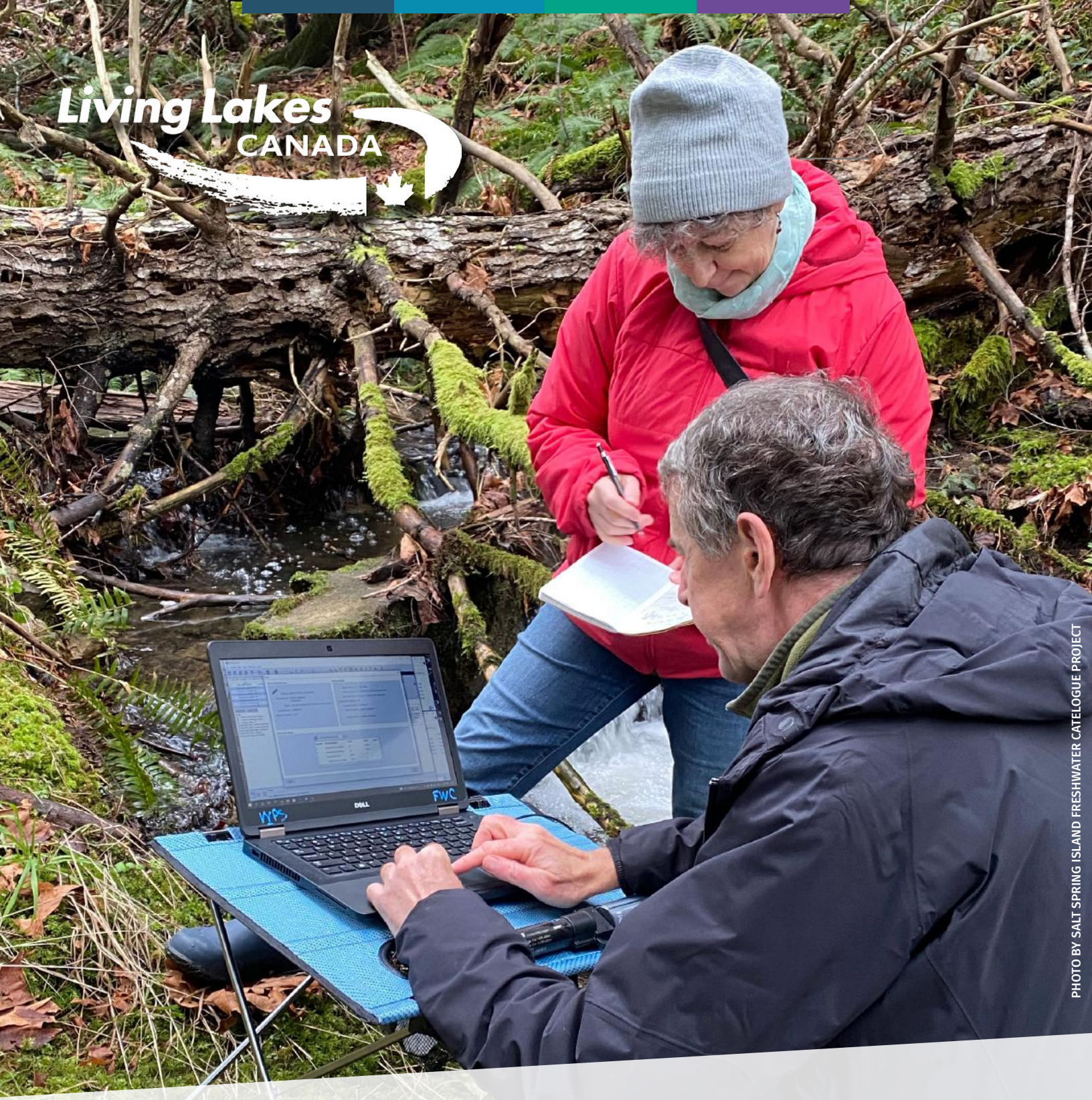
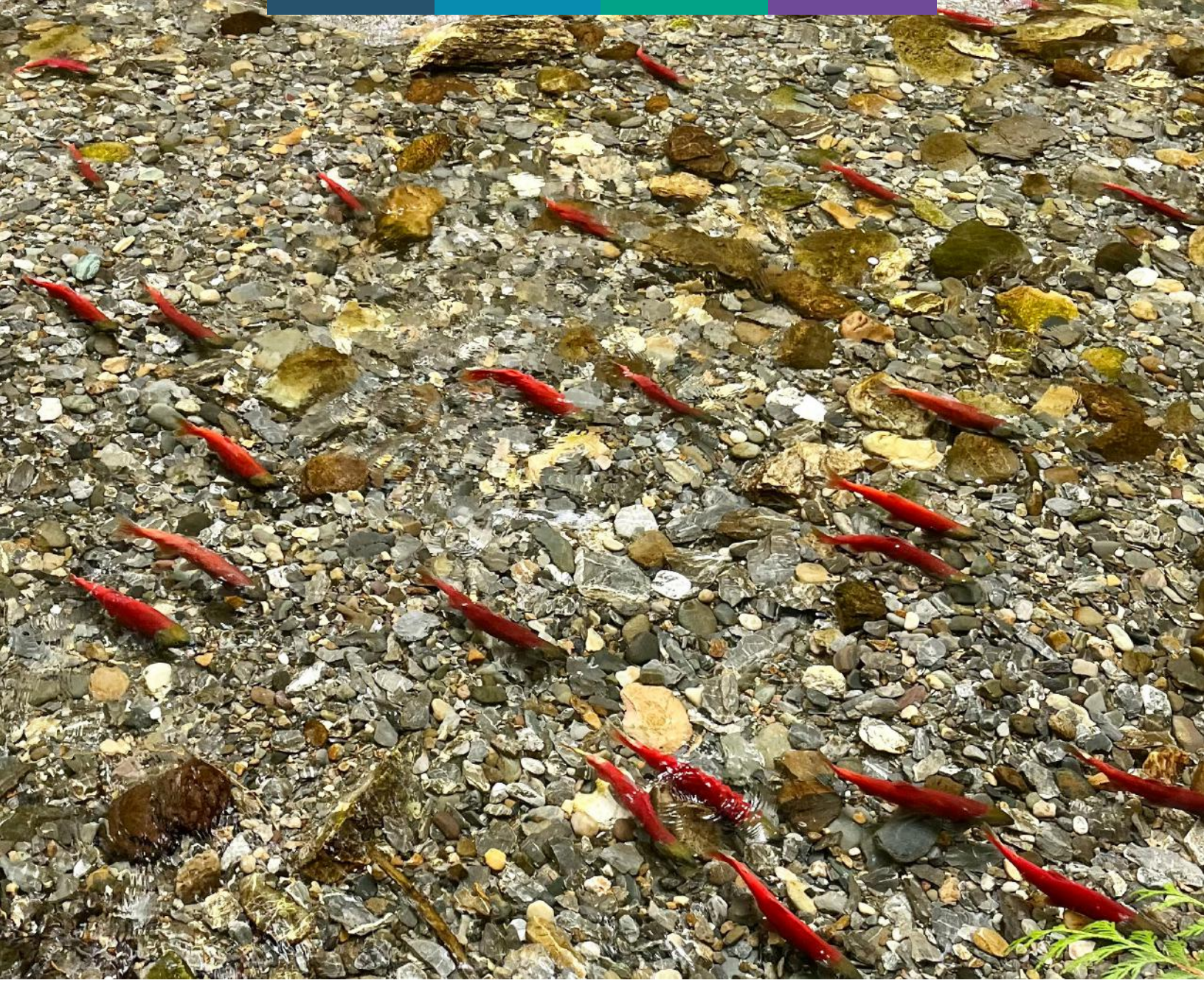


PHOTO BY SALT SPRING ISLAND FRESHWATER CATELOGUE PROJECT

COMMUNITY-BASED WATER MONITORING

Data Use Cases in British Columbia to Support Planning and Decision Making

Prepared by: Paige Thurston and Ian Sharpe (2023)



KOKANEE SALMON, BRISCO WATERFALL / PHOTO BY NICOLE TRIGG

LAND ACKNOWLEDGEMENT

Living Lakes Canada acknowledges that our water stewardship work originated in the unceded traditional territories of the Ktunaxa, Secwepemc, Sinixt and Syilx Nations who have stewarded these lands for generations. Recognizing Indigenous People as the rightful caretakers of their unceded territories, we work to complement their intergenerational work and Indigenous-led water stewardship initiatives.

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Living Lakes CANADA

BECK CREEK / REGIONAL DISTRICT OF NANAIMO

ACKNOWLEDGEMENTS

This report was made possible through the collaboration and support of several organizations, to whom we extend our sincere appreciation:

- Chilako Monitoring and Restoration Initiative
- Salt Spring Island FreshWater Catalogue Project
- Okanagan Basin Water Board
- Okanagan Nation Alliance
- Regional District of Nanaimo

This project was funded by the BC Ministry of Environment and Climate Change Strategy.

BRITISH COLUMBIA | Ministry of Environment and Climate Change Strategy

SUGGESTED CITATION:

Thurston, P. & Sharpe, I. (2023). Community-based Water Monitoring Data Use Cases in British Columbia to Support Planning and Decision Making. Prepared by: Living Lakes Canada.

INTRODUCTION

There is a growing need for locally specific, high quality data, and knowledge to inform decision making around climate adaptation and water stewardship in British Columbia. This need is driven by increasing demands on water supply, intensifying climate impacts, and provincial commitments to support watershed security. Given the extent of ongoing data gaps in relation to water and climate in B.C., many groups across the province, and Canada, are addressing these issues by gathering and sharing data and knowledge[2].

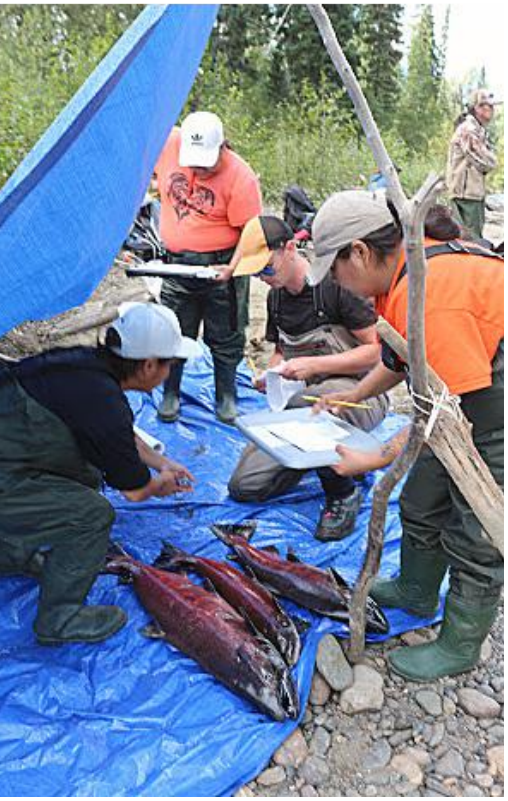


PHOTO BY CHILAKO MONITORING AND RESTORATION INITIATIVE

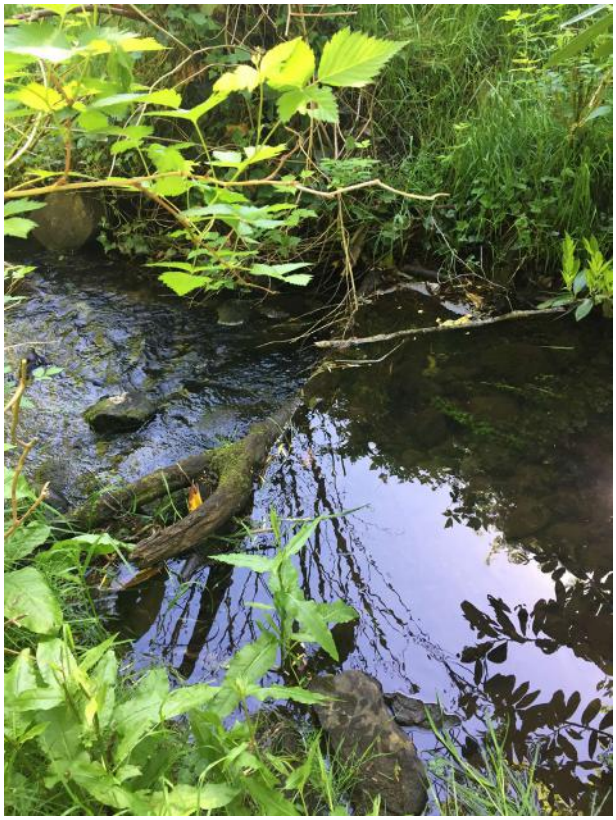
For the purpose of this report, Community Based Water Monitoring (CBWM) refers to any monitoring or knowledge gathering that is not led by the provincial or federal governments, although these entities may be collaborators on community-led projects. Research shows that CBWM data often has a similar level of accuracy as data collected by professional scientists[3, 4]. CBWM leaders include First Nations governments, Indigenous-led organizations, water stewardship non-profits, local governments and regional water boards. Many more groups are seeking opportunities to similarly engage[5]. These groups span a wide range of experience and capabilities, but with appropriate guidance and support, virtually all CBWM data can contribute to watershed management processes.

To understand and expand the potential applications of CBWM, it is valuable to track the links between CBWM initiatives and specific purposes and outcomes (e.g. data "use cases"). Some CBWM groups have been collecting data for several years but have yet to see its application for stewardship or decision making. In many cases, this is due to the long-term datasets required for analysis to yield meaningful results. In the case of Indigenous Knowledge, data collection spans thousands of years and the information is available but additional support is required to see them applied. With continued support, CBWM datasets will become increasingly valuable in future years. However, there are many instances where CBWM data and/or Indigenous Knowledge has been applied towards research, decision making and improved water stewardship[6]. Documenting these links and harnessing the energies of CBWM groups will support the continued success of such initiatives and lead to improved watershed security.

Five data use cases have been selected to demonstrate the value of CBWM data, and to provide guidance to CBWM programs and collaborators in data application. These examples are also meant to inspire additional efforts among a wide variety of collaborators (e.g. governments, communities, industries, researchers, others) to create and publicize additional data use cases. Sharing success stories has the potential to raise the profile of valuable, cost-effective CBWM projects and allow new programs to build off of the success of more established projects, an

essential practice for CBWM initiatives[7]. This results in more purpose-specific, trusted data that is integrated into a variety of watershed management processes at multiple levels.

This selection of use cases represents a diverse range of data collection methods, analysis and knowledge systems for a variety of watershed management purposes and processes. Interviews with CBWM-led data collectors and owners provided insight into the broad range of data types and purposes that CBWM groups in B.C. are currently working with. Each use case example is created through the experience and knowledge shared during these in-depth interviews.



BEACH CREEK / PHOTO BY RDN

What is a "Use Case"?

A use case is a "short examination of how decision makers use data"[8]. Use cases can provide a way to identify core data sources, gaps and potential data interoperability, leading to significant efficiencies.

"As government capacity to monitor freshwater has fluctuated in recent decades and gaps in our knowledge of Canada's watershed health remain, understanding the current state of [CBWM] programs and their potential to inform decision-making is paramount."[9]

"Water governance in Canada is complex and cross-jurisdictional. While this fragmented landscape poses challenges, community groups offer an untapped capacity. The federal government can overcome fragmentation by working alongside CBWM initiatives to ensure communities and governments have the data necessary to manage and maintain healthy freshwater resources."[10]

USE CASE #1

Chilako Monitoring and Restoration Initiative

Who is involved with the initiative?

This initiative has many partners. Leading the initiative are Lheidli T'enneh (project holder) and Saik'uz First Nations, Upper Fraser Fisheries Council, Nechako Environmental and Water Stewardship Society, and the Province of BC.

Other partners include the Society for Environmental Restoration in Northern BC, BC Ministry of Water Land and Resource Stewardship Ecosystems Branch (formerly BC Ministry of Forests Lands and Natural Resource Operations), BC Ministry of Transportation and Infrastructure, Federal Department of Fisheries and Oceans, Regional District of Fraser Fort George, University of Northern British Columbia, College of New Caledonia and University of British Columbia.

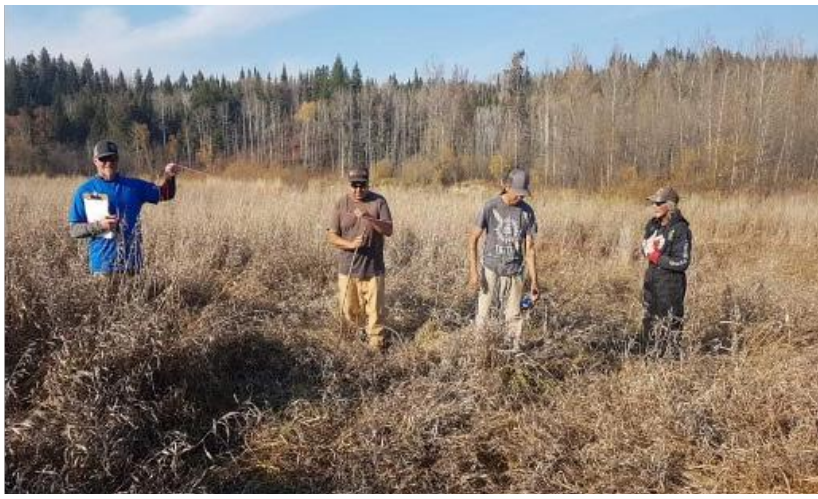


PHOTO BY CHILAKO MONITORING AND RESTORATION INITIATIVE

Collaborators include: Mike Miles (River Restoration Northwest), Lee Hesketh (BC Cattlemen's Association Farmland-Riparian Interface Program – FRISP) and David Polster (Polster Bioengineering).

What was the motivation to initiate the monitoring program?

It was observed that the ecological integrity of the Chilako (Mud) River and its tributaries were deteriorating and required large-scale restoration efforts. The Chilako River basin is subject to a variety of land uses, including forestry, agriculture and climate change, that influence seasonal flows. As a result, a holistic understanding of the watershed and how conditions had changed over time was needed prior to initiating restoration. Monitoring and analysis provided the insight necessary to develop a restoration strategy, assess its effectiveness and inform further restoration efforts.

What is monitored and how?

Many monitoring methods are employed to gain a complete picture of the watershed. The overall intention of the analysis is to establish baseline and historic changes in floodplain dynamics to inform restoration efforts.

Remote sensing techniques include the interpretation and comparative analysis of historic air photos, augmented by conventional maps, and drone, LiDAR and satellite imagery (e.g. LANDSAT, Sentinel).

In the field, monitoring methods focus on fish, channel, and floodplain morphology conditions, and ecosystem response to change. eDNA techniques are used, in particular to monitor for the presence of the Western pearlshell mussel (Margaritifera falcata), an indicator of healthy water quality. An Indigenous-led fish counting fence and snorkel surveys assist in determining fish presence, and habitat utilization. Riparian condition surveys augment the remote sensing tools for assessing riparian health.

Once restoration actions are initiated, the data is used for post-restoration monitoring and assessment to determine the effectiveness of restoration efforts and guide further actions.

What is the impact of the data?

The data is used to inform process-based watershed restoration of the degraded river, its tributaries and floodplain with a focus on improving impaired ecosystem and human values (including Indigenous and landowner perspectives). The data supports ongoing long- and short-term project planning and logistics.

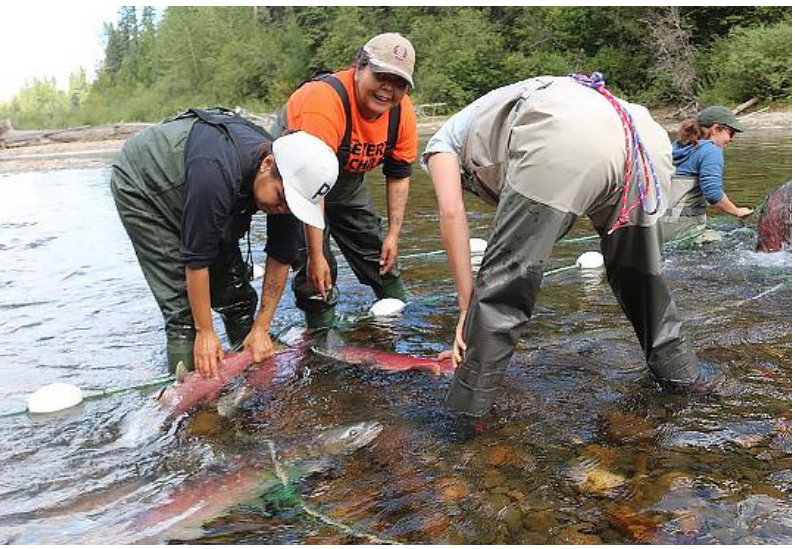


PHOTO BY CHILAKO MONITORING AND RESTORATION INITIATIVE

The data is used to prioritize locations for restoration. This primarily includes identifying locations where ecosystem or habitat values are impaired, but may be improved. Additionally, it is useful to identify areas where human activities are contributing to ecosystem impairment, and areas where landowners and other collaborators may support the restoration efforts. Where permits and authorizations are required for the restoration work, having a comprehensive dataset available to support applications has been beneficial in obtaining these authorizations.

A variety of process-based streambank restoration techniques have been trialled. The most beneficial techniques include:

- streambank re-sloping to spill high flows onto the floodplain
- planting willow and cottonwood live stakes to promote the development of riparian forest (using excavator-assisted planting in coarse soils and waterjet stinger in finer-grained soils)
- irrigation and mulching on planted areas to promote new growth
- inserting vertical logs in a pegboard pattern on re-sloped streambanks to add roughness and reduce the erosive effects of high flows
- placing large wood and willow bundles at streambank toes to reduce undercutting
- fencing to exclude livestock from restoration areas

Additional techniques currently planned include methods to either mimic beaver activities (including beaver dam analogs - BDAs) or to promote beaver activity where appropriate.

Post-restoration effectiveness monitoring is conducted and compared with the baseline data. Retrospective analysis is carried out to review the project with a different lens on river processes and ecosystem dynamics. Both the analysis and monitoring support continuous deep learning and adaptation.

The data generated through this project can be used to contrast the costs of not acting with the costs of investing in restoration prior to further degradation. Learnings from the data collection and implementation stages of this project can be used to modernize government land and water use policies. In this project, the Chilako River corridor is viewed as a functional landscape element. This approach, along with shifting attitudes away from physical to biological controls will lead to better ways of improving watershed health.

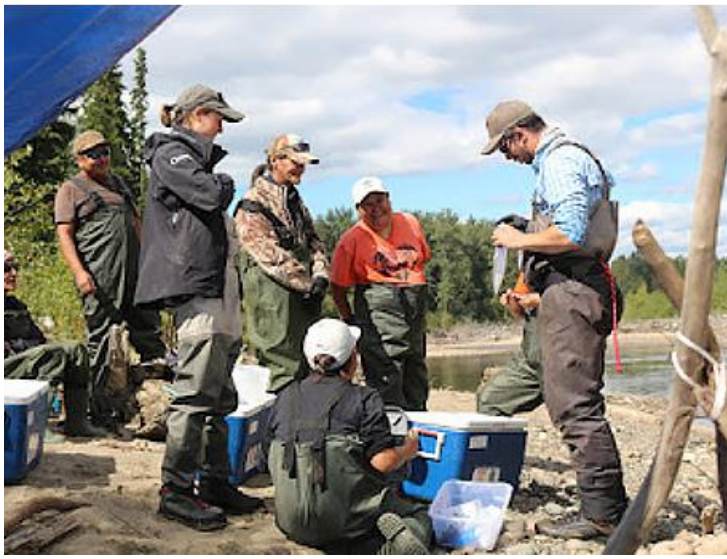


PHOTO BY CHILAKO MONITORING AND RESTORATION INITIATIVE

Why is the initiative effective?

The depth of partnerships and relationships built and maintained during the project has demonstrated the value of collaboratively engaging in long-term watershed restoration efforts.

Lheidli T'enneh and Saik'uz First Nations have been leaders on this project. Indigenous participation in the project stems from their cultural attachment to the watershed. The name Chilako comes from the Dakelh Tsalakhoh, meaning "the river in the hands of the beaver". This provides part of the basis for restoration objectives in the watershed and learning from the beavers.

The use of monitoring data to prioritize restoration sites and guide restoration activities contributed to the efficiency and effectiveness of the restoration efforts. Pre- and post-restoration data is vital as it captures changes in watershed condition. In the case of the Chilako River, the data indicated an improvement in the watershed condition.

The living laboratory aspect of the project stimulated continuous learning among participants and inspired others to become interested in watershed restoration.

USE CASE #2

Salt Spring Island FreshWater Catalogue Project

Who is involved with the initiative?

The project is led by the Salt Spring Island Water Preservation Society (SSIWPS), a non-profit society that has been working to protect the water and watersheds of Salt Spring's drinking-water lakes since 1982. Local stewardship and community groups collaborating on the project include the Quw'utsun Nation, Stqeeye' Learning Society, Transition Salt Spring, Gulf Islands National Parks, and Raincoast Foundation. The project's data is being used in studies by the Capital Regional District and Islands Trust.

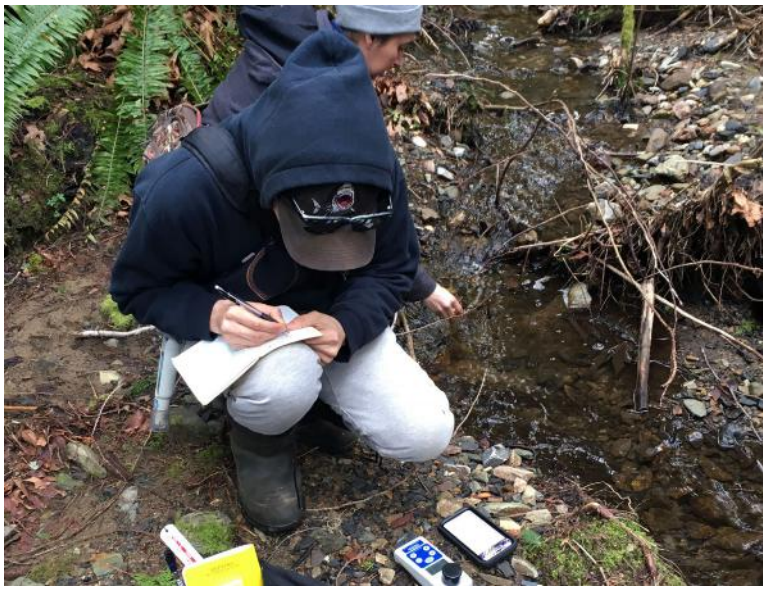


PHOTO BY SSIWPS

What was the motivation to initiate the monitoring program?

Salt Spring Island has a population of over 10,000 residents. The entire water supply system for Salt Spring Island is dependent upon seasonal rainwater. Available water supply is impacted by community water uses, changes in land use, and climate change. A lack of information on water availability, water supply, and climate impacts limited efforts to understand and adequately protect and manage Salt Spring Island watersheds. With the local population expected to grow, there is a need to create an awareness of the island's delicate water balance and gather relevant information on freshwater to inform the development of water budgeting on the island.

Work with the Quw'utsun community supports the monitoring of key watershed restoration work in the Xwaaqw'um[11] area and impact of restoration on the area's creek and natural ecosystems.

What is monitored and how?

The Freshwater Catalogue project aims to support watershed protection planning in order to ensure a sustainable, freshwater supply for people and ecosystems on an island that experiences water scarcity. In 2018, monitoring began across seven watersheds. Monitoring is now conducted in 20 watersheds across the island. Data collection is guided by the SSIWPS, with guidance on procedures from various hydrological staff with significant field and office support from community volunteers.

Monitoring of water quantity (a rough proxy for watershed recharge efficiency) is the primary FreshWater Catalogue

project priority, and includes surface water flow and/or level measurements. Surface and groundwater chemistry sampling is a secondary priority. This work conducted by volunteers occurs at over 100 locations. The dataset as of spring 2023 included over 35,000 surface and groundwater measurements taken during 7,200 site visits.

Surface flows are measured using a variety of measurements: observing the presence/absence of flow, bucket and timer measurements, and flow measurements using creek profiling and velocity measurement. Water levels are measured using staff gauge readings, and automated level loggers.

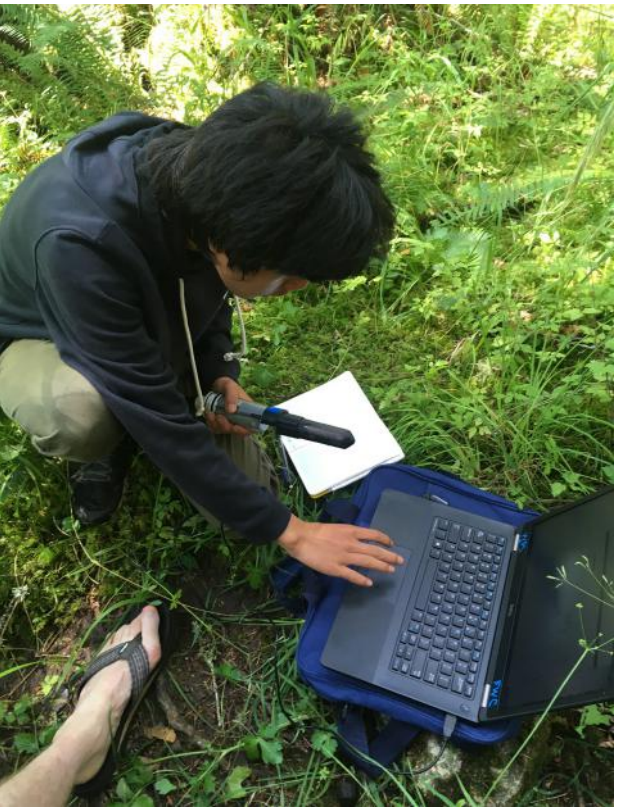


PHOTO BY SSIWPS

Basic water quality data including field measurements of dissolved oxygen, temperature, pH and conductivity are also collected. A pilot project to include further water quality analysis (bacteriology, metals and nutrients) is underway in the Fulford Bay area across seven creeks within seven watersheds supporting shoreline and marine ecosystems.

Within the FreshWater Catalogue project, and in related agency projects mapping products (e.g. satellite imagery, air photos, ground truthing surveys, prior mapping study reports) are used to characterize and quantify aspects of watersheds such as landforms and land use, vegetation, water bodies, water connectivity and recharge effectiveness.

FreshWater Catalogue data is housed in a dedicated cloud database. A data gathering field app is used to gather and input data. Data is shared with the public using a project webmap, and via Pacific Datastream. Data uploading to the provincial Aquarius database is being investigated, with guidance from the province.

What is the impact of the data?

The data generated by the Freshwater Catalogue project helps to characterize seasonal surface freshwater conditions including the impact of precipitation, withdrawals, and other water uses. It also provides information about surface and groundwater hydraulic connectivity.

The monitoring data will be used as input to modelling for the water budgets that are being developed by Islands Trust and the Capital Regional District. These water budget models will support the improvement of water management on Salt Spring Island. For example, the water budgets may support decision making around where and how to permit new housing and infrastructure and inform existing and new water allocation and conservation measures.

Islands Trust has commissioned island-wide groundwater recharge modelling. The FreshWater Catalogue surface and groundwater monitoring data collected by volunteers will be valuable in calibrating and ground truthing these evolving models.

The Capital Regional District is currently completing a Water Availability Assessment for Lake Weston, the source of the island's Fulford Water System. FreshWater Catalogue monitoring data has helped inform this assessment and helped contribute to the long-term sustainable management of Lake Weston.

The visibility of the FreshWater Catalogue project, and the data collected from the project, paired with the modelling and water budgeting initiatives being carried out by local governments, will result in improved water stewardship and management on Salt Spring Island.

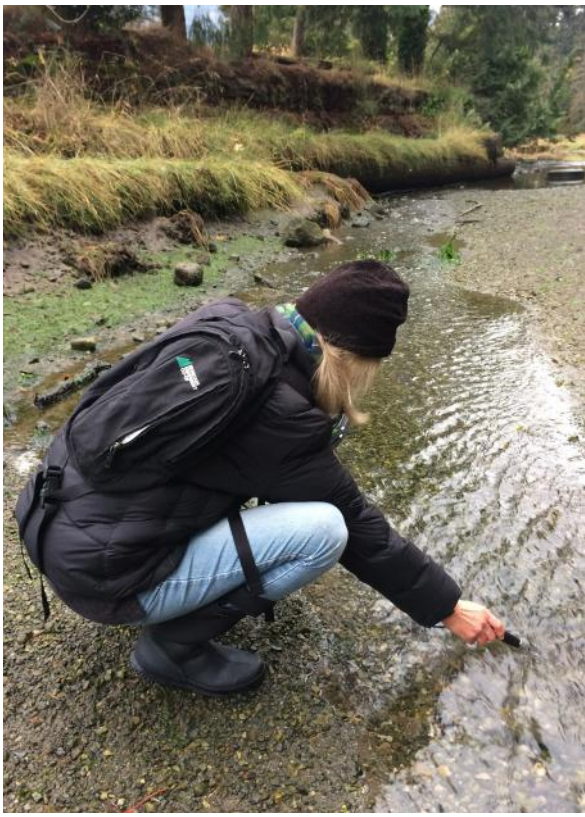


PHOTO BY SSIWPS

Why is the initiative effective?

No single agency has had the personnel/capacity to gather and provide this island-wide information. The SSIWPS was well-positioned to support this work through education, and motivating individuals and groups to participate in monitoring. The FreshWater Catalogue acts as a hub to organize, focus and share the information gathered and promote better understanding of watershed dynamics in support of informing specific agency planning and island decision making.

With the initiative and able leadership of John Millson, the project includes collaborations with a wide range of community members and engages with many volunteers. This has led to significant community support for the project and community education to raise awareness of the need for further watershed sustainability planning.

USE CASE #3

Okanagan Basin Water Board and Okanagan Nation Alliance

Who is involved with the initiative?

Data is collected in partnership with the Okanagan Basin Water Board (OBWB), the Okanagan Nation Alliance (ONA), Environment and Climate Change Canada, local governments and Okanagan water suppliers.

What was the motivation to initiate the monitoring program?

Water supply is a concern in the Okanagan Basin region for many reasons. It's critical for sustaining fish populations and supporting the agriculture industry, an important economic driver for this region. Increasing water demand paired with climate change impacts has heightened the need for adequate monitoring and management of water supply in the Okanagan Basin.

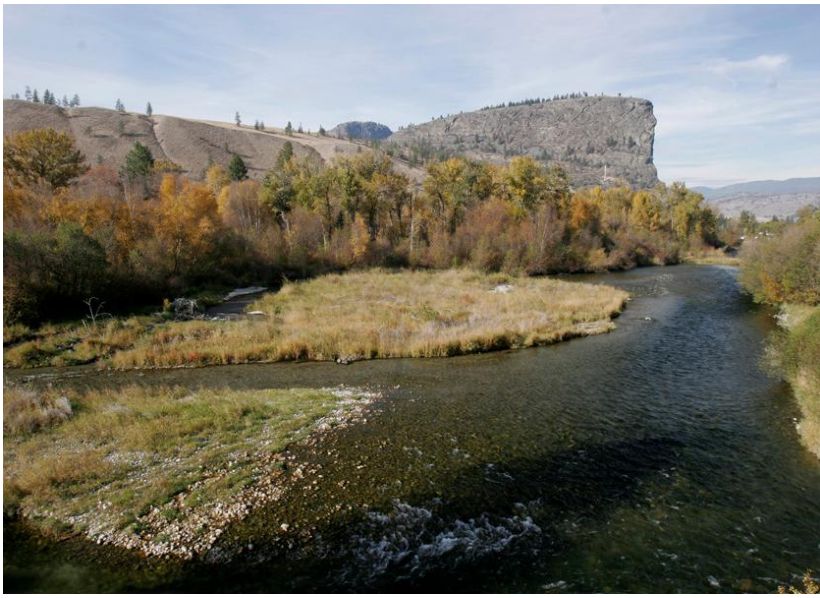


PHOTO BY OBWB/OBA

A 2008 report recommended that the hydrometric network in the Okanagan Basin be expanded to approximately 160 stations[12]. At that time, only 25 stations were operated by the Water Survey of Canada in the region. This was inadequate to address existing and future needs for water management.

In 2016, the Syilx Okanagan Nation Alliance, the Okanagan Basin Water Board, and the B.C. Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD) initiated the Environmental Flow Needs Project[13]. This project aims to understand Critical Environmental Flow Thresholds (CEFT) and Environmental Flow Needs (EFN) for streams in the region. These parameters are respectively the minimum and optimal stream flows required for fish and ecosystem health (see sidebar). A collaborative process was initiated to develop the methodology for setting Okanagan Basin EFNs. Historic data records were used to develop the EFNs. However, there was a need for more location-specific and current hydrometric data to incorporate climate impacts and modelled scenarios into the EFNs, assess actual stream flows, and implement management strategies in response to actual stream flows in relation to the EFNs.

For these reasons, the Okanagan Hydrometric Information Network Program was developed[14].

Critical Environmental Flow Thresholds and Environmental Flow Needs are defined in the BC Water Sustainability Act[15]:

- **"Critical environmental flow threshold", in relation to the flow of water in a stream, means the volume of water flow below which significant or irreversible harm to the aquatic ecosystem of the stream is likely to occur.**
- **"Environmental flow needs", in relation to a stream, means the volume and timing of water flow required for the proper functioning of the aquatic ecosystem of the stream.**

What is monitored and how?

The Okanagan Hydrometric Information Network Program was initiated to respond to the long-recognized deficit of hydrometric monitoring stations in the valley. The program's aim is to increase the number of stations and improve data access to existing stations. Currently, 25 hydrometric stations are part of the program, with 6 stations managed by Water Survey of Canada, and 19 stations funded by the OBWB and its local partners and managed by the ONA. Data collected will also provide information on stream flow and water levels that are needed to calculate accurate EFNs and CFNs for sustaining fish populations.

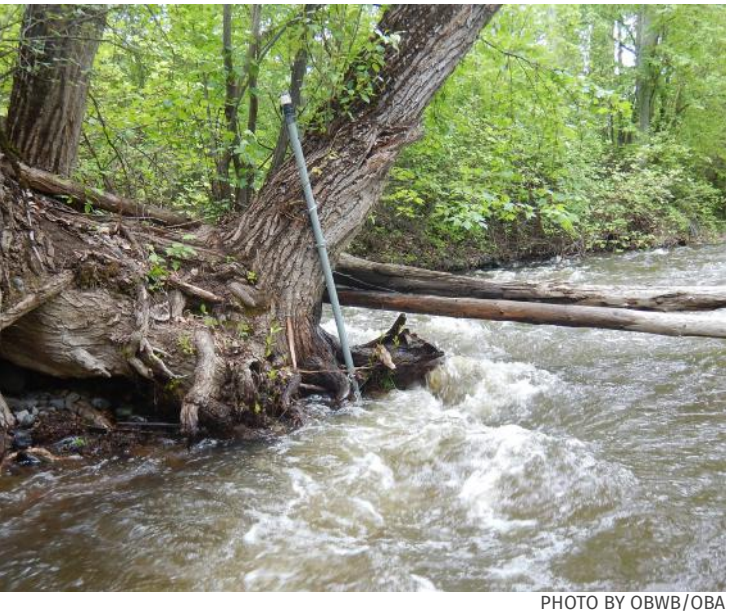


PHOTO BY OBWB/OBA

Data is collected according to the provincial RISC standards. Most of the stations in this network transmit real-time data. The data will be integrated into the provincial hydrometric data warehouse where it can be accessed and used.

What is the impact of the data?

The data being collected by the Okanagan Hydrometric Information Network Program is providing critical information about water supply and aquatic ecosystem health in the region.

ONA are using the hydrometric data in tandem with Weighted Usable Width (WUW) data to calculate and refine the EFN values which provide support for decision making around approvals for water licensing. The data can also be used to inform water withdrawals, watering restrictions, or the management of reservoirs and dams if required to achieve EFNs during low flows.

Over time, the new hydrometric data will be used to update the EFNs to better reflect the recent conditions observed in monitored streams and to further consider climate change impacts. An app is being developed to help decision makers understand the EFNs for various species and to look at how varying climate scenarios may impact these flows.

Why is the initiative effective?

Water (siwɬkʷ in the nsyilxcəən language) is intrinsic to the natural laws and governance systems of Syilx communities. The EFN initiative has been successful because it is guided by Syilx captíkʷɬ and the natural laws. The Syilx siwɬkʷ Strategy was developed by ONA to guide actions to protect and restore siwɬkʷ[16]. The Syilx siwɬkʷ Strategy emphasizes a collaborative approach, such as the partnership with OBWB, to implement the Okanagan Hydrometric Information Network Program.

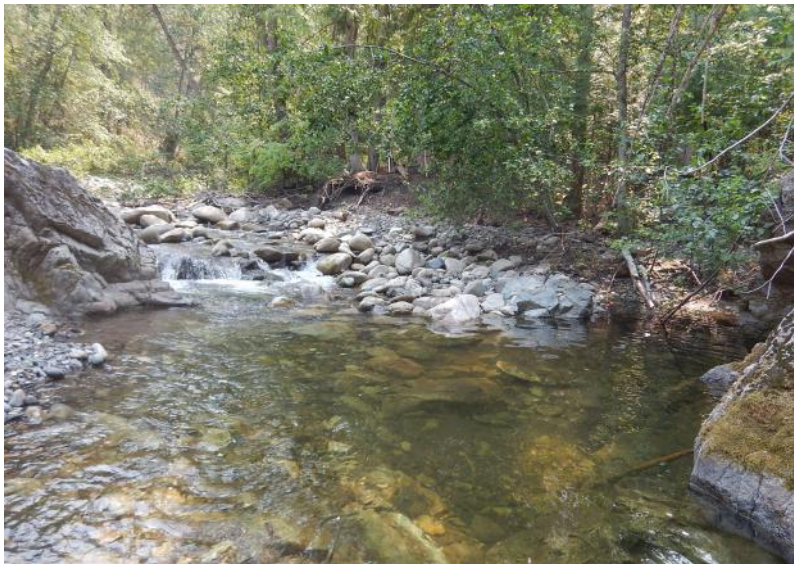


PHOTO BY OBWB/OBA

One Guiding Principle included in the Syilx siwɬkʷ Strategy Action Plan is to "utilize Western Science in conjunction with Syilx Okanagan-based processes." This project implements that principle by collecting data according to provincial hydrometric standards, while guided by and grounded in Syilx teachings. Real-time and publicly accessible data facilitates responsive management and decision making.

This initiative is responding to a recognized data gap felt by all valley communities using the joint resources at hand. The OBWB provides the mechanism for pooling funds and project management of the expanded network, and the ONA is expanding their internal technical capacity and gathering data that will support all their Water Strategy goals. This project maximises the impact of local resources through collaboration.

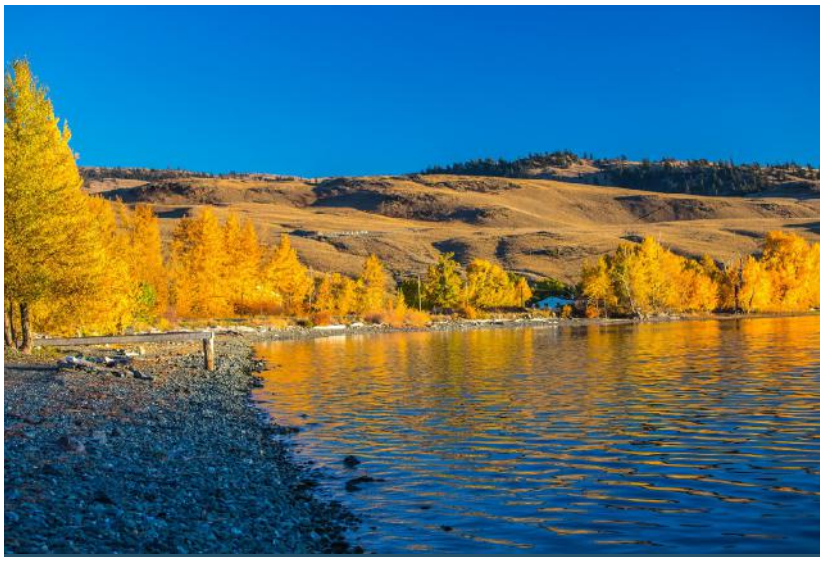
In the face of a changing climate and increasing demand for water, the Okanagan Hydrometric Information Network Program is providing critical information for water stewardship and management to support healthy fish populations and a thriving agricultural sector.

USE CASE #4

Foreshore Integrated Management Planning: Local Indigenous Knowledge and Values Framework

Who was involved with the initiative?

This project was co-led by Living Lakes Canada and Upper Nicola Band (UNB). Students from the University of British Columbia Sustainability Scholars Program supported the project. The project was funded by the Real Estate Foundation of BC.



NICOLA LAKE, BC / PHOTO BY LLC

What was the motivation to initiate the monitoring program?

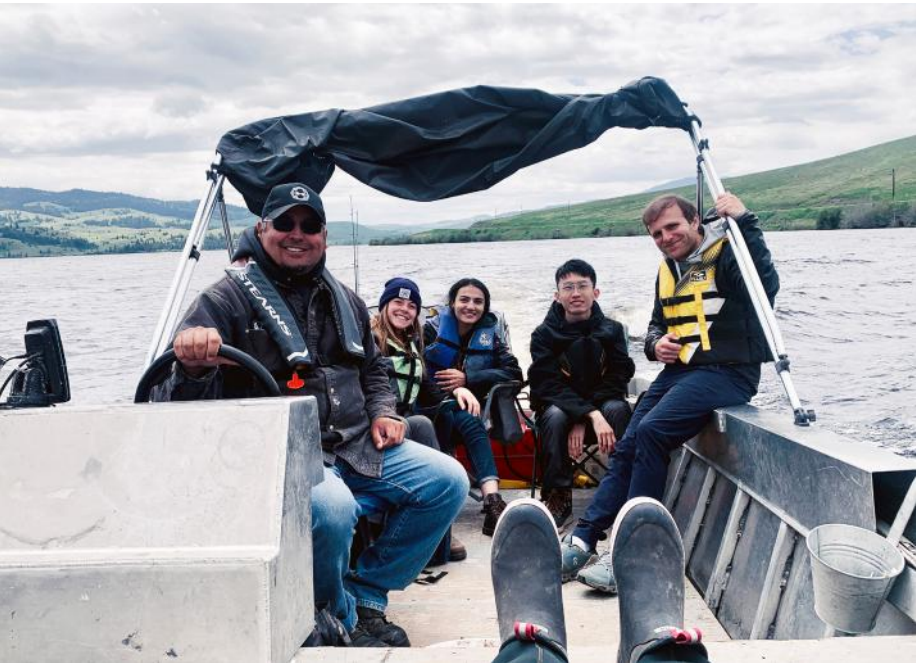
In 2020, Living Lakes Canada updated the Foreshore Integrated Management Planning (FIMP) methodology through a contribution agreement with Fisheries and Oceans Canada. The purpose behind this update was to make FIMP more broadly applicable to different types of lakes, and to identify the steps around re-FIMP surveys, where the rate of change or the rate of loss in natural shoreline can be determined. Under the facilitation of the Living Lakes Canada FIMP team, the updated methods have since been applied to 10 priority lakes in the Canadian Columbia Basin (six of which were re-surveys). There are many examples of FIMP data influencing decision making as a result of these surveys and the corresponding Foreshore Development Guideline documents (see box on page 17).

While this project has seen many previous successes, the FIMP team has also recognized challenges and limitations in the way that cultural and archaeological foreshore values are recognized and the way that inclusivity is prioritized within the FIMP protocol. In response, the Local Indigenous Knowledge and Values Framework has been co-created between Living Lakes Canada and the Upper Nicola Band. The framework instructs ways of harmonizing Indigenous Knowledge and Western science and creates opportunities for both worldviews to work in tandem throughout the FIMP project process.

This framework is being tested and applied during the Nicola Lake FIMP re-survey, starting April 2023. The ultimate intent behind this project is to demonstrate an inclusive process for foreshore planning that places cultural and ecological integrity at the forefront of decision-making with a holistic approach supported by relationships.

What types of knowledge and information were applied?

The development of this framework was guided by the foundational captík^{w}ł (oral stories) of the Four Food Chiefs. This foundational oral story describes how food was made available to people from the Four Food Chiefs; land (black bear), water (king salmon), underground (bitter root) and plants (saskatoon).



LEFT TO RIGHT: BRIAN HOLMES, UPPER NICOLA BAND, GEORGIA PECK, LIVING LAKES CANADA, AND THREE UBC STUDENTS AT NICOLA LAKE / PHOTO BY LLC

Within this framework's action plan, the FIMP project process was broken down into 7 distinct phases; project planning, place-based planning meeting, assessment, analysis, compilation, implementation, and project evaluation. Each phase was categorized based on the dominant Chief it is most closely associated with. This ensures that each phase is grounded in the teachings of the Four Food Chiefs.

Though this framework was developed within the specific context of the Nicola Lake FIMP re-survey, the intent is that the process of developing a place-based framework for interweaving Indigenous Knowledge and Western science is applicable in many other contexts and can act as a model. This intent is aligned with the greater vision of the framework surrounding the value of relationship as well as cultural and ecological integrity.

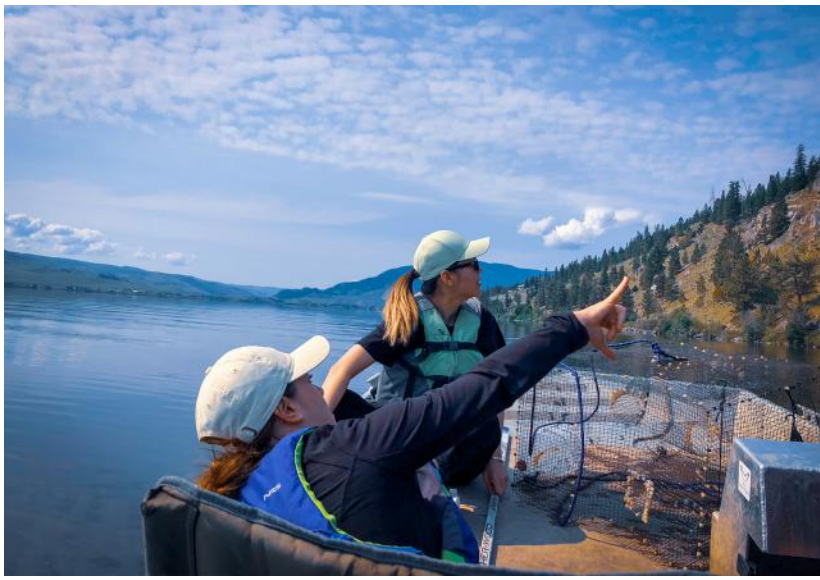
The results of the existing and formalized FIMP protocol have influenced management decisions on many lakes. For example, the Windermere Lake Official Community Plan requires a development permit when development is proposed within a 'red' or 'orange' zone (RDEK 2019) as identified in the original shoreline management guidelines (East Kootenay Integrated Lake Management partnership [EKILMP] et al. 2009). The Regional District of East Kootenay (RDEK) has also incorporated updated Foreshore Development Guidelines for Columbia Lake into the updated Columbia Lake Management Plan (CLMP). LLC worked with RDEK to ensure these updated recommendations could inform the new CLMP, which means evidence-based Best Management Practices for the foreshore will be referenced for years to come when watershed decisions are made. FIMP data and reports are available through the Columbia Basin Water Hub database operated by Living Lakes Canada[17].

What was the impact of the knowledge? What decisions were made?

The knowledge and values communicated through the Four Food Chiefs were not only integral to the framework as a guide to a holistic FIMP process, but also to the development of the framework itself. Just as the values exemplified by the Four Food Chiefs (such as the innovation of Chief Saskatoon) dictate the application of FIMP in the 2023 Nicola Lake re-survey, those same values guided every aspect of how the framework itself was created. This meant that the values of innovation, relationships, traditions, and action guided all decisions in the development process. For example, valuing relationships meant that it was necessary to add a place-based planning meeting as a major step in the FIMP project process to foster long-term relationships between Indigenous and non-Indigenous partners, as well as between people and nature. The outcome was a framework that innovatively places emphasis on cultural values and traditions, and relationships, alongside ecological concerns to inform foreshore development actions.

Why was the initiative successful/effective in achieving this outcome?

The creation of the Local Indigenous Knowledge and Values Framework is only successful because of the Indigenous Knowledge and values it is grounded in. For example, Chief Bitter Root helped team members from Living Lakes Canada and Upper Nicola Band understand that trust and strong relationships were pivotal to the successful creation of the framework. Thus, opportunities for trust and relationship building were prioritized, such as in-person gatherings around Nicola Lake.



NICOLA LAKE / PHOTO BY LLC

The framework implementation during the 2023 Nicola Lake FIMP re-survey will be evaluated using both quantitative and qualitative measures. Ideally, learnings will be integrated into a scalable framework that can be replicated in other regions of British Columbia and Canada, using unique creation stories and other culturally specific perspectives. The framework aims to standardize the interweaving of Indigenous Knowledge and Western science in future watershed initiatives and supports the inclusion of Indigenous voices in water management. Various Indigenous and non-Indigenous communities, and local, provincial, and federal government, have already shown interest in this project and the opportunity it offers to follow a place-based approach to interweaving Indigenous Knowledge and Western science in a similar approach.

USE CASE #5

Regional District of Nanaimo Drinking Water and Watershed Protection Program

What was the motivation to initiate the monitoring program?

The Regional District of Nanaimo (RDN) Drinking Water and Watershed Protection Program (DWWP) was created out of the need to develop a better understanding of water resources in the RDN, and to inform improved decision making and management. While DWWP includes a variety of program areas, two are highlighted in this report: the Community Watershed Monitoring Network and the RDN's groundwater monitoring initiative.

In 2007, the RDN's Drinking Water-Watershed Protection Stewardship Committee oversaw the preparation of the Drinking Water and Watershed Protection Action Plan, which was adopted by their Board in 2008. In a 2008 referendum, electoral area residents elected to approve a parcel tax which would enable the Action Plan to be implemented. The original Action Plan was in effect from 2009-2019. A new Action Plan has been created for 2020-2030, which also takes a longer term outlook on the following decades[18].

Groundwater Monitoring Initiative

Who is involved with the initiative?

The groundwater monitoring initiative is carried out by RDN in collaboration with the Province of BC and local private well-owners.

PHOTO BY RDN

What is monitored and how?

Beginning in 2011, through the Groundwater Monitoring project, RDN has collaborated with the province to expand the BC Groundwater Observation Well Network within the region, and create the RDN Volunteer Observation Well Network. For the Volunteer Observation Well Network, groundwater levels are monitored using privately owned wells in collaboration with local well owners. Through these efforts, 16 wells were added to the provincial network, and 31 private Volunteer Observation Wells were established in the regional district.

The RDN Volunteer Observation Well Network informed the creation of the Living Lakes Canada Columbia Basin Groundwater Monitoring Program which began in 2013. Staff of the two programs continue to exchange learnings and best practices for community groundwater monitoring[19].

What is the impact of the data?

The data from the Groundwater Monitoring project is used to inform the RDN Water Budget Project, an initiative intended to "examine the relationship between surface and groundwater, current water demands, and the long-term impacts of climate change."[20]

In early summer each year, the RDN prepares pre-summer groundwater water level reports which compare current groundwater levels with previous years. These reports are shared with municipal partners, water purveyors and landowners to provide an outlook on what the water supply could look like through the upcoming summer. This informs water management and any needed water usage restrictions during the summer months.

Why is the initiative effective?

The collaboration between RDN and the province has been instrumental to the success of this project. As this program has now been operating for over 10 years, the consistent funding made available through the parcel tax has supported the long-term operation of the program.

Community Watershed Monitoring Network

The Community Watershed Monitoring Network is a surface water monitoring program, which supports local community stewardship groups in collecting high-quality, long-term datasets in their local watersheds.

Who is involved with the initiative?

The Community Watershed Monitoring Network is a partnership between the Regional District of Nanaimo's Drinking Water and Watershed Protection program, the provincial Ministry of Environment and Climate Change Strategy (ENV), Mosaic Forest Management and many community-based stewardship groups.

In 2010, the RDN worked with the province to develop monitoring protocols for the program. RDN provides monitoring equipment and the province provides technical expertise to community stewardship groups that carry out the monitoring. Mosaic Forest Management supports the program through supporting access to monitoring sites on their lands, and providing safety equipment for participants going on private forestry land. 14 community stewardship groups are currently participating in the program.

What is monitored and how?

The program began with the monitoring of specific conductivity, turbidity, water temperature and dissolved oxygen. It has also completed nutrient sampling at sites.

For surface water quality, measurements are taken weekly for five weeks during the summer low flow period (August - September) and again, for five weeks during the fall flush period (October - November).

Participants receive annual training, and RDN supports the maintenance and calibration of equipment. The data is shared through the provincial water quality database. RDN supports the analysis of data collected, and annually reports to local streamkeepers organizations the findings of completed data analysis. To financially support the community stewardship groups in implementing those recommendations, RDN offers a Stewardship Seed Funding Program.

What is the impact of the data?

The Community Watershed Monitoring Program has supported a better understanding of the state of watersheds in the RDN, and has helped to identify and guide opportunities for restoration and improved watershed management. Many of these recommendations have been acted upon by community stewardship groups with support from the Stewardship Seed Funding Program.

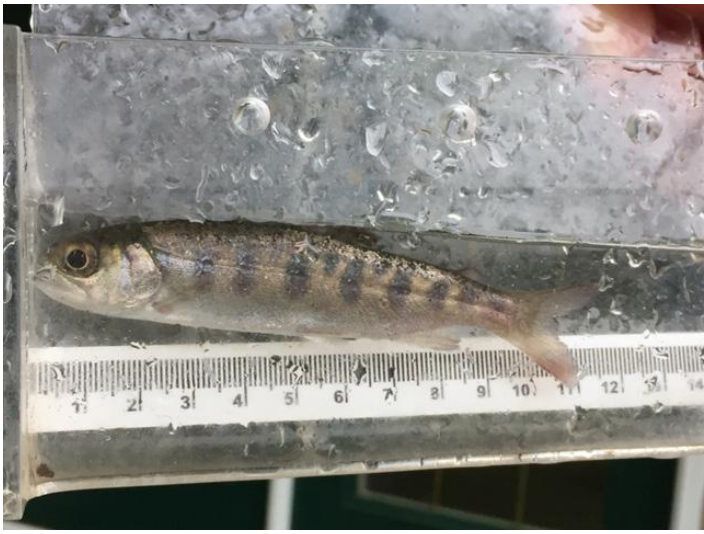


PHOTO BY RDN

One example of the program's success is the Departure Creek Spawning Channel. Local knowledge indicated that the creek was historically a spawning habitat for salmon, but salmon were no longer thriving in the stream. The Departure Bay Streamkeepers had been monitoring water quality on Departure Creek since 2012 and measured low levels of dissolved oxygen at certain locations in the stream. Year-round monitoring of dissolved oxygen was implemented to gain more information. The results of this monitoring indicated that the creation of an engineered side channel would improve the spawning habitat for salmon. This led to a collaborative effort to create a new spawning channel on Departure Creek, which was completed in 2022.

Why is the initiative effective?

The program has yielded high-quality, long-term water quality datasets. This outcome has been supported by the development of protocols in alignment with provincial standards and objectives, the availability of high-quality monitoring equipment, equipment maintenance and calibration facilitated by RDN staff, annual training sessions and a QA/QC protocol.

KEY ATTRIBUTES OF SUCCESSFUL USE CASES

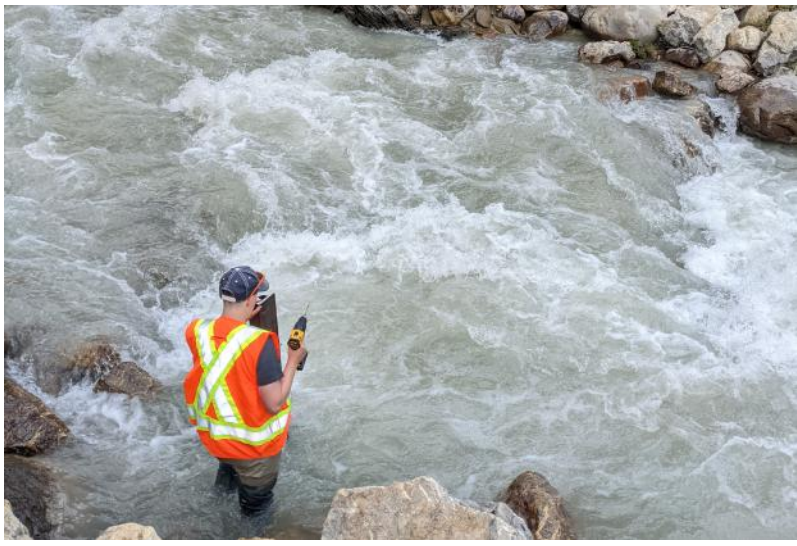
Through the examination of these five CBWM data use cases, several themes emerge that contribute to successful project implementation and increased data usage and application. The following observations may provide guidance to CBWM groups and the entities supporting them.

Collaboration across sectors and demographics

All of the use cases profiled here involve collaboration across sectors and demographics. Such collaborations have many benefits including the sharing of knowledge, experience and resources, garnering community support and endorsement of the projects, and building efficiencies through work that supports the objectives of multiple parties. Data users are more likely to trust and use the data if they have been involved in its collection.

Projects grounded in multiple knowledge systems

Similar to the theme of collaboration, grounding projects in multiple knowledge systems (e.g. Western science, Indigenous knowledge, local knowledge) can elevate the impact of the project outcomes. By drawing from the strengths of each distinct knowledge system, a multiple knowledge-systems approach allows for both a broader and deeper field of view that cannot be attained using one knowledge system in isolation.



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Using standardized methods and protocols

Where appropriate, the use of existing methods and protocols to collect, process, and analyze data can lead to the collection of higher quality data. It also results in data that can be compared with results from other projects. Where existing protocols are not appropriate or available, consultation with experts and advisors can lead to successful data collection.

Long-term datasets

For many purposes, a long-term dataset is required. The projects profiled in this report use a combination of long-term datasets collected by the projects themselves, accessing historical data, and learning from Indigenous knowledge and local knowledge to understand the long-term conditions of the watersheds. Accessing consistent funding is frequently a challenge for CBWM initiatives, and multi-year funding agreements or alternatives such as tax-based funds can facilitate the collection of long-term datasets.

Sharing the data

For data to be used, it must be made available to potential users. Data was shared in each of these five use cases, either directly with project partners or end-users, or publicly through open access databases. Sharing data in adherence with the FAIR Data Principles[21] (Findable, Accessible, Interoperable and Reusable) can lead to an increased usage of the data, although where First Nations Indigenous knowledge is used, the First Nations Principles of OCAP®[22] (Ownership, Control, Access and Possession) may take precedence. For data to be shared and used, appropriate data management and metadata tracking systems must be in place. The 2022 "Data Management System Options for Community-Based Water Monitoring Groups" report prepared by CMI provides further analysis of British Columbia CBWM data management systems and their capabilities[23].

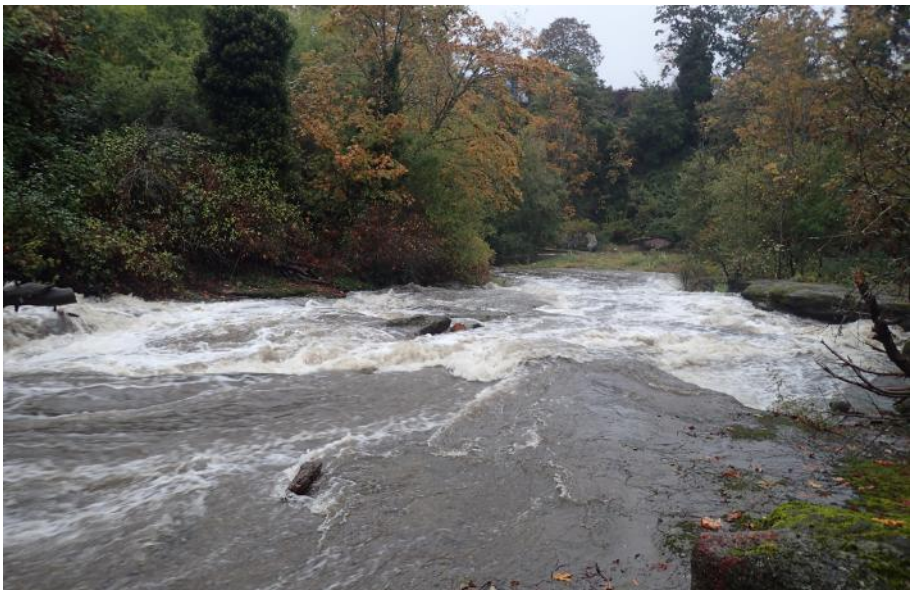
CONCLUSION

The use cases profiled in this report demonstrate the efficacy of CBWM programs, and the value of applying CBWM data and multiple knowledge systems to water stewardship initiatives. Many other use cases exist[24], which could be profiled in future reports.

Concurrently, many CBWM groups are collecting valuable data for which a use case has yet to be realized; there is untapped potential here whereby all levels of government could benefit from the efforts of CBWM groups. In 2018, Living Lakes Canada, WWF-Canada and The Gordon Foundation convened a national roundtable aimed at identifying actionable steps that governments can take to show leadership and support in advancing CBWM in Canada[25]. The outcomes of this roundtable were 60 recommendations, which were divided into the following themes:

1. Capacity building
2. Effective monitoring
3. Data management
4. Regional and national collaboration
5. Data to inform decision-making

Following these recommendations will help to bolster existing CBWM efforts and inspire new initiatives to emerge. Through capacity building, guidance on existing data collection, management and QA/QC protocols, integration of multiple knowledge systems, increased collaboration, long-term funding, and access to appropriate data sharing platforms, CBWM groups can continue to drive innovation and make valuable contributions to the water stewardship sector.



MILLSTONE RIVER / PHOTO BY RDN

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