katrina Calon, and Mariem Oloroso.

AWC would also like to acknowledge a grant from Alberta Innovates (\$199,425) to fund the development of the THREATS web tool and Alberta Environment and Protected Areas for providing project and operational funding to the AWC.

Appendices

Appendix A – Project Team Terms of Reference

Source Water Protection Phase I: Risk Assessment Tools and Data Project Team Terms of Reference

Approved by the Alberta Water Council on: February 2021

Amended: June 2023

CONTEXT

Albertans' quality of life depends on a healthy, secure, and sustainable water supply for communities, the environment, and the economy. Population growth, development, and climate variability continue to influence water resources and affect Alberta's residents, economy, and aquatic environments.

Source water protection (SWP) is a risk management process designed to maintain or improve the conditions of water through proactive and collaborative identification, validation, assessment, and management of risk. Source water is untreated, raw water from surface or groundwater sources used for drinking water or other uses.

In 2018, the Alberta Water Council (AWC) formed a project team to provide guidance on protecting sources of drinking water in Alberta. The project included surveying drinking water providers and assessing SWP practices, processes, risks, and initiatives in Alberta. Results of the project supported development of a "Guide to Source Water Protection Planning",³⁷ and the Alberta Water Council, Protecting Sources of Drinking Water in Alberta Companion Document (Companion Document).³⁸ The Guide lays out six steps to help drinking water providers develop SWP plans in collaboration with other key groups in their source water area. The companion report summarizes information to be considered when protecting public, private, and individual drinking water sources in Alberta.

Over 670 drinking water systems are regulated by Alberta Environment and Parks (AEP), most of which serve small municipalities of 1,500 residents, or less. AEP regulates all municipal systems and a portion of non-municipal systems, which combined serve about 85 percent of Alberta's population. The majority of remaining Albertans get their drinking water from systems regulated by regional health authorities, Alberta Health, or federal agencies. Although Drinking Water Safety Plans (DWSPs) are mandatory for water systems regulated by AEP, they may lack the attention and detail needed to effectively assess and mitigate risks to drinking water sources.

37 https://www.awchome.ca/_projectdocs/?file=0a5a74e0ad3f5403

38 https://www.awchome.ca/_projectdocs/?file=0166503d95357d39

For example, the DWSPs may lack information and validation of potential contamination of drinking water sources from adjacent land use activities and operations.

The previous project found that while several communities have voluntarily developed SWP plans and several tools exist in Alberta to support SWP, some communities may have a need for more efficient and timely access to data to support the risk assessment process. Furthermore, the ability for municipalities to implement SWP varies and is dependent on many factors such as population, geography, and access to expertise. The results of this project also indicate the need for education and collaboration, as well as tools and training to meet the diverse needs of the various types and sizes of drinking water systems in Alberta. A description of some of the successes, barriers and gaps related to SWP planning can be found in Section 2.0 and Section 5.0 of the Companion Document.

This project intends to build on the steps to SWP planning outlined in the Guide, specifically Step 1, “Involve key groups and create a vision” and Step 2, “Characterize your Source Water Area.” This involves collaboration with stakeholders and information gathering to identify and assess risks. However, for small urban, rural, or other drinking water providers with limited capacity, the effort, time, and cost involved in this process can be prohibitive. Through development of an online centralized inventory of tools and data (a “web platform”), as well as a suite of associated educational resources, this project will support drinking water providers to enhance their source water risk assessments and collaboration efforts.

STRATEGIC INTENT (GOAL)

The purpose of this work is to develop increasing access to a web platform and educational tools and resources to assist drinking water providers and local decision makers in Alberta to understand and assess risks to their drinking water sources. This work will also support the integration of SWP approaches and to enable greater collaboration between drinking water providers and stakeholders to ensure alignment with local priorities, statutory and non-statutory watershed management initiatives, and regional plans. Finally, this project will include the development of recommendations for an implementation phase to support mitigation of risks and a future strategy for SWP in Alberta.

OBJECTIVES

1. Users and other stakeholders understand the need for SWP risk assessments and the benefits of collaborative SWP approaches and are aware of the SWP web platform.
2. An inventory of SWP data sources, risk assessment tools, and procedures.
3. Capabilities and limitations of the web platform are understood and inform the next steps of the project.
4. A web platform that provides access to data to support the risk assessment process as well as educational resources to support collaboration efforts for SWP planning.
5. Feedback from end users and other stakeholders on the web platform, tools, and educational resources are incorporated to improve user experience.
6. A final report on the web platform, resources, lessons learned, and recommendations for an implementation phase and a future strategy for SWP in Alberta.
7. Effective communication around the project work and deliverables.

KEY TASKS

1. Develop a work plan that includes key tasks, deliverables, and timelines.
2. Create a team of engagement experts to develop communication and engagement plans to improve user understanding and gain feedback in relation to i) the need for in-depth SWP risk assessments, ii) the benefits of collaborative SWP approaches, and iii) the web platform.
 - a. Communication plans related to improving the understanding of the need for risk assessments and collaborative efforts for SWP may include:
 - i. A review of outcomes from the previous SWP project related to users, needs, and barriers.
 - ii. Workshops on SWP risks including users and other stakeholders.
 - b. Stakeholder engagement related to the web platform which may include:
 - i. Use of focus groups and interviews/surveys where appropriate.
 - ii. Inclusion of a feedback mechanism in the web platform.
 - iii. Focused survey on the effectiveness of the web platform.
3. Develop an inventory of SWP data sources, risk assessment tools, and procedures for obtaining the information.
 - a. Generate a list of data sources and risk assessment tools.
 - b. Confirm tools with stakeholders.

4. Assess the capability of the web platform given technological and budget limitations. This task may include:
 - a. Documenting challenges and limitations related to construction and ongoing maintenance.
 - b. Assessing which data sources and tools from the inventory are possible to include, such as data extraction and mapping tools (i.e., delineation of source water areas using the Alberta Flow Estimation Tool for Ungauged Watersheds).
 - i. Consider whether any modifications are needed to the tools for the purposes of the web platform.
5. Service Alberta, working with a consultant, will develop the web platform, supported by AEP.
 - a. The web platform is expected to be hosted by Service Alberta on the Government of Alberta (GoA) open data portal; ongoing maintenance will be supported by the GoA.
6. Develop educational resources and tools to support SWP initiatives.
 - a. Form a Communication and Education Subgroup to determine educational resources that best support knowledge uptake regarding SWP initiatives and the web platform. Materials should include:
 - i. Key background information.
 - ii. Benefits of SWP planning (e.g., informs business case development or internal outreach and communication with stakeholders).
 - iii. How to use the platform (e.g., tutorials, instructions).
 - iv. Key messages for municipal representatives and other drinking water providers for internal and external communication needs.
 - v. Contact information for technical and collaborative support, including explicit instructions relating to communication with contacts as appropriate.
 - b. Integrate educational resources into the web platform as appropriate (e.g., “help” webpages, interactive or non-interactive tutorials).
 - c. Materials should be prepared such that they can be used for future technical support and training sessions.
7. Pilot the web platform and educational resources with stakeholders.
 - a. Host a workshop or series of workshops to pilot the web platform and educational resources with key municipal and drinking water providers.
 - b. Summarize feedback and lessons learned from the pilot sessions and revise the project deliverables as necessary.
8. Provide regular updates to the AWC board during the project.
9. Compile a final report on the web platform, resources, lessons learned, and recommendations for an implementation phase and a future strategy for SWP in Alberta.

TIMELINES and DELIVERABLES

The Project Team will provide the following deliverables to the AWC:

Share the engagement plan	Oct 2021
Share results of feasibility assessment	Feb 2022
Share web platform beta and results from pilot session(s)	June 2024
Final report, web platform, and supporting materials	Nov 2024

MEMBERSHIP

Membership on the project team is open to AWC members and other relevant groups identified by the project team. The project team will operate in a manner that is consistent with the rules, policies, and procedures adopted by the AWC, including the use of consensus to make decisions in a multi-stakeholder process.

Key sectors identified for participation include:

- Alberta Agriculture and Forestry
- Alberta Energy Regulator (AER)
- Alberta Environment and Parks (AEP)
- Alberta Federation of Rural Water Co-ops (AFRWC)
- Alberta Geological Survey (AGS)
- Alberta Primary and Preventative Health Services and Alberta Health Services
- Alberta Irrigation Districts Association (AIDA)
- Alberta Urban Municipalities Association (AUMA)
- Alberta Water and Wastewater Operators Association (AWWOA)
- Association of Summer Villages of Alberta (ASVA)
- Indigenous communities and the First Nations – Technical Services Advisory Group
- Industry (e.g., mining, oil and gas, and petrochemical)
- Research agencies, such as Alberta Innovates and academia
- Rural Municipalities of Alberta (RMA)
- Urban and rural municipalities
- Watershed Planning and Advisory Councils (WPACs)

BUDGET

The working group estimates a budget of \$424,000. Details are as follows:

Core Funding Costs (covered by the AWC)

Type	Amount Provided by AWC	Amount Provided by Alberta Innovates
Stakeholder support	\$50,000	
Hosting	\$5,000	
Communications (final report preparation)	\$5,000	

Project Funding Cost (AWC has funds set aside to cover this, but support from stakeholders will be sought)

Type	Amount Provided by AWC	Amount Provided by Alberta Innovates
Web tool development	\$5,000 ¹	\$200,000
Pilot sessions, educational resources, and feedback	\$115,000	
Ongoing web tool maintenance	\$44,000 ²	

¹ With 50% NGO reimbursement on GST

² 2 years of maintenance at \$22,000 per year; amount per year is subject to change and not incurred until after web tool development is complete

Appendix B – Communications Plan



SOURCE WATER PROTECTION PHASE I: RISK ASSESSMENT TOOLS AND DATA PROJECT TEAM COMMUNICATIONS PLAN

Alberta Water Council
May 2026

BACKGROUND

Source water protection (SWP) is a risk management process designed to maintain or improve the conditions of water through proactive and collaborative identification, validation, assessment, and management of risk. Source water is untreated, raw water from surface or groundwater sources used for drinking water or other uses.

The Source Water Protection Phase I: Risk Assessment Tools and Data Project (2021–2024) was established to assist small urban, rural, and other drinking water providers in enhancing their source water risk assessment and collaboration.

This project continues previous work undertaken by AWC which developed the Guide to Source Water Protection Planning (Guide) and associated Companion Document. The Guide provides advice on how to protect drinking water sources through developing a SWP plan.

Through this project, an existing web tool, The Healthy River Ecosystem Assessment System (THREATS) tool was enhanced through backend updates, addition of datasets, increased functionality, and user interface/user experience improvements. Webinars and workshops were held to showcase the tool and gather feedback on ideas for further improvement.

The Guide, Companion Document and THREATS tool are intended for drinking water providers (public, private, and individual). Additional groups that may find these materials useful include municipalities, drinking water providers (utilities), Indigenous communities, Watershed Planning and Advisory Councils (WPACs), Watershed Stewardship Groups (WSGs), and other interested groups.

GOALS

The goals of the Source Water Protection Phase I: Risk Assessment Tools and Data Project Team Final Report and Communications Plan are to:

- share the work of the project team
- inform and support drinking water providers in developing source water protection plans
- assist relevant stakeholders in developing drinking water safety plans, watershed plans, and other related initiatives
- raise the profile of the AWC

AUDIENCES

The audiences for these documents are:

- Government of Alberta (Environment and Protected Areas, Agriculture and Irrigation, Forestry and Parks, Primary and Preventative Health Services, Municipal Affairs)
- Alberta Innovates
- AWC members and their networks
- Participants of the webinars and workshops
- Small urban and rural communities, including towns, villages, and municipalities
- WPACs, WSGs
- Other jurisdictions interested in completing source water protection plans, including Indigenous communities

PROPOSED APPROACH

To achieve the above goals and communicate with target audiences, the project team will use the following tools and methods:

1. Factsheet
 - a. Short, readable, to the point
 - b. For members and other organizations to post on social media
2. Template slides
 - a. For member use in presentations for conferences, seminars, and other meetings
3. Effective use of the AWC website and social media
 - a. Post the factsheet and all other project documentation, including the letter for Recommendation 3
 - b. Develop a webpage to describe and provide a link to the THREATS tool
 - c. Share the project documents and other relevant articles and information brought forward by sectors on AWC's social media platforms
4. Effective use of existing partnerships to share project outcomes where appropriate
 - a. WPACs (through their newsletters)
 - b. Canada WaterPortal
5. Share project materials directly with select groups outside the AWC membership
 - a. Alberta Water and Wastewater Operators Association
 - b. Water North Coalition

AWC staff will provide Alberta Environment and Protected Areas' (EPA) communications staff with release materials and timelines in advance of the release to ensure their response can be coordinated. A press release, backgrounder, and newsletter article will be developed by project managers, in consultation with the team's co-chairs, for distribution to AWC board members team members, and others. The spokesperson for the release will be the AWC's Executive Director. Project managers will also prepare a website update and an email with project highlights.

BUDGET

There is \$5,000 allocated in the project budget for communications, mostly expected to be spent on design and layout and printing. Core AWC operating budget is available to complete this work. The communications plan and any related project documentation will be made available electronically. Hard copies of project documentation will be provided upon request to AWC.

Appendix C – Webinar Survey Results

The team held two webinars to showcase and gather support for the THREATS tool on September 27 and October 12, 2022. The two webinars were identical and had three objectives:

1. To educate potential users and stakeholders on the presence and functionality of the existing tool,
2. To gather feedback on the tool, and
3. To gauge potential interest, need for the tool, and support for potential development of such a tool for all of Alberta.

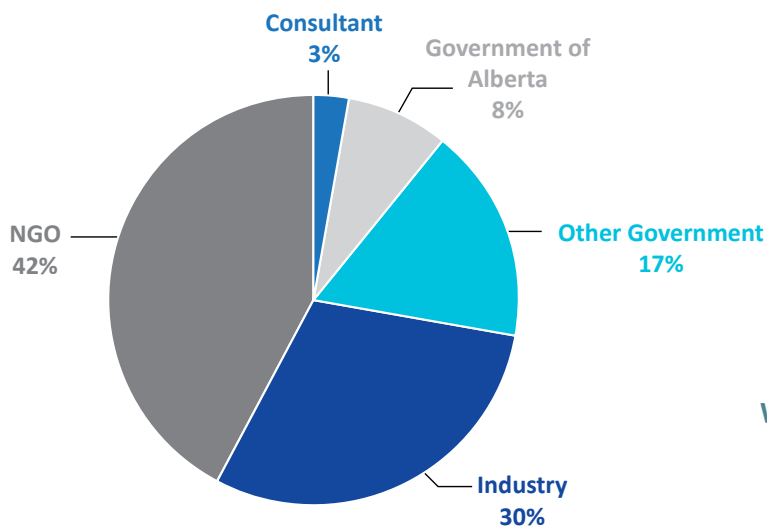
Electronic surveys were sent to webinar participants to gather information on their affiliation, whether they would use the tool for their work, how they might use the tool, any barriers to its use, and ways it could be improved.

The information below summarizes the results from the participant surveys.

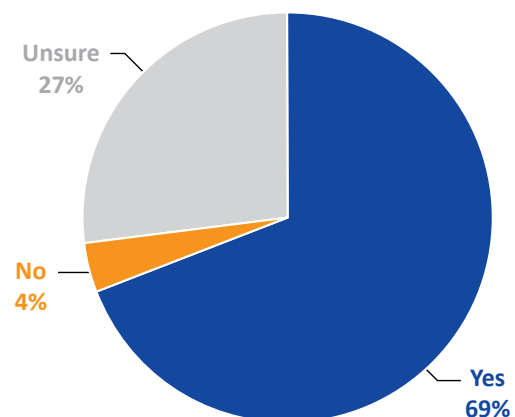
About the webinars

- Two webinars: Sept. 27, 2022 and Oct. 12, 2022
- Gathered feedback through live polls and electronic survey

About the Participants



Would you use the tool for your work?



How might you use the tool for your work?

- Understand land-use, what is impacting the landscape, calculate statistics related to land-use area development
- SOW reporting
- SWP planning
- Riparian management
- Watershed management planning
- Watershed delineation
- Trend analysis
- Incident response
- Helping local WPAC with planning efforts
- Communicating about climate change

Barriers to using the tool

- Cost to users, if applicable
- Staff expertise required to use the tool
- Computer processing capability

Ways the tool could be improved

- Easy ways to export data and analysis
- Adding tutorials and templates

General comments/suggestions

- Tool addresses gaps in publicly available data
- Value will likely spread once rolled out to users
- Academics and consultants are likely users; could contribute to maintenance
- Funding the tool would demonstrate province is forward thinking for resource management

Appendix D – Project Letters of Support



Water North Coalition

February 5, 2023

Dear Alberta Water Council:

This letter is provided to support the proposed web tool developed as part of the Alberta Water Council's Source Water Protection Phase I: Risk Assessment Tools and Data project.

The Water North Coalition (WNC) is a group of northern community leaders and water and wastewater partners working together to advance sustainable water systems in our northern communities through advocacy; education and awareness; and recruitment, training, and retention.

Formed in 2014 with the support from the Northern Alberta Development Council, our coalition is open to all municipalities, commissions, and Indigenous Communities within the Northern Alberta Development Council's boundary. We are supported by expert water and wastewater professionals, operators, and various levels of government within the northern region.

WNC would like to express our support to the initiative and will promote the use of the web tool among our membership to further Source Water Protection and development of associated plans for our members.

WNC and its members could use this web tool to fulfill regulatory requirements, engage in proactive, sustainable management of water resources and support forecasting for future operations. Sharing resources in the north is the crux of what WNC does, accordingly this tool would provide another means of sharing resources and supporting communities with capacity challenges.

I am pleased to address any questions you may have about WNC's support for the project.

Sincerely,

A handwritten signature in black ink, appearing to read "Bob Marshall".

Bob Marshall
Chair, Water North Coalition
Reeve, County of Grande Prairie No. 1



February 9, 2023

Alberta Innovates
Bell Tower
1500, 10104 – 103 Avenue
Edmonton, AB T5J 0H8

Dear Alberta Innovates:

Alberta Municipalities represents over 85% of Alberta's population with member municipalities ranging from large, mid-sized, and small cities to towns, villages, and summer villages.

ABmunis supports Alberta Water Council's (AWC) application to fund the development and maintenance of the proposed Source Water Protection tool. We also support this project's overall goal to maintain safe and secure drinking water for Albertans. Source water protection planning supports the development of mandatory Drinking Water Safety Plans and has numerous benefits including cost-savings and reduced environment and public health-related risk.

Each year, ABmunis members submit resolutions on issues affecting municipalities. These resolutions are then presented, debated, and voted on by our members at the fall Convention. These resolutions form the foundation for our policy and advocacy work. Four resolutions were passed in September 2022 related to our Sustainability and Environment portfolio—each resolution concerned a different aspect of water. This underscores the importance of water to municipalities.

We have consistently heard from our member municipalities about the challenge of complying with the increasing regulatory burden regarding water. We also agree with AWC that ensuring safe water is a critical goal, and support efforts to help municipalities meet these regulations. The proposed Source Water Protection tool addresses this barrier by providing drinking water providers with a helpful tool to perform risk assessment as part of the Government of Alberta's mandatory Drinking Water Safety Plans. If this proposal is approved ABmunis would assist in the promotion and education of this tool to our member municipalities.

If you have any questions, please contact Kris Samraj, Policy Analyst, at kris@abmunis.ca.

Sincerely,

A handwritten signature in black ink that reads "C. Heron".

Cathy Heron
President, Alberta Municipalities
Mayor, City of St. Albert

300, 8616 - 51 Avenue NW ▪ Edmonton, AB, T6E 6E6 ▪ abmunis.ca ▪ hello@abmunis.ca
T 780.433.4431 ▪ F 780.433.4454 ▪ AB Toll Free 310.MUNI

Appendix E – Workshops

This workshop summary was produced by Greenland International Consulting Inc. in support of the Alberta Water Council’s Source Water Protection Project Team.

Workshop Description

Source Water Protection Planning Pilot Project

A virtual workshop hosted by the Alberta Water Council was held on October 1, 2024, with a multi-stakeholder group including Alberta Water Council (AWC) members, the project team, and others interested in source water protection (SWP) planning.

The purpose of the workshop was to:

- Receive background info on SWP and why it is important
- Receive an overview of The Healthy Rivers Ecosystem Assessment System™ (THREATS), a tool that can assist with SWP planning
- Understand THREATS’ utility through a case study (Town of Spirit River)
- For the audience to participate in, or observe, a demonstration of THREATS and provide feedback

The workshop included:

- an overview of SWP planning and its importance,
- an introduction demonstration of the software platform and tools,
- a case study discussion illustrating how the analysis tools might be used to address real issues,
- a short workshop exercise
- questions and discussion

A list of participants is in Appendix 1 and the workshop agenda is in Appendix 2.

Post-workshop questions were circulated to get feedback from participants on the workshop and on their experience using the THREATS platform.

A recording of the workshop is available on YouTube:

<https://www.youtube.com/watch?v=TmEp5ywZ9m4>

The THREATS platform can be accessed from <https://threats3.greenlandgroup.ca/>.

Presentations

Participants heard three presentations: background information on the project and SWP, an overview of the THREATS tool, and a case study of water-related challenges from the Town of Spirit River and how THREATS can be used to address those challenges. There was a feedback session following the presentation.

Introduction

Adam Norris with the Mighty Peace Watershed Alliance and co-chair of the SWP project team provided some background information on SWP and the project team.

Source Water Protection is a risk management process designed to maintain or improve the conditions of water through proactive and collaborative identification, validation, assessment, and management of risk. Source water is untreated, raw water from surface or groundwater sources used for drinking water or other uses.

In 2018, the Alberta Water Council (AWC) formed a project team to provide guidance on protecting sources of drinking water in Alberta. The project included surveying drinking water providers and assessing SWP practices, processes, risks, and initiatives in Alberta. Results of the project supported development of a “Guide to Source Water Protection Planning,” and the Alberta Water Council, “Protecting Sources of Drinking Water in Alberta” Companion Document.

The previous project found that while several communities have voluntarily developed SWP plans and several tools exist in Alberta to support SWP, some communities may have a need for more efficient and timely access to data to support the risk assessment process. Furthermore, the ability for municipalities to implement SWP varies and is dependent on many factors such as population, geography, and access to expertise. The results of this project also indicate the need for education and collaboration, as well as tools and training to meet the diverse needs of the various types and sizes of drinking water systems in Alberta.

The goal of the project is:

“[T]o develop increasing access to a web platform and educational tools and resources to assist drinking water providers and local decision makers in Alberta to understand and assess risks to their drinking water sources. This work will also support the integration of SWP approaches and to enable greater collaboration between drinking water providers and stakeholders to ensure alignment with local priorities, statutory and non-statutory watershed management initiatives, and regional plans. Finally, this project will include the development of recommendations for an implementation phase to support mitigation of risks and a future strategy for SWP in Alberta.”

The team first met in April 2021. They started by scoping the web tool and then developed a request for proposals, selecting Greenland International Consulting Ltd. and the THREATS tool. The team developed communications materials (webinars and online written content) to gather support and interest from potential users of the tool.

Alberta Innovates provided approximately \$200,000 in funding for web tool development.

Much of the software development is now complete; through this workshop, the team wants to showcase the tool and gather feedback on it. The next steps are to update the tool based on the feedback and write their final documents (final report, communications plan).

Platform Demonstration

Trevor Boston from Greenland Consulting demonstrated three key modules in the THREATS platform for use in SWP planning: the water quality module, spatial analysis module, and hydrometric stations module.

Part 1: THREATS Water Quality Module

The Water Quality Module in THREATS accesses water quality data hosted by the Gordon Foundation's DataStream platform. It allows users to query data according to geographic location, chemical parameter, minimum number of samples, and period of record. The selected data can be used to run statistical analysis and generate a variety of charts. Station data can be grouped or compared.

Key content included:

- How to filter water quality stations for locations and chemicals of interest.
- Setting up analysis – adding one or more stations, adding chemicals and respective fractions, and period of record.
- Interactive features of the data plots – comparing upstream/downstream stations and other uses.
- Using the Exploration and Graphics for River Trends (EGRETS) flux analysis and discussion of the charts it produces.
- Trends analysis.

Part 2: THREATS Spatial Analysis Module

The Spatial Analysis Module performs basic clipping and summarization of spatial data within a user-selected area of interest. The data library contains a large selection of spatial data to assist in identification and quantification of risk.

Key content included:

- Source water protection risk factors tables and reference to data in THREATS.
- How to select an area of interest from existing data or from custom delineated catchment areas.
- Overview of the types of data available.
- Interpreting the tables and charts produced.
- How data is aggregated and how the spatial analysis module clips and interprets data into tables.
- Special cases for Census of Agriculture and National Pollutant Release Inventory datasets.

Part 3: Hydrometric Stations Module

The Hydrometric Stations Module accesses historic and real-time hydrometric flow and elevation data from Water Survey of Canada and the Alberta Government. It allows users to quickly generate charts and statistical analysis on data.

Key content included:

- Delineation of catchment areas and flow trace features.
- Overview of charts and statistical tools available to see trends in hydrometric station flows.

Case Study: Town of Spirit River

Steve Jack from the Town of Spirit River described the Town's current pressures around limited available water supply and growing demand.

The Town of Spirit River water issues present significant challenges that are becoming increasingly concerning. Three primary issues are low water volumes of source water; competition with the upstream land use and industrial activities; and the need for significant upgrades to water treatment and distribution systems.

- 1. Low Flows Affecting Water Supply:** The Town of Spirit River relies on natural surface water sources for its municipal water supply. However, changing climatic conditions and increasing demand is leading to reduced stream flows, which in turn impacts the town's ability to draw sufficient water. Extended periods of drought, combined with fluctuating precipitation patterns, exacerbate this issue, leading to lower water levels in the tributary river and wetland that feed into the town's water system. When flow rates in nature drop, the town faces difficulties in maintaining an adequate water supply for its residents, which can strain existing infrastructure and potentially lead to water shortages. There is no alternative source of water for the Town.
- 2. Competition with Upstream Land Use and Industrial Activities:** Another concern is the impact of upstream land use and industrial activities on the water sources. Alberta's regulatory framework under the Water Act is designed to manage and mitigate impacts on water

resources. However, in practice, industrial activities such as oilfield operations and agriculture often lead to significant alterations in the landscape. These activities include the creation of drainage ditches, infilling or alteration of wetlands, creeks, and waterbodies, and the draining of dugouts for oilfield use. These alterations lead to increased sedimentation, changes in water flow patterns, and contamination of water sources making it difficult to treat any water received. Some industries continue practices that degrade water quality or alter hydrological patterns with insufficient oversight or remediation efforts.

- 3. Need for Significant Upgrades to Water Treatment and Distribution Systems:** As the town grows and the demands on its water infrastructure increase, addressing these needs has become crucial for ensuring safe, reliable, and efficient water service. The existing water treatment facilities in Spirit River were designed to meet past demands and are not equipped to handle future challenges. Many of the pipes and components in the distribution network are aging, resulting in leaks, bursts, and inefficiencies resulting in water loss and service disruptions. The aging distribution system struggles to maintain adequate pressure and flow, especially during peak usage times and in times of emergencies. The aging infrastructure requires substantial upgrades to address issues such as capacity and efficiency as the population grows. Upgrading the facilities can help accommodate higher volumes of water needed and ensure that the treatment processes remain effective.

Collaborative efforts with provincial authorities, industry stakeholders, and local community members are crucial in developing a comprehensive strategy for protecting source water and upgrading the water treatment and distribution systems. The Town of Spirit River needs to consider these issues to ensure a sustainable, reliable water supply that meets the needs of its residents now and in the future.

Trevor walked through some of the analysis that could be used to better understand and quantify some of the pressures being realized by the Town of Spirit River and to explore options for addressing supply uncertainty.

The Hydrometric Station Analysis module illustrated the pattern of intermittent and low flows in the tributary adjacent to the catchment the Town relies on for refilling its reservoir. The Spatial Analysis Module was used to quantify the extent of agricultural land use and livestock in the watershed and the number of wells, oil and gas activity, and historic releases. The absence of available water quality data was noted as an issue that should be addressed to better understand and manage risks.

Interactive Exercise

Participants were given a short exercise to work through using the THREATS platform. The idea was to have everyone leave the workshop having knowledge of how to operate some of the basic

functions in each module and to generate discussion around use of the tools and where there might be areas for future development, as well as how intuitive participants found the platform.

The exercise included use of the Spatial Analysis, Water Quality, and Hydrometric Stations Analysis modules for the Bow River above the City of Calgary.

A copy of the exercise is in Appendix 3.

Questions/Discussion/Issues and Responses During the Session

Questions and Answers

Q: In addition to the data sets profiled in the demonstration, what are some of the other data sets that are available in THREATS for assessing risk?

A: Some examples include pasture, fields, rail, roads, cut lines, oil infrastructure, water quality, and hydrology. THREATS is a tool for accessing relevant data from many public sources and making it available in one location. One area that is currently not yet available is data on groundwater, due to the nature of the data structure.

Q: How can the quality of [water quality] data uploaded in the system be verified?

A: DataStream is dependent on data providers to ensure the quality of Citizen Science or Community-Based Monitoring data. Many of the data providers are government agencies and have their own standards for quality control before data is published. It is important that the tools are used by practitioners who can scrutinize the data and the analytics to ensure appropriate conclusions are reached. There are experts who can be consulted to assist where organizations need help.

Q: What services can the tool provide to WPACs?

A: The tool can be used to support SWP planning, but it can also be used for other purposes; for example: looking at impacts to fish habitat by using the delineation tool, and then looking at water availability and quality within the catchment area. Study of erosion and sediment within a catchment area may also be possible.

Q: On the quality side and to address recent drought, climate change, and water availability, how might the tool be used to address those issues?

A: Trend analysis and long-term changes over time can be used in infrastructure planning and adaptation. THREATS can be used as a “forensic analysis” tool to identify the cause of changes. It might also be used as a tool for identification of mitigation options, such as analysis of alternative water sources, which might be in neighbouring watersheds, for example.

Q: The Athabasca Watershed Council is starting to upload data to DataStream, but data availability is still an issue.

A: Particularly for rural Alberta, water quality data availability remains a challenge. A two-tier approach is needed where people are actively uploading data and using THREATS to access it.

Q: Does the tool capture treated effluent releases?

A: Typically, water quality data associated with treated effluent is not uploaded; however, it technically could be if facility operators were to begin sharing that data.

Q: Is it possible to generate custom catchment areas for small ephemeral streams?

A: Yes, custom catchments can be generated. The system used the Alberta 24 m resolution digital elevation model to generate catchments and flow paths. It is often useful to use the drainage lines to tweak catchment delineations.

Q: Regarding return period flows such as 1 in 100-year flows: Are these determined based on geographic locations? Are they determined based on watershed characteristics such as those that define eco-regions?

A: No, these return period flows are calculated strictly using the historical record from the hydrometric stations and applying a statistical distribution.

Q: There are some limitations with respect to the number of ungauged catchments and watersheds.

A: We are currently working on a system that applies machine learning techniques to extend or fill gaps in historic hydrometric stations that may eventually be helpful in addressing this issue.

Q: Regarding the case study on Spirit River, are there issues with water quality?

A: For the most part, water quality is good. There were some concerns with the amount of organics in the water but a secondary holding pond seems to be addressing that issue.

Q: Since risk is the product of source and receptor and pathway, does the tool provide mechanisms to consider slope and topography in conveyance between a risk source and receptor?

A: The flow trace tool can be used to map the surface path of a contaminant source to a receptor over land.

Q: Does the contaminant pathway have regard for permeability of the land it traverses?

A: No, that type of analysis would require a modelling approach to assess the proportion of infiltration versus runoff. The routing approach in THREATS is based only on topography.

Q: Regarding old data with different data standards, how difficult is it to make use of this type of data?

A: DataStream has a strict policy to not alter any of the data received into their platform. They do not do any data cleaning. There are known issues with changes in methods, naming conventions, and detection limits. They do provide a robust data entry template to guide data providers. In addition, DataStream includes metadata and links to all original data sources, and includes information such as what quality control has been done, where laboratory analysis was completed, where samples came from, etc. There are some challenges but there may still be value in legacy data.

Q: Is it possible to access benthic invertebrate data using THREATS?

A: Currently the platform does not include benthic or fisheries data. To our knowledge DataStream does not currently have data structures in place to access these data.

General Comments

- THREATS is useful to be able to aggregate data in one place.
- In the flux analysis, there was a suggestion to include a pop-up of the range of dates that data are available.
- Annual box plots for water quality are good. Seasonal plots would be useful.
 - Response: There are monthly box plots already in the tool which might address this need.
- In the Hydrometric Stations Analysis module the Mann-Kendall plot provides a series of sub-plots including a list of monthly plots. Can you elaborate on their purpose as they do not appear to be for monthly trend analysis.
 - Response: These are monthly auto-correlation and partial auto-correlation plots. They are used to help provide validation of the appropriateness of the Mann-Kendall analysis which assumes that each observation is independent. Mann-Kendall is not appropriate where data in a times series are highly correlated to each other. These plots measure the level of correlation between points with different periods of lag.
- WPACs are willing to work with municipalities to address the lack of knowledge and skills they might have in working with the data.
- There is lots of content and options to visualize and analyze data.
- It is a powerful and useful tool. It is interesting to hear how people can use it.

Platform Monitoring

The THREATS development team monitored the backend computing environment while participants in the workshop undertook a short exercise to work through example cases using the software. The system had not previously been tested “live” with more than 20 users.

Prior to the workshop, the system had been load tested by simulating the simultaneous calls of multiple users and requests using scripts to make numerous calls to the servers in rapid succession. Running the script many times simulated the load that the backend servers would experience during the exercise. From these simulations, the development team was confident that the platform would perform well during the exercise.

Monitoring found that there were 23 active users during the exercise. There were minimal errors logged during the session, indicating that nearly all requests received by the database were successful.

There was one exception where a user(s) with an unknown username produced many “failed to fetch data” responses. This may have been an error in loading one of the pages that carried forward in subsequent attempts and resulted in many errors for the same user.

There were a few reports from users that the page froze or became non-responsive. This was not due to traffic on the server as the maximum load experienced by the server only exceeded 10% of maximum CPU capacity once for a short duration and was still maintained below 20%. The non-responsiveness may be the result of client computers having insufficient resources, network speed, or possibly firewall or other internal permissions issues. THREATS downloads some data in advance to enable a more responsive environment. If resources are too limited, this may cause non-responsiveness.

In general, the load testing was successful, and most participants were able to complete at least parts of the exercise.

- There were approximately 23 unique users outside of the Development Team who used the THREATS platform on the day of the event and in the period from Oct 1–10, 2024.
- Analysis of the system requests made by the users during the workshop:

user_name	count	result
admin	2	
2081Wadgo2089	45	SUCCESS
AWC-WPAC-Projects	34	SUCCESS
Aaron Janzen	2	SUCCESS
Al Corbett	10	SUCCESS
BRWA_Sarah	34	SUCCESS
BRWA_Skinner	30	SUCCESS
Bezawit Lemma	70	SUCCESS
Francine	20	SUCCESS
Guest	186	SUCCESS
ILWG	58	SUCCESS
Mike Murray	22	SUCCESS
Nathan Ballard	56	SUCCESS
Phil_J	127	SUCCESS
RDRWAOutreach	77	SUCCESS
Unknown	110	SUCCESS
acarrigy	20	SUCCESS
adamnorris	21	SUCCESS
admin	201	SUCCESS
alex.simon	35	SUCCESS
awc_testuser	43	SUCCESS
deas	54	SUCCESS
developer3	169	SUCCESS
developer4	39	SUCCESS
drobertson	57	SUCCESS
hurlyta	46	SUCCESS
nwang	63	SUCCESS
phil_jero	31	SUCCESS
scaik	188	SUCCESS
Bezawit Lemma	1	ERROR
ILWG	1	ERROR
Mike Murray	1	ERROR
Nathan Ballard	2	ERROR
RDRWAOutreach	6	ERROR
Unknown	3379	ERROR
hurlyta	2	ERROR
scaik	4	ERROR

Figure E-1 Platform users and number of successes and errors logged during the workshop session.

- Out of approximately 23 active, non-development team users, except for the user(s) showing as “unknown”, the majority of server calls were successful.
- Username showing as “unknown” accounts for most of the errors observed on that day. These errors were caused by improper page loading and resulted in numerous errors associated with trying to load the page contents. This issue could result for a variety of reasons including browser cache and network speed.

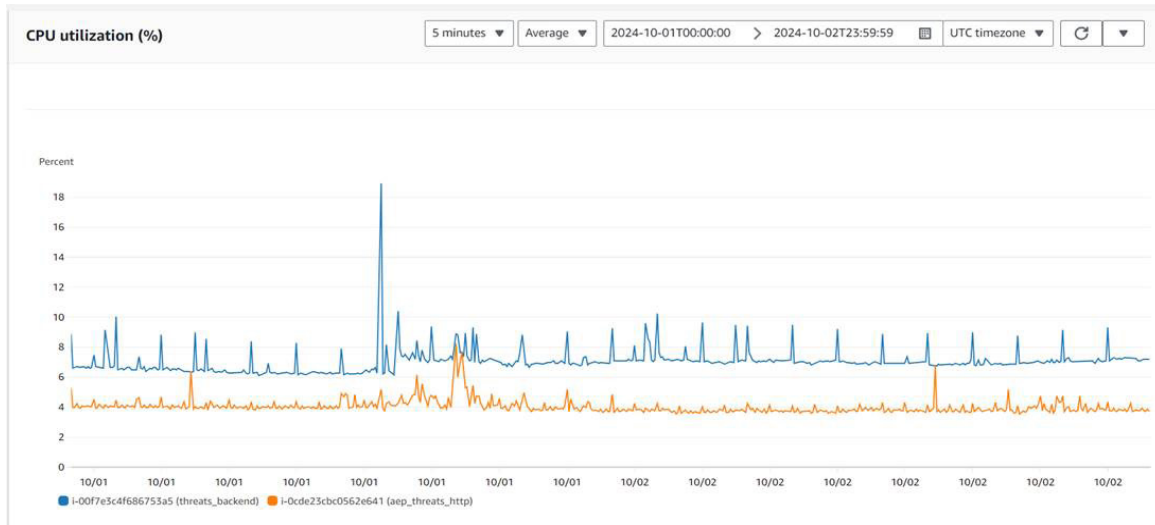


Figure E-2 Chart of THREATS primary backend and web servers CPU usage prior, during, and after the workshop. Box represents approximate time of the workshop including preliminary checks prior to the event.

Feedback Received from Participants

Feedback was collected from participants during the workshop and via an electronic survey afterward. Input was limited during the workshop, as many participants were new to the tool and some were unable to access it during the workshop. Below is a summary of the feedback received both during the workshop and through the post-workshop survey.

- Someone was not seeing catchments available in the Spatial Analysis Module.
- Having difficulty seeing one of the plot legends in flux Mann-Kendall analysis.
 - Response: Resizing the plot area or analysis panel can help.
- During the session, two participants reported issues with loading times lagging.
- One participant indicated that he was not seeing water quality stations on the map.

Questions and Responses Received to Post-Workshop Survey (three responses total)

1. Tell us about your experience using the THREATS tool. What did you like? What didn't you like?
 - I liked the ability to compile data from different sources in the same query. Also to learn what monitoring is being conducted by other groups.
 - This is an excellent tool and a much-needed resource for decision and policy makers, WPACs, and others. Some of the main decision points required to configure an output and get accurate results seems like it might require a) expert input, or b) significant training. This may be a downside to the ongoing use of the tool by decision makers. I suggest defining a specific group of superusers who should be trained and can support groups looking for results from localized datasets.
 - In addition to the tool itself and the availability of all the data sources, I really liked how it's possible to export and download the data in various formats. It really helps with making the data and not just the results be accessible, enabling various types of analysis as needed.
2. Did you find the tool to be responsive? If not, please provide additional information, such as which browser you were using (e.g., Chrome), whether you had other programs open, etc.
 - It was okay. A lot of messages to wait or close the program because it was not responding. This happened during the demo, but also happened on my own time when not in the meeting. I tried both Chrome and Edge. I did not have other programs open (other than MS Teams).
 - I noticed that the THREATS tool freezes on both Chrome and Microsoft Edge. At times, it freezes as frequently as every 1–2 minutes and often after clicking drop-downs or switching between the Water Quality window and the Spatial Analysis window. Very few other programs and tabs were open while using the tool.
3. Was THREATS intuitive to use without needing explanation, guidance, or tutorials? Please indicate any areas where it was not self-evident how to use features or understand the meaning of results.
 - Not really. There are a lot of great tools, but I would say it is not intuitive without explanation, guidance, and tutorials.
 - Some degree of expertise is needed. I suggest defining a specific group of superusers who should be trained and can support groups looking for results from localized datasets.
 - Although I personally have less technical knowledge than would enable me to fully understand how to use the THREATS tool and interpret results, I find that the explanations, guidance, and tutorials are necessary because it likely would have been difficult and confusing to use the tool without them.

4. What areas would you need more assistance using the tool (e.g., instructions, videos, tutorials)? Is there any specific documentation within or outside the tool that would be helpful in completing a SWP risk assessment?
 - How to reset your registration. It appears that once you select your preferred use at registration, there does not appear to be a way to change that. If you accidentally select the wrong one — how do you reset it?
 - Instructions, videos, tutorials. A dedicated support person would be ideal or consider ongoing training opportunities with a focus on having a knowledgeable set of superusers (perhaps by basin) who can support other groups on an ongoing basis, using a “train the trainer” model.
5. Is anything missing from the tool (datasets, descriptions, functions, etc.)?
 - Question 4 & 5: None that I can think of. The tool seems very comprehensive and it’s helpful that there are various tutorials and explanations within the tool, without which it might have been difficult and confusing to use.
 - A visualization of allocations, and water use if it is available, as percentage of available allocations or water use respectively. If there is a Water Conservation Objective, how close are allocations to the Water Conservation Objective and visualize this on stream reaches.
 - The spatial distribution of wetlands and their rates of loss in relation to source water.
6. Are there other types of risk factors for SWP that might be considered that are missing? If so, how should they be evaluated?
 - None that I can think of. The tool seems comprehensive with a variety of data resources.
7. Do you see yourself using this tool as part of your work? If so, provide examples of where/how you would use it.
 - Not really.
 - It would be very valuable in our work.
 - While myself and my colleagues are not likely to use the tool directly, this is a very valuable tool and collection of resources for municipalities to use. As noted in the Oct. 1 workshop session, the THREATS tool would be best used by municipalities with the assistance of technical experts to help interpret results and navigate the tool itself.
8. (Optional): Please provide any additional commentary related to your answers to this survey.
 - I was unable to view Water Quality Monitoring sites after numerous re-logins, re-registration (different user name), trying different browsers, etc.

Appendix 1: Workshop Participant List

Presenters	Affiliation
Adam Norris	Mighty Peace Watershed Alliance
Alec Carrigy	Alberta Water Council
Steve Jack	Town of Spirit River
Trevor Boston	Greenland International Consulting Ltd.
Participants	Affiliation
Aaron Janzen	Environment and Protected Areas
Al Corbett	Battle River Watershed Alliance
Alex Simon	Environment and Protected Areas
Alison Deas	Alberta Innovates
Allan Garbutt	Livingstone Landowners Group
Andre Asselin	Alberta Water Council
Andy Hurlly	University of Lethbridge (former)
Angela Crowe	Primary and Preventative Health Services
Bezawit Lemma	Rural Municipalities of Alberta
Bill MacMillan	Lethbridge County
Catherine Peirce	Battle River Watershed Alliance
Catie Seifert	Athabasca Watershed Council
Curtis Horning	Environment and Protected Areas
Dan Rites	Alberta Water and Wastewater Operators Association
Darian Coulter	Red Deer River Watershed Alliance
Davey Robertson	Town of Okotoks
Douglas Thrussell	Environment and Protected Areas
Francine Forrest	Red Deer River Watershed Alliance
Jordan Thompson	City of Lacombe
Katie Duffett	Alberta Water Council
Linda Cerney	Environment and Protected Areas
Meghan Payne	Lesser Slave Watershed Council
Melody Garner-Skiba	Intensive Livestock Working Group
Mike Murray	Bow River Basin Council
Nathan Ballard	Environment and Protected Areas
Nina Wang	Primary and Preventative Health Services
Petra Rowell	Athabasca Watershed Council
Phillip Jerome	City of Calgary
Sarah Skinner	Battle River Watershed Alliance
Steve Craik	Alberta Environment and Protected Areas
Steven French	Greenland International Consulting Ltd.
Tim Ainscough	Mountain View Regional Water Services Commission
Vasuki Lolla	Greenland International Consulting Ltd.
Wade Goin	Alberta Health Services

Appendix 2: Workshop Agenda



Source Water Protection Project Team
Workshop
Microsoft Teams

AGENDA

October 1, 2024

9:00 am – Noon

Meeting Objectives	<ul style="list-style-type: none"> • Receive background information on Source Water Protection (SWP) and why it is important • Receive an overview of The Healthy River Ecosystem Assessment System™ (THREATS) • Understand THREATS' utility through a case study • Participate/ observe a demonstration of THREATS and provide feedback
10 mins	1.0 Welcome, introductions, administration 1.1 Welcome & introductions
10 mins	2.0 Background 2.1 What is SWP? Why is SWP important? 2.2 About the project team
30 mins	3.0 THREATS 101 3.1 Overview of datasets, functionality 3.2 How THREATS can be used to identify and assess risks to source water
10 mins	BREAK
50 mins	4.0 Case study: assessing source water risks in the Peace watershed using THREATS 4.1 Town of Spirit River source water challenges 4.2 Using THREATS to address challenges
10 mins	BREAK
55 mins	5.0 THREATS exercise & feedback 5.1 Guided examples using select functions within THREATS 5.2 Feedback from participants on THREATS: ease of use, likes/ dislikes, gaps in data or information
5 mins	6.0 Close 6.1 Next steps & timelines for the project 6.2 Post-workshop survey

Appendix 3: Guided Exercise

Exercise for Discussion

[Note to reader: this exercise was relevant to an older version of THREATS that is no longer available. While the functionality is still available in the new version, the instructions on how to use and navigate THREATS are out of date].

Source Water Protection Workshop

This short exercise will walk workshop participants through a short example of using THREATS that can be completed using the platform. Please have a user account setup in advance. Login to the platform from the landing page at: <https://threats3.greenlandgroup.ca/> and launch the site.

1. Dashboard Guidance

From the dashboard, click the link to the SWP Source Risks – THREATS Guide or the EPCOR SWP Source Risks – THREATS Guide. These links will open in a new tab. Scroll through the tables to see possible risk factors and data sets that might be used to quantify them using THREATS.

Risk I.D.	Risk Description	Hazard	Cause of Potential Failure	Comments	THREATS Data Source
DWSP-S-001	Microbiological contamination of raw water as a result no restriction in access to source	Microbiological contamination	Due to livestock having access to source due to inadequate fencing.		ABMI Human Footprint: - Confined Feeding Operations Area 2014 - Confined Feeding Operations Area 2018 - Cultivation 2014 - Cultivation 2018 Government of Canada: - Census of Agriculture 2016 Land Cover: - Land Cover 2000 - Land Cover 2010
DWSP-S-002	Microbiological contamination of raw water resulting from wildlife activity in watershed.	Microbiological contamination	Due to wildlife dying or defecating in watershed.	Some animals such as beaver can carry Giardia and other pathogenic organisms	ABMI Wetland Inventory: - ABMI Wetland Inventory Alta LIS Land Use Designations: - National Parks - Natural Areas - Provincial Parks - Provincial Recreation Areas Land Cover: - Land Cover 2000 - Land Cover 2010
DWSP-S-003	Deterioration of water quality due to birds roosting on reservoirs at night	Microbiological contamination	Due to bird roost due to large faecal loading	Bird excrement contains very large numbers of bacteria.	ABMI Human Footprint: - Reservoir Areas 2014 - Reservoir Areas 2018 ABMIT Wetland Inventory: - ABMI Wetland Inventory

2. Water Quality Module

In this exercise we will use the Water Quality Modules to filter stations for analysis, generate plots, and explore some different views of the data.

1. Use the search bar on the map (top left) to zoom into the Calgary area.
2. Open the Water Quality module from the Tools Menu.
3. Use the Map Filter in the Analysis Panel to filter water quality stations on the map. Click the polygon button to draw an area on the map (as shown below).
4. Search the chemical list for Total Suspended Solids (TSS) and apply a minimum count of 50:

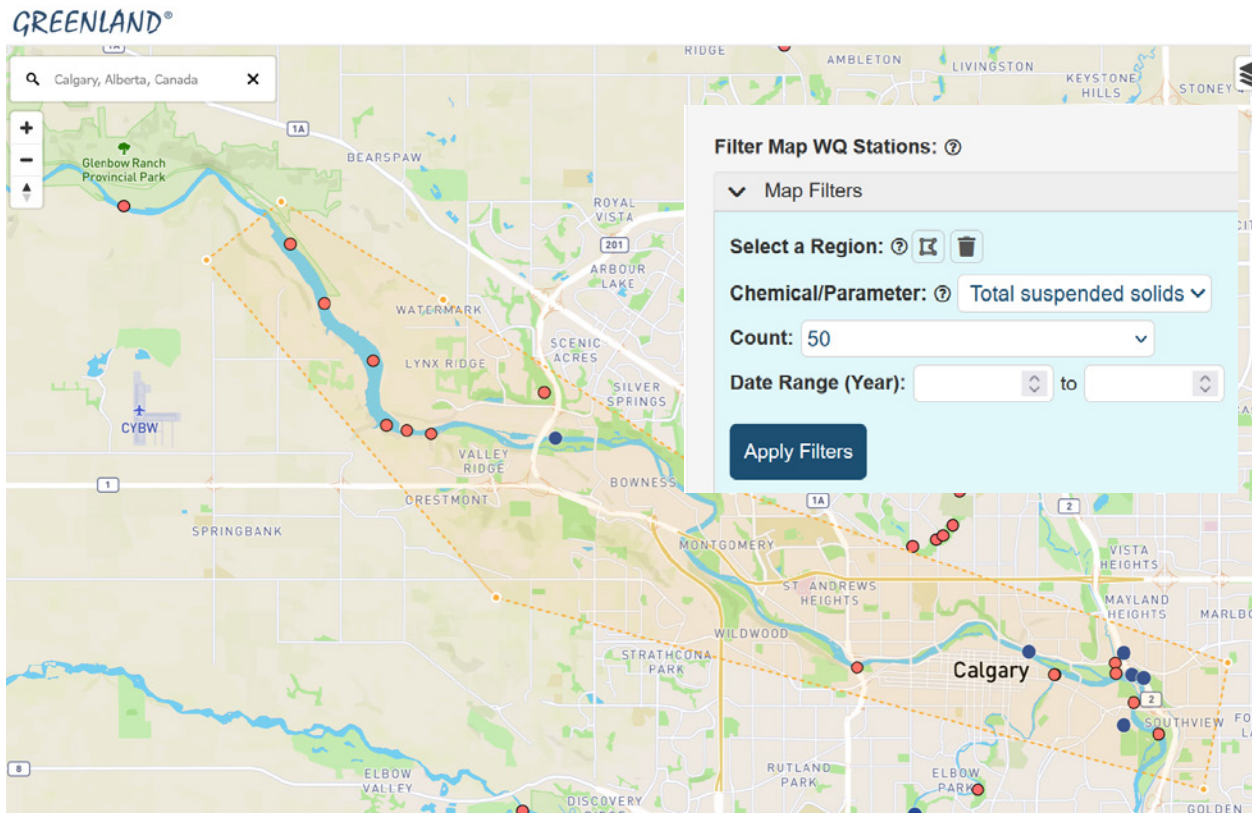


Figure E-3 Bow River upstream of Calgary with geographic area drawn to filter water quality stations.

5. Once the filter is applied only seven (7) red monitoring stations will be available. Below the Map Filter input box, setup the analysis for TSS on an upstream and downstream location on the Bow River. For the upstream location, select the Bow River Below Bears paw Dam (ID: 41846) and Bow River Pumphouse (ID: 41863).

- Use the filter next to the Chemical/Parameter drop-down and select “Common to All” to see chemicals that are available to all stations resulting from the map filtering of stations. This will shorten the list of Chemical/Parameter options that are displayed. Type or scroll in the Chemical Parameter drop box and select “Total suspended solids” and hit Submit.

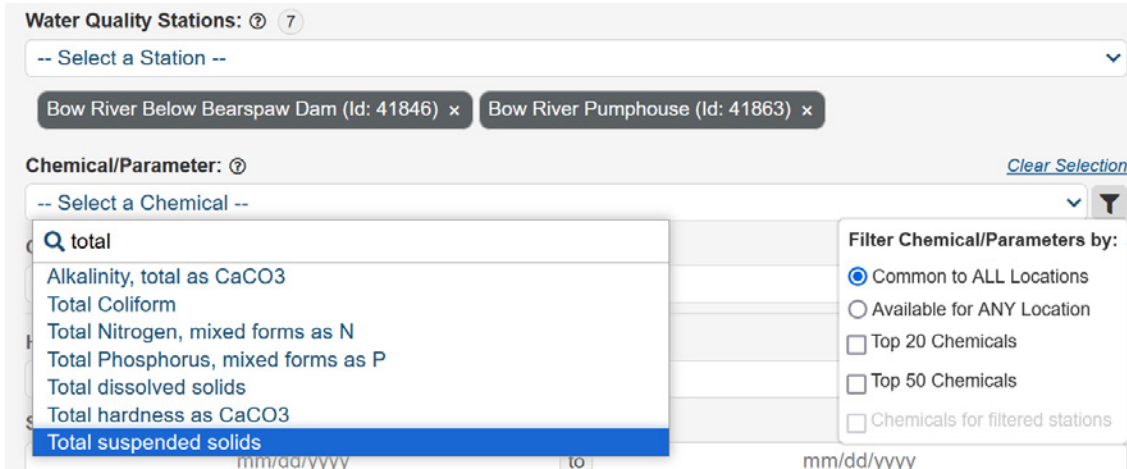
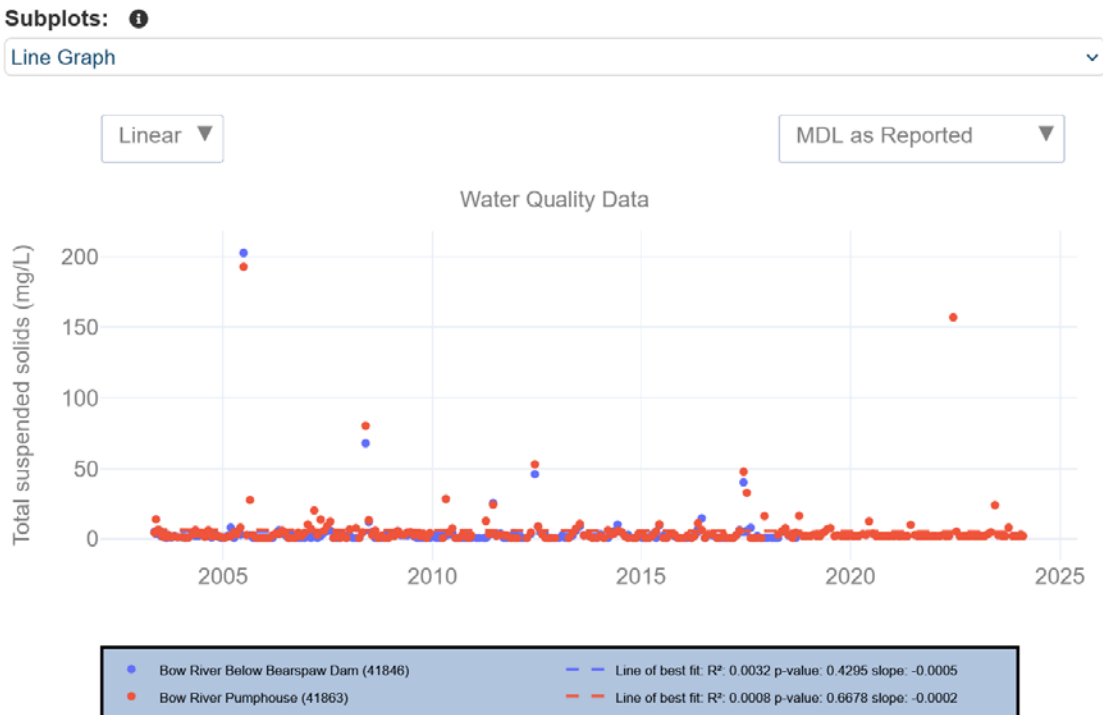


Figure E-4 Water quality analysis setup.

- You should get a plot like this:



[Bow River Below Bearspaw Dam \(Id: 41846\) \(41846\), Source](#)
[Bow River Pumphouse \(Id: 41863\) \(41863\), Source](#)

Figure E-5 Plot of TSS concentrations as a scatter plot showing two locations on the Bow River.

8. Try changing the Subplot Type; click the drop-down menu that says “Linear” and try changing to Log. Play around with the handling of Method Detection Limit (MDL) and observe the changes. Set it to “Remove under MDL.”
9. Turn on/off data series by clicking them in the legend. Hover over the plot for more information and note that another set of options appears at the top of the plot where you can adjust the plot display and download data from the plot. It is also possible to zoom in/out and resize the plot space:

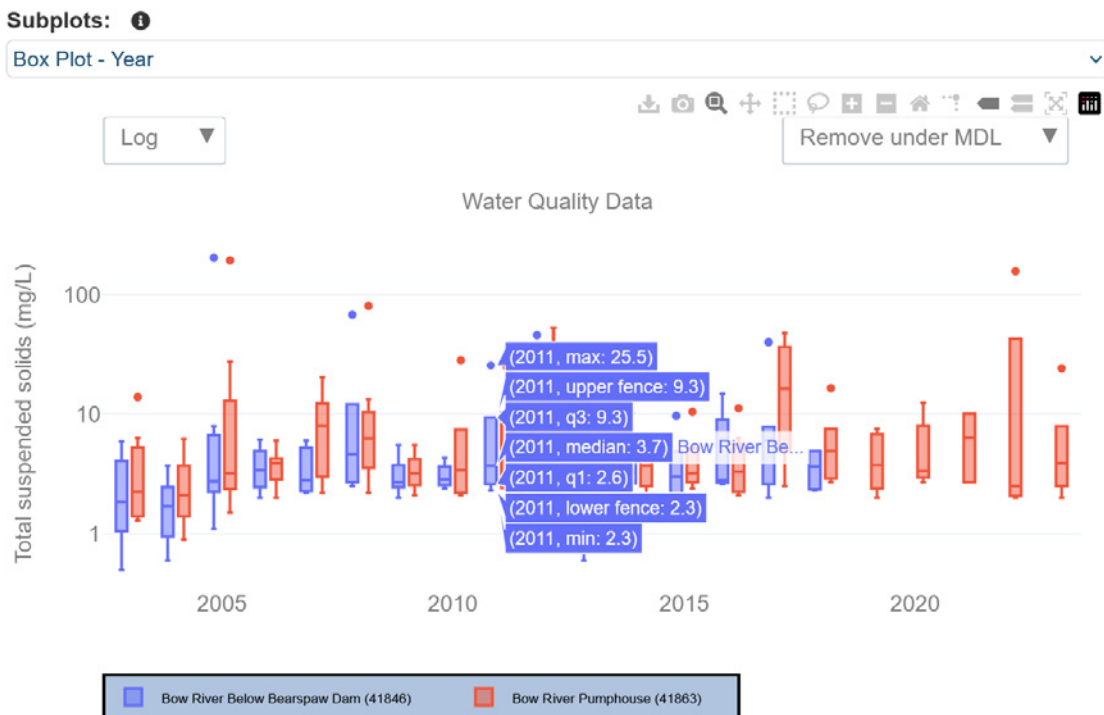


Figure E-6 Plot of TSS data for two locations on the Bow River using box plots aggregated by year to compare upstream and downstream concentrations over time.

Observations: Look for trends over time; periods with higher or lower concentrations relative to other years; note the range of data – some years have lower variance than others. Note extreme values – these may be indicators of an event that released a particular contaminant.

3. Hydrometric Stations Analysis Module

In this exercise we will select a hydrometric station for analysis and explore the contribution of flow to that location from upstream tributaries.

1. Under the Tools Menu (top right on the map screen), select “Water Hazard and Hydrograph Tool” and click “Hydrometric Station Analysis.”
2. Zoom to Calgary and Select the “Bow River at Calgary” for analysis. You can type in the box or select from the map. The catchment area for this hydrometric station should appear on the map and a new entry should appear in the analysis panel.
3. Click the “Hydrologic Charting” drop-down menu at the bottom of the box. Under “Date Range (Year),” set the range as 2010 to 2024. From the “Data Analysis” drop box, select “Stacked Hydrograph.” Check the two filter boxes in the blue box to apply them.

HYDAT Station: 05BH004

Show Point Data on Map ⓘ

🔍 Latitude: 51.0503, Longitude: -114.0515

Downstream Flow Path

Upstream Watershed

▼ Hydrologic Charting Data Source: [HYDAT](#)

Parameter Type: Flow Level

Date Range (Year): 2010 to 2024

Data Analysis: **Stacked Hydrograph** ▼

Select Upstream Hydrometric Stations to include in chart.
Note: This feature is designed to compare flow contributions from tributary catchments. Avoid selection of nested catchment areas and check that period of record is overlapping between selected hydrometric stations

Filters

Only include stations which have data for the selected date range

Only include stations which have catchment area data

Main Stations: ▼

Other Stations (to group together in chart): ▼

Figure E-7 Setup hydrometric station analysis using stacked hydrograph feature to analyze the contribution of upstream tributaries to flow at the point of interest.

- Under “Main Stations,” select 05BB001 (Bow River at Banff) and 05BF025 (Kananaskis River Below Barrier Dam) upstream tributary hydrometric stations and Submit. The map should show the catchment areas for these two stations in red.
- Toggle the station data on/off in the line graph by clicking the station names in the legend. Note that data is only available from 05BF025 (Kananaskis River Below Barrier Dam) up to 2017.
- Change the Subplot to Pie Chart to see the flow contribution from each tributary to the total at 05BH004 (Bow River at Calgary).

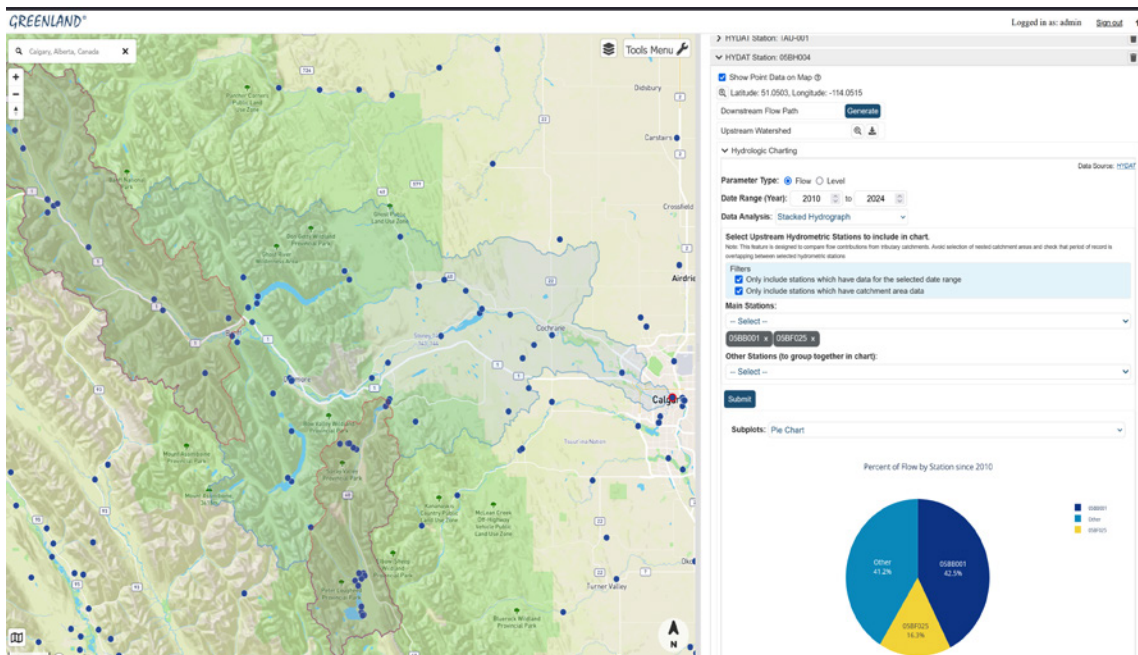


Figure E-8 Watershed area and contributing catchment areas map; pie chart showing the contribution of flows from the selected tributaries.

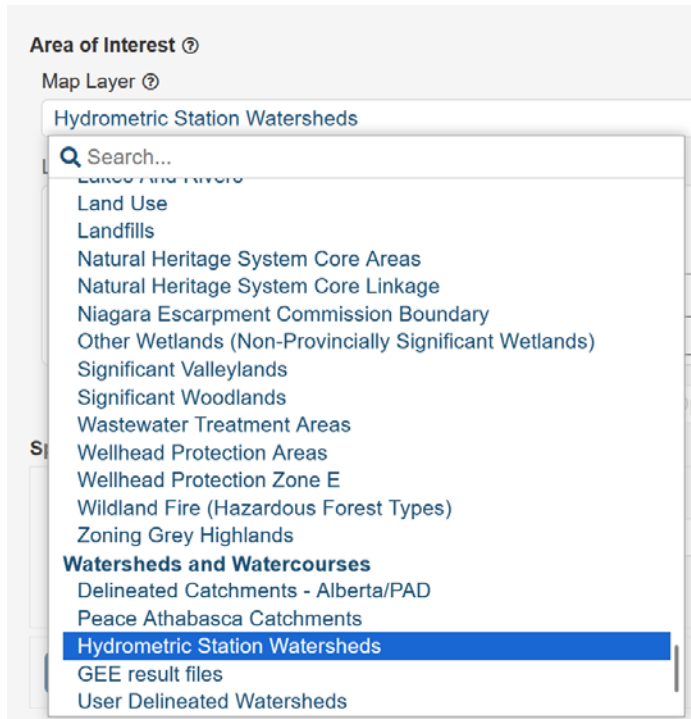
Observations: This analysis can be run with different selections of upstream tributaries and time ranges where data is available. The periods of available data will determine how it can be used. The tool can be used to compare tributary contributions during different periods of time.

4. Spatial Analysis Module

This exercise will use the previously selected watershed as an area of interest and conduct a basic spatial analysis of two spatial data sets to quantify features within the area of interest.

- Go to the Tools Menu and switch to the Spatial Analysis Module. (Note: You can easily switch between modules without losing your work during a session. It will timeout and reset after a period of inactivity.)

2. Under the Area of Interest heading, scroll to the bottom of the Map Layer drop box and select (or type) “Hydrometric Station Watersheds.”



3. All active hydrometric station catchment areas that are currently cached in the Hydrometric Stations Analysis Module will be available to select from. On the map, click on the catchment area for the Bow River upstream of Calgary. It should be added to the table as shown.

Layer Polygon(s)

Selected polygons

Station Name	Station Number
undefined	05BH004

4. If you want to increase contrast (for use in a report), check the box to generate a mask for the area of interest map layer.
5. Under Spatial Data, click the Map Layer drop-down and add Harvest Areas 2018. Under Data Attribute, select “Feature Type.”
6. Click “Add a Spatial Dataset” and select Mine Areas 2018 also with the data attribute as “Feature Type.”

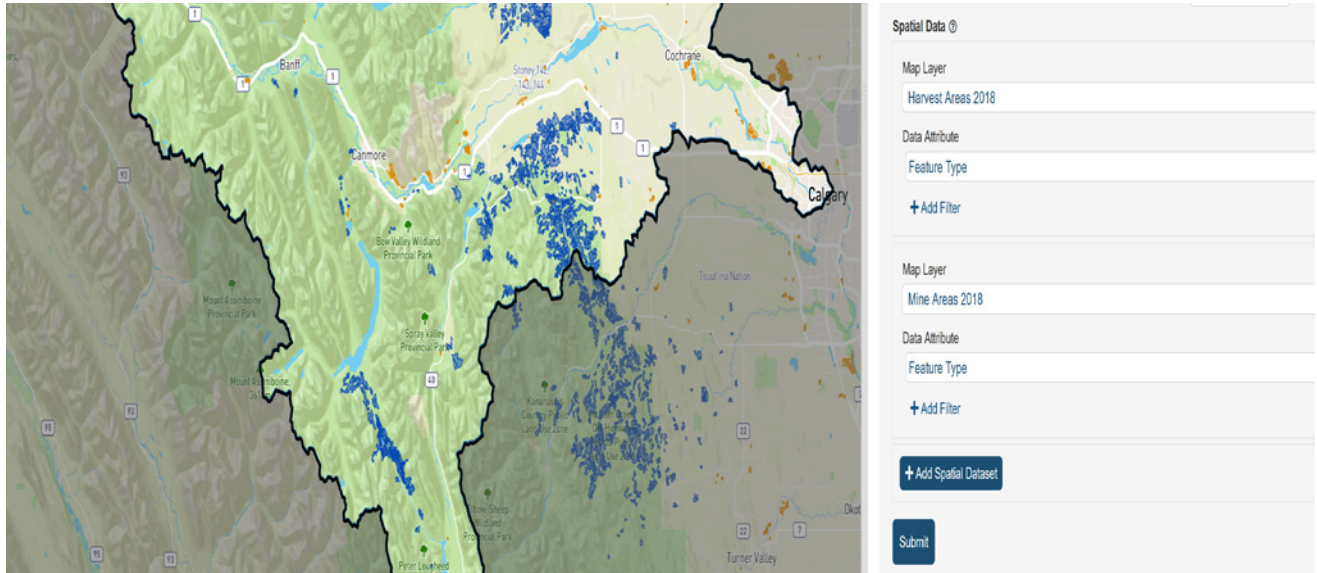


Figure E-9 Setup for spatial analysis on two data sets.

7. Submit the analysis query to generate output tables and pie charts.

Clipping Area: 7868 km²

of Decimal Places:

Harvest Areas 2018			
Feature Type	Data Field Count	Sum of Areas (km ²)	Clipped geometry / Area of Interest
HARVEST-AREA	1191	174.806	0.022

Mine Areas 2018			
Feature Type	Data Field Count	Sum of Areas (km ²)	Clipped geometry / Area of Interest
GRVL-SAND-PIT	120	7.244	0.001
MINES-PITLAKE	3	0.097	0.000
OPEN-PIT-MINE	83	4.186	0.001
TAILING-PILE	3	0.139	0.000

Observations: The tables and pie charts show the clipped area of the Area of Interest above the table. According to the feature type, the tables show the number of fields – polygons, lines, or points within the area of interest. The sum of areas is the area of those features within the area of interest. The fourth column is the ratio of the sum of areas divided by the area of interest. Hover over the table headings to see an explanation. There are two pie charts for each table. These show the area of the feature relative to the area of interest and a breakdown by feature type.

Appendix F – Copy of the Letter for Recommendation 3

Copy of the letter for Recommendation 3: AWC to write a letter to Alberta Environment and Protected Areas (EPA) to support their initiative to connect the Water Quality Data Portal to DataStream.

February 2026

Dear Alberta Environment and Protected Areas,

The Alberta Water Council (AWC) is a collaborative multi-sector partnership that provides leadership, expertise, and sector knowledge and perspectives to help governments, industry, and non-governmental organizations to advance the stewardship outcomes of *Water for Life*. The AWC identifies opportunities and approaches that support shared responsibility for effective water management through each members' policies, practices, and tools.

Through our recent source water protection (SWP) project, the AWC provided an enhanced decision-support tool, known as The Healthy River Ecosystem Assessment System (THREATS™), with the aim of empowering drinking water providers to develop and update SWP plans efficiently and effectively. This web tool collates relevant data on water quality, water quantity, land use, and other information, and provides resources that allow drinking water providers to visualize and analyze it.

The AWC understands that Alberta Environment and Protected Areas (EPA) is currently working with DataStream to integrate their datasets, allowing them to be used in DataStream, and in turn THREATS. For example, EPA developed an application programming interface to enable automatic updates of the North Saskatchewan River (NSR) Tributary Monitoring Network (TMN) and Long Term River Network (LTRN) datasets from the Water Quality Data Portal (WQDP) to DataStream. EPA is currently adding TMN and LTRN datasets from other basins to DataStream.

The AWC would like to acknowledge the commitment EPA has made toward this ongoing initiative, and we support your continued efforts to make this data open and publicly accessible. The historical water quality data from GoA is integral to developing SWP plans, and having this data available will demonstrate transparency, accountability, and will hopefully drive further collaborative SWP planning efforts across the province.

Sincerely,

Andre Asselin
Executive Director
On behalf of the Alberta Water Council





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