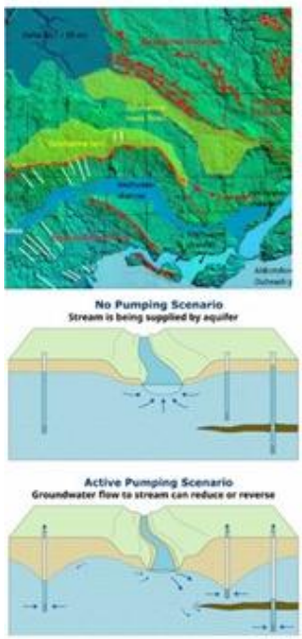
WATER SCIENCE SERIES

Compendium of Provincial Groundwater Science and Monitoring Projects: 2024-25



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Cover Photographs:
From left to right:
Geomorphic interpretation of aquifer mapping study area in the Lower Mainland. Source: Qin et al, 2025
Image from the Groundwater, Wells and Aquifer Story Map. Figure: T. Josephy
Drilling Provincial Observation Well 520. Photo: Ministry of Environment and Parks
Groundwater monitoring well at the Rithet's Bog. Photo: K. Rathfelder

Acknowledgements

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PREFACE

The B.C. Provincial Groundwater Program originated in 1961 when the *Water Act* was revised to enable the licensing of groundwater. The primary goals of the Groundwater Program are to increase the understanding of groundwater resources in British Columbia and to promote the sustainable management and protection of groundwater resources. To advance these goals, there is an ongoing need to improve scientific knowledge and monitoring of aquifer characteristics, groundwater availability, and groundwater interactions with surface water. This knowledge is central to the review of groundwater licence applications in accordance with the 2016 *Water Sustainability Act* (*WSA*) and supports the goals of sustainable allocation and use of groundwater resources and science-based policy development.

The Groundwater Program is jointly administered by the Ministry of Water, Land and Resource Stewardship (WLRS) and the Ministry of Environment and Parks (ENV). Currently, groundwater science and monitoring projects are primarily supported through two main funding envelopes:

- the Groundwater Science Program, administered by the Watershed Stewardship and Security Branch in WLRS; and,
- dedicated funding in ENV to support the expansion, management and maintenance of the Provincial Groundwater Observation Well Network (PGOWN).

The Groundwater Program also partners with other ministries and agencies in support of groundwater related studies including: the Ministry of Forests; the Ministry of Agriculture and Food, the Ministry of Energy and Climate Solutions, Geoscience BC, the BC Energy Regulator, universities, local governments, and First Nations.

This compendium is published under the *Water Science Series* to bring together a compilation of short summaries of the groundwater science and monitoring projects supported by the Province during the 2024-25 fiscal year. The intent is to communicate to a wide audience about the nature of the projects undertaken and to provide an overview of the project results. Linkages to key institutions, personnel and supporting references are provided within each summary.

CONTENTS

1. AQUIFER MAPPING

To effectively manage groundwater resources and the impacts of land development on groundwater availability and quality, it is essential to understand the existence and characteristics of B.C.'s aquifers. Identifying and mapping aquifers is often the first step in developing this understanding.

The Groundwater Wells and Aquifers (GWELLS) application is a primary source of groundwater information and data across the Province. The GWELLS database is used to: i) support and inform groundwater allocation and water rights; ii) prioritize groundwater management initiatives; iii) support the protection of groundwater quality and groundwater remediation efforts; and iv) serve as a public resource for groundwater data, information and education.

As of July 2025, the GWELLS database contained nearly 1,300 aquifers. The Province continues to conduct new aquifer mapping projects to expand and refine the database. The demand for aquifer mapping is ongoing as communities expand and new resource development projects are initiated. In addition, previously mapped aquifers are revisited periodically and updated as new information becomes available, or a more detailed level of assessment is required. Aquifer mapping studies are prioritized based on several factors including: i) local knowledge of emerging issues identified through regional work with communities; ii) the location of water wells in the provincial GWELLS database that are not yet associated with a mapped aquifer; and iii) the location of major resource development projects (e.g., mines, oil and gas).

In 2024-25, a key project refined aquifer mapping in Southern Langley and Abbotsford; an area which is geologically complex and has substantial groundwater development. WLRS also partnered with ENV to improve mapping of aquifers in the vicinity of PGOWN wells. Aquifer mapping was also conducted on eastern Vancouver Island to support the establishment of water reservations in treaty negotiations between the Crown and Indigenous Nations.

Aquifer mapping information is used in groundwater allocation and licensing decisions under the *Water Sustainability Act* and is available to the public to inform groundwater well protection and land use planning.

Spatial information about mapped aquifers can be accessed using the following tools:

- GWELLS – The Provincial database for storing, visualizing and retrieving water well records and aquifer information; and,
- iMapBC – allows users to view, visualize and analyze mapped aquifers along with hundreds of additional data layers compiled from across the BC Government and other agencies. The provincial aquifer layer (named "Aquifers - All") and is found under the heading "Fresh Water and Marine."

Southern Langley and Abbotsford Aquifer Mapping, Lower Mainland

Project Description

Southern Langley and Abbotsford have substantial groundwater development, population growth and complex hydrogeology. The Province initiated an aquifer mapping project in the Bertrand Creek and Fishtrap Creek watersheds to update and refine the hydrogeologic understanding of this area thereby supporting planning and decision-making related to the *Water Sustainability Act*. The study area is in an area of the Lower Mainland with thick unconsolidated deposits. The distribution of these deposits, including the coarse-grained, permeable deposits that form aquifers, reflects a particularly dynamic and complex geological history.

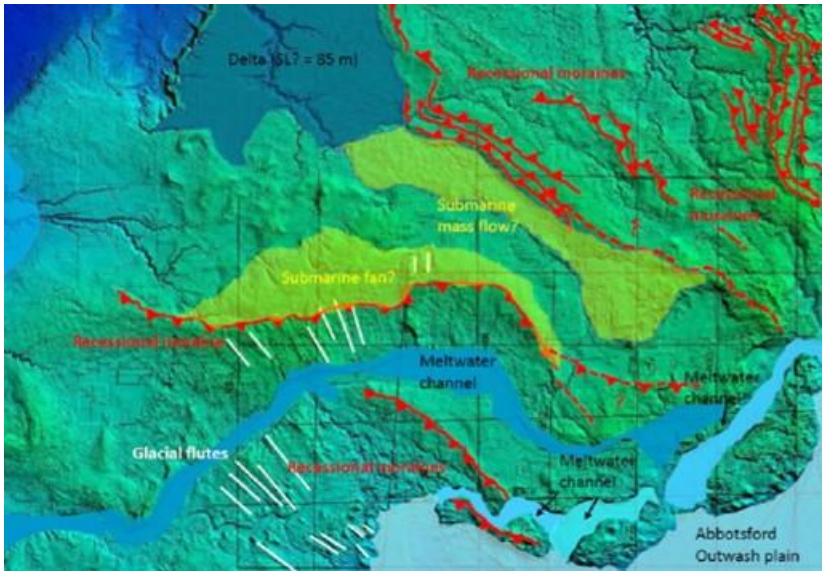

Figure 1: Geomorphic Interpretation of the Western Study Area

Project Outcomes

Eleven aquifers were mapped. The extensively studied Abbotsford-Sumas Aquifer (#15) was remapped into two separate, but hydraulically connected, aquifers named Abbotsford Shallow (#15) and Abbotsford Shallow West (#1297). Insights about shallow groundwater-flow systems were a key finding of this study. In the southern and eastern parts of the study area, surficial soils are coarse and well-drained with good hydraulic connections with local watercourses. In the northern and western areas, soils are less permeable resulting in lower groundwater recharge and greater shallow perched flow except where limited permeable windows are present. These observations are key to interpreting groundwater-surface water interactions and the impacts of development within the study area.

Relevance

This project will support development of a watershed-specific framework for informing groundwater licensing decisions and for managing water use during drought. Updated aquifer geometries and aquifer well correlations will be used to update the conceptual model of the watershed, assess hydraulic connection with surface water, understand inter-aquifer connections, and estimate aquifer demand. This work is key to addressing the backlog of groundwater licence applications received following outreach and compliance efforts in this highly developed and water scarce area.

Learnings and Recommendations

Shallow aquifers in the study area have limited connectivity with one another enabling management on an aquifer scale. Deeper aquifers may need to be managed conjunctively due to hydraulic connections, although some uncertainty remains in the magnitude of deep aquifer connectivity. Further study is recommended to the west and east of the study area where aquifers extend beyond the study limits.

References

Qin, K., J. Perreault, N. Gorski, J.P. Sacré and M. Bolton. 2025. Hydrogeological Mapping and Analysis, Bertrand Creek and Fishtrap Creek Watersheds. Water Science Series, WSS2025-05. June 2025. Prov. B.C., Victoria B.C.

Project Contacts

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Funding Acknowledgements:
Groundwater Science Fund

2. WATER MONITORING

Groundwater Monitoring

The Provincial Groundwater Observation Well Network (PGOWN) monitors groundwater conditions in aquifers across British Columbia through provincially managed groundwater observation wells. Groundwater level measurements collected through the network help inform water stewardship decisions across the Province. The two main objectives of the network are:

1. Understanding local and regional hydrogeological processes; and,
2. Supporting the sustainable use of groundwater.

Information collected through the PGOWN is publicly available through several Provincial portals:

- Groundwater Level Data Interactive Map – includes all PGOWN-related information, such as the location of active and inactive monitoring wells, links to observation well construction reports, and groundwater level data charts.
- Real-time Water Data Tool – is a browser-based information and data presentation system for access to continuous (time-series) surface, groundwater, and snow monitoring data.
- Drought Information Portal (Groundwater Conditions Map) – is a single source to access drought information and data across British Columbia, including groundwater percentiles and regional drought reports.
- Environmental Monitoring System (EMS) Web Reporting – is an online search tool for provincial environmental monitoring data, including groundwater quality information from the PGOWN.

The PGOWN was formally established in 1961 and the network has evolved with new observation wells added over time while other wells have been discontinued as priorities, staffing levels and funding levels have fluctuated. During the 2024-25 fiscal year, three new observation wells were drilled and added to the network; however, two of these wells were to replace existing, ageing PGOWN stations. These new observation wells are described in the following project summaries. As of July 2025, there were 238 active observation wells in the PGOWN, a reduction from 240 wells in July 2024 as 5 older and/or redundant stations were removed.

In addition to the PGOWN network, monitoring wells exist across the province to support a variety of initiatives and special research projects. These include wells operated in collaboration with neighbouring governments and First Nations. In some cases, these wells may eventually be integrated into the PGOWN network.

Surface Water Monitoring

The Province co-manages the Federal-Provincial Hydrometric Network with the Water Survey of Canada, which includes greater than 460 hydrometric stations across the province. Network operation costs are shared between the provincial and federal governments and 3rd parties. The majority of hydrometric stations are operated on larger river systems for a variety of objectives such as public safety, trans-boundary water management, and utility, transportation and resource management. The network focuses on the primary hydrometric parameters of water level and discharge with auxiliary parameters at select locations. Stations are operated in both real-time (telemetry) and non-real-time. Data are published through the government of Canada, *Water Office* website (https://wateroffice.ec.gc.ca/).

Some regions in BC conduct additional local hydrometric measurements to fill data gaps on smaller systems to support water management activities. Monitoring of surface waters helps provide insight into the interactions between aquifer-stream systems and provides a more complete picture of the water exchanges between the surface and sub-surface characterizing water resources.

Provincial Groundwater Observation Well #518, Westwold, B.C.

Project Description

The Provincial Groundwater Observation Well Network (PGOWN) monitors water levels and water quality in aquifers across B.C. to support effective and sustainable water management and to protect valuable groundwater resources.

Observation Well 518 (OW518) was installed in Provincial Aquifer 289, an unconfined sand and gravel aquifer in the Westwold Valley. This well was installed as a replacement for OW045, which is an ageing 1-inch well installed in 1965 and is scheduled to be decommissioned.

Drilling of Observation Well 518.
Photo: Ministry of WLRS.

Project Outcomes

OW518 was successfully installed in Aquifer 289 at a depth of 18 meters below ground surface (mbgs). The static water level in OW518 has ranged over the current period of record from a low of 8.50 mbgs in September 2024 to a high of 7.46 mbgs in May 2025. Telemetry was added to OW518 in February 2025 to provide real-time monitoring of groundwater levels. Hourly water level monitoring data is publicly available through the B.C. Groundwater Level Data Interactive Map and the provincial Aquarius time-series database. Water quality information is publicly available through the Environmental Monitoring System (EMS ID E335684).

Relevance

OW518 will replace OW045 as the only well installed in Aquifer 289, allowing for continuity of the groundwater level record insights on trends within this aquifer. The data from OW518 will inform water management decision-making in a water scarce area, as well as help understand the regional hydrogeologic setting.

Learnings and Recommendations

The drilling and installation of OW518 provides detailed lithological information and valuable insight into aquifer properties. The ongoing, real-time data will inform flood and drought management in the area.

References

Province of British Columbia. 2024. Well Record for Observation Well 518. GWELLS, Well Tag Number: 130861

Project Contacts

Caroline Wisheart | e-mail: Caroline.Wisheart@gov.bc.ca | Phone: 778-572-3826

Funding Acknowledgements:
WLRS South Area Regional Operations
ENV Groundwater Monitoring Program

Provincial Groundwater Observation Well #520, Smithers, B.C.

Project Description

The Provincial Groundwater Observation Well Network (PGOWN) monitors water levels and water quality in aquifers across B.C. to support effective and sustainable water management and to protect valuable groundwater resources.

Observation Well 520 (OW520) was installed in Provincial Aquifer 584, a confined sand and gravel aquifer in North Smithers, on the west side of the Bulkley River. This well was installed as a replacement for OW089, which was an ageing 1-inch well installed in 1968 and decommissioned in September 2024.

Drilling of Observation Well 520.
Photo: Ministry of ENV.

Project Outcomes

OW520 was successfully installed in Aquifer 584 at a depth of 89 meters below ground surface (mbgs). The static water level in OW520 has ranged over the current period of record from a high of 30.72 mbgs in November 2024 to a low of 31.46 mbgs in June 2025. Telemetry was added to OW520 in May 2025 to provide real-time monitoring of the groundwater levels. Hourly water level monitoring data is publicly available through the B.C. Groundwater Level Data Interactive Map and the provincial Aquarius time-series database. Water quality information is publicly available through the Environmental Monitoring System (EMS ID E335944).

Relevance

OW520 is the only observation well currently installed in Aquifer 584 and will provide insights on groundwater level trends within the aquifer. The data collected from OW520 will inform groundwater licensing and water management decisions, as well as help understand the regional hydrogeologic setting.

Learnings and Recommendations

The drilling, installation and pumping test at OW520 provided detailed lithological information and valuable insight into aquifer properties. The ongoing, real-time data will inform flood and drought monitoring in the area.

References

Province of British Columbia. 2024. Well Record for Observation Well 520. GWELLS, Well Tag Number: 130965.

Project Contacts

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Funding Acknowledgements:
WLRS Skeena Regional Operations
ENV Groundwater Monitoring Program

Provincial Groundwater Observation Well #521, Comox, B.C.

Project Description

The Provincial Groundwater Observation Well Network (PGOWN) is intended to monitor groundwater conditions in selected aquifers throughout B.C. to support water management. With input from the Tsolum River Restoration Society and K'ómoks First Nation, Provincial Observation Well 521 (OW521) was installed to monitor groundwater level conditions in the western extents of Provincial Aquifer 408 (Comox-Merville), an unconfined sand and gravel aquifer that is a significant water resource for nearby communities and agriculture.

Completed OW521 with stickup and well cap.
Photo: C. McKenzie

Project Outcomes

OW521 was drilled in February 2025 to a depth of 60 meters below ground surface (mbgs) with bedrock at 58.2 mbgs. The expected Quadra Sands deposit associated with Aquifer 408 was not encountered, and instead a heterogeneous, undifferentiated surficial deposit extended all the way to the bedrock. OW521 was screened from 52.8 to 54.3 mbgs, at the bedrock contact, although there was very little water in the well. The water level quickly rose in the well and as of June 2025, groundwater levels were less than 2 mbgs. A pumping test will be completed in the future to assess well yield and aquifer characteristics.

Relevance

Comox-Merville is an area with significant reliance on groundwater extraction. The drilling of OW521 was able to determine the depth to bedrock and delineate the absence of sandy Aquifer 408 sediments.

Learnings and Recommendations

Despite a low water yield and the absence of Quadra Sands, the groundwater level in OW521 is very close to the surface. Aquifer 408 does not appear to be present at this location, and the aquifer may not be as contiguous as previously thought. There does appear to be groundwater in the area even though the sediments are not typically high yielding. Future hydraulic testing will be completed to assess well performance and aquifer properties.

Partners and Linkages

This project was completed with assistance from K'ómoks First Nation, the K'ómoks Guardian Watchmen, and the Tsolum River Restoration Society.

Project Contacts

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Funding Acknowledgements:
WLRS West Coast Regional Operations
ENV Groundwater Monitoring Program

Long-term Trends in Groundwater Levels, BC

Project Description

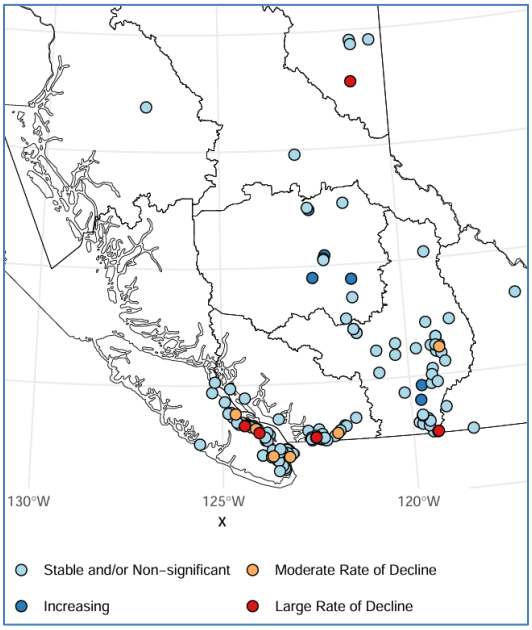
Every 5 years, Environmental Reporting BC analyzes groundwater level data from the Provincial Groundwater Observation Well Network (PGOWN) to determine aquifer trends across the province.

Project Outcomes

This project was completed in 2024 and published to the Environmental Reporting BC website. This includes an interactive map, results summary, PDF report and public access to the coding used to run the analysis. This iteration of the PGOWN groundwater level trends report included a more comprehensive analysis of monitored aquifers, such as being able to select between 10- or 20-year trends and monthly or annual trends.

Relevance

Groundwater is an essential source of water for British Columbians. One in four people in BC rely on groundwater for drinking water. It also provides water for industry, municipalities, and farms. This analysis will be used to assist resource managers in water management decisions, including the issuance of water authorizations.



10-year annual groundwater level trends results.
Image: Environmental Reporting BC

Learnings and Recommendations

Most of the analyzed aquifers in B.C. are considered stable or do not exhibit a statistically significant trend; however, exact results depend on the time-period of interest (i.e. results from the most recent 10 years differ from results from the entire time series). The results for the 10-year annual trends demonstrated that 8% of analyzed aquifers had declining groundwater levels, compared to 9% that were rebounding.

Partners and Linkages

This work was spearheaded by Environmental Reporting BC with input from groundwater staff at the Ministry of Environment and Parks and the Ministry of Water, Lands and Resource Stewardship.

References

Province of British Columbia. 2024. Long-term Trends in Groundwater Levels in BC. Environmental Reporting BC.

Project Contacts

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3. GROUNDWATER CHARACTERIZATION AND RESEARCH

The Provincial Groundwater Program supports ongoing groundwater science, research and data projects to promote effective groundwater resource stewardship and to provide a technical basis for groundwater policy development.

In 2024-25, groundwater–surface water interaction studies continue to be an area of focus. These studies have encompassed a variety of methods and objectives, and most have been largely field-based. Integrated hydrological modeling has also been used characterize regional groundwater flow, streamflow regimes and groundwater–surface water (GW-SW) exchange. A pilot project that integrated a GIS desktop study with outreach, and compliance & enforcement demonstrated how science can address pressing water management issues, such as drought response and water scarcity in a high-risk, hydraulically connected watershed.

Research into drought and extreme events also continued in 2024-25, with the River Forecast Centre and the Pacific Institute for Climate Solutions both funding projects to better understand and predict these events. In addition, work continues to improve access to groundwater information and data in B.C. through the compilation of various datasets into GWELLS.

Studies to characterize the location and dynamics of groundwater – surface water interactions included:

- Investigation of Seasonal Groundwater Contributions to Streamflow Using an End Member Mixing Analysis (EMMA) Approach, Carnation Creek Watershed;
- Groundwater-Surface Water Exchange Dynamics in Low Gradient and Tidally Influenced Streams in the Lower Fraser Valley;
- Rithet's Bog Groundwater Study, Saanich, B.C.;
- Fishtrap Creek Watershed Pilot Project – Abbotsford, B.C.;
- Tsolum River Fiber Optic Distributed Temperature Sensing Pilot (Year 1), Comox, B.C.

Studies that focus on the role of groundwater in times of drought and water scarcity

- Drought and Deluge: Informed Water Allocation Decision Making in a World of Intensifying Hydrologic Extremes;
- Groundwater Drought Forecasting

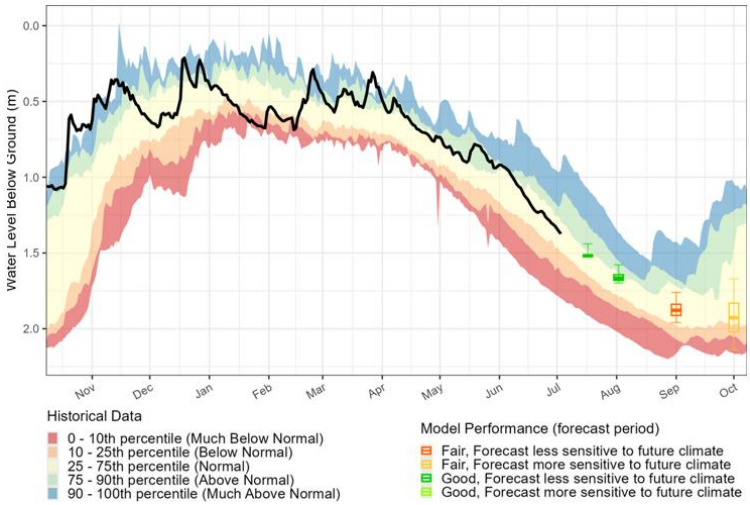
Projects that support accessing and processing provincial data to support watershed management and groundwater science and research:

- Enhancing Access to Provincial Groundwater Science and Data;
- An Overview of LiDAR for Watershed Applications in British Columbia

Groundwater Drought Forecasting

Project Description

Groundwater drought can pose a major threat to maintaining stream baseflows and water supply in B.C. This project developed a new groundwater level forecasting model to support drought management across the province. This tool builds on existing monitoring through the Provincial Groundwater Observation Well Network (PGOWN) by providing predictive insights, rather than relying solely on the latest observed conditions. By offering early warnings of declining groundwater levels, the model supports improved drought preparedness and water resource planning.



Example output figure (OW128) from the groundwater level model forecast showing recent groundwater levels (black line) and forecast water levels (range bars) against historical percentiles (coloured ribbons).

Project Outcomes

The forecast model utilized a machine learning-based approach capable of forecasting groundwater levels up to 90 days in advance for the 184 wells that were analyzed within the PGOWN. Once completed and implemented, the following products will be available:

- A web-based map displaying the likelihood of groundwater levels being below normal during forecast periods;
- Outputs for each forecasted well showing figures of observed levels and forecasted ranges, along with tables of likelihood estimates for various groundwater conditions; and
- Documentation of model performance and suitability for operational use.

Relevance

This project lays the foundation for expanding groundwater forecasting capacity and integrating it into provincial water resource planning tools to support proactive drought management. It enhances the Province's ability to anticipate low groundwater levels and complements existing monitoring by adding predictive capacity to groundwater assessment tools. Furthermore, the analysis supports the PGOWN network by enabling real-time review of station data and identifying priority areas for monitoring and management—helping to optimize resource allocation and strengthen drought response strategies.

Partners and Linkages

This project expands and operationalizes work completed in previous years through groundwater and drought-related projects led by Dr. Diana Allen at Simon Fraser University (SFU). This project is led by the River Forecast Centre in collaboration with SFU and staff in the Ministry of Water, Land and Resource Stewardship, and Ministry of Environment and Parks.

Project Contacts

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Bryan Jackson | e-mail: Bryan.Jackson@gov.bc.ca | Phone: 778-572-2159

Funding Acknowledgements:
ENV Groundwater Monitoring Program

Drought and Deluge: Informed Water Allocation Decision Making in a World of Intensifying Hydrologic Extremes

Project Description

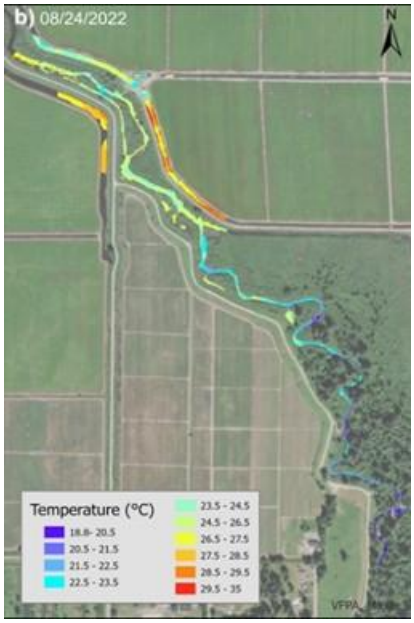
Climate change is resulting in shifting hydrologic regimes which are increasingly accompanied by intensified extremes, including heavy rain events and prolonged drought periods. This PICS Opportunity Project focuses on developing a strategy for building resilience in light of the impacts of climate extremes, specifically through decision support tools intended to support water allocation decision-making.

Summary of Project Outcome

Simon Fraser University hydrologists have partnered with Ministry of Water, Land and Resource Stewardship staff in the South Coast Region to 1) understand how coastal watersheds respond to extreme climate; and 2) identify tools that can be used to aid in water allocation decision-making.

Relevance

Currently, water licences are issued in perpetuity; however, under s. 23 of the *WSA* a Water Manager may direct a licensee to submit to a review of the terms and conditions of their licence. There is currently no guidance on when, where (e.g., focus on selected areas) or how to do this review. The review offers a window of opportunity to introduce new terms and conditions for the water licence (e.g., monitoring, or a reduction in the water licence volume) to address climate extremes. In this regard, the Province is seeking input on what to consider when water licences are reviewed and what new terms and conditions could be introduced.



Drone thermal infrared image of the North Alouette River (Antesz, 2024)

Learnings and Recommendations

Year 3 of this project saw the completion of three sub-projects which primarily focused on; 1) stream temperatures, nitrate concentrations, and stable isotopes in precipitation and waters (Antesz, 2024); 2) integrated hydrological modeling of the North Alouette and Bertrand Creek watersheds; and 3) analysis of groundwater level responses to extreme precipitation events and drought in provincial observation wells. Additional sub-projects are ongoing including; 1) numerical modeling of pumping effects on recession rates (individual wells and at the watershed scale); 2) the evolution of hydrological conditions of Bertrand Creek watershed since 1937, specifically the water balance due to the cumulative effects of pumping; and 3) a field-based investigation of water use for holly (invasive) vs western redcedar (native) at study sites on Galiano Island and the Malcolm Knapp Research Forest.

Partners and Linkages

Diana Allen (Earth Sciences) and Jesse Hahm (Geography), Simon Fraser University
Marc Porter, Pacific Salmon Foundation
Eric Saczuk, British Columbia Institute of Technology

References

Antesz, L. (2024). *Investigating temperature dynamics and evaluating thermal infrared (TIR) remote sensing in the North Alouette River, British Columbia* (Master's thesis, Simon Fraser University). https://summit.sfu.ca/item/39087

Project Contacts

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Funding Acknowledgements:
Groundwater Science Fund

Investigation of Seasonal Groundwater Contributions to Streamflow Using an End Member Mixing Analysis (EMMA) Approach, Carnation Creek Watershed

Project Description

This year-long field experiment at Carnation Creek watershed, on Vancouver Island, aims to sample streamflow and estimate groundwater contributions during different hydrological periods to determine the seasonal and geographical components of groundwater to surface flow. Using End Member Mixing Analysis (EMMA), a mass balance model, the project analyzes stable isotope ratios, electrical conductivity, and water temperature from samples of streams, groundwater, and precipitation to understand changes in water sources over time and space.

Carnation Creek
Photo: D. Lamhonwah

Project Outcomes

Learning and recommendations from this project are expected to enhance the understanding of the seasonal and annual nature of groundwater contributions to streamflow in coastal watersheds. Comparing findings with other watersheds exhibiting similar groundwater and surface water interactions will enhance our understanding of coastal versus interior B.C. watersheds. This comparison will inform geographically variable decision-making regarding water use in the province, and ultimately support water allocation and drought planning decisions in British Columbia.

Relevance

Drought and increased groundwater demand in the province underscore the need to understand how the location and seasonal timing of groundwater contributions to streamflow may affect aquatic ecosystems and the availability of water for human use.

Learnings and Recommendations

Water samples from upper catchment groundwater seeps are characterized as having consistently high electric conductivity (an indication of high ion concentration) and lower temperatures throughout the year relative to water sampled in the lower stream and tributaries of the watershed. This characterization suggests that upper catchment groundwater sources may be an important source of nutrient-rich, cooler water during the summer months in the catchment. Stable isotope analysis results suggest shallow storage of groundwater resulting in a rapid hydrological response following rainfall with limited long-term storage of rain in the subsurface.

Partners and Linkages

Samples were analyzed for stable isotopes by Edward Hornibrook, PhD, Professor of Biogeochemistry, at the Fipke Laboratory for Trace Element Research, University of British Columbia Okanagan.

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Funding Acknowledgements:
Groundwater Science Fund

Fishtrap Creek Watershed Pilot Project – Abbotsford, B.C.

Project Description

The Fishtrap Creek Watershed Pilot Project is a multi-year initiative led by the South Coast Region to develop a watershed-scale approach to groundwater and surface water management using the tools available under the *Water Sustainability Act* (*WSA*). Work on the Project began in 2023 and is ongoing. The Project integrates GIS, outreach, compliance & enforcement, and drought response to address water scarcity. This work represents a new approach to address unauthorized groundwater use in a high-risk, hydraulically connected watershed. Hydrogeological science and environmental flow needs assessment work is in the early stages and will be expanded. The Project is intended to inform scalable approaches for priority watersheds and to support licensing that enables effective and sustainable water management.

Fishtrap Creek Watershed. iMapBC

Project Outcomes

A preliminary conceptual model developed to characterize the hydrogeological and hydrological conditions will be refined using recent aquifer mapping (Qin et al., 2025). The project also included a comprehensive assessment of unauthorized groundwater use, supported by targeted outreach and compliance actions over a two-year period, resulting in a significant increase in licence applications, which will lead to a reduced number of unauthorized users.

Relevance

Fishtrap Creek is a transboundary, flow-sensitive watershed with critical habitat for *Species at Risk Act* (*SARA*)-listed species, high agricultural water demand, and extensive unauthorized use. The Project supports provincial goals for sustainable water allocation, ecosystem protection, reconciliation, and agricultural water use. Most unauthorized users (>100 historical farms) would have qualified for existing use (had they applied before March 1, 2022) and currently need to be brought into compliance. Water licences are the primary tool for managing water use, and unauthorized users cannot be effectively managed under the *WSA*.

Learnings and Recommendations

The Project has shown that desktop studies and outreach, combined with targeted compliance actions can effectively address and reduce unauthorized use. However, field-based outreach was essential, as mailouts were insufficient to drive application uptake. Licensing decisions should balance ecological, agricultural, and Indigenous values—particularly in flow sensitive watersheds with species at risk. A limited-term licensing approach with monitoring clauses is being considered to support adaptive management. A draft decision-making framework and licence clauses are in development and have not yet been implemented. Work is also underway on a water demand model, and a curtailment model as well as additional hydrometric and shallow groundwater monitoring. These efforts will lay the groundwork for a future Adaptive Water Management and Allocation Plan for the Fishtrap Creek watershed.

Partners and Linkages

Ministry of Agriculture and Food, and Ministry of Forests (Natural Resource Officer Service)

References

Qin, K., Perreault, J., Gorski, N., & Sacré, J. P. (2025). Hydrogeological Mapping and Analysis, Bertrand Creek and Fishtrap Creek Watersheds. Water Science Series: WSS2025-05. Province of British Columbia.

Project Contacts

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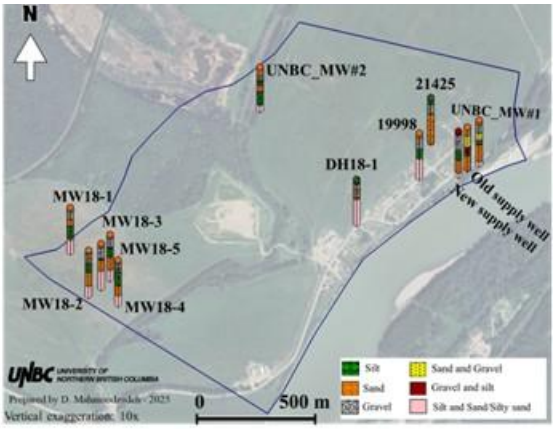
Funding Acknowledgements:
WLRS Permitting Transformation Division
Authorizations – South Coast Region

Groundwater Protection Towards Sustainable Management of Water Supply for a Northern BC Indigenous Community: Insights from Field Observation, Numerical Modelling, Laboratory Experiments, and Community Engagement

Project Description

Safe water supply in Lheidli T'enneh First Nation (LTFN) has become a challenge due to a lack of information on the community aquifer and its interaction with the Fraser River. Limited knowledge is available on the aquifer supplying water to the Shelley Reserve community. Therefore, it is of great importance to better understand the aquifer and local groundwater trends. The overall goal of this project is to develop a groundwater protection plan for water supply from aquifers in the Shelley Reserve community through partnership with LTFN.



Locations of vertical lithology wells at the study site

Project Outcomes

2024-2025 was the first year of this multi-year project. To date, a field monitoring program has been implemented. The successful drilling and development of two new monitoring wells, combined with data from existing wells, provided valuable insights into the subsurface lithology and hydraulic properties of the aquifer system. Slug tests conducted on the monitoring wells and pumping tests from the supply wells allowed an estimation of the aquifer's hydraulic conductivity, transmissivity, and storativity. In addition, 3D modelling of the stratigraphy of the study area has been developed and verified. In the next phase of the project, the aquifer vulnerability, groundwater and surface water quality analysis, supply well capture zone, source water protection plan, and the numerical model boundary conditions will be determined, and the variables and parameters of the 3D numerical model will be developed.

Relevance

A recent review by McElhanney and Western Water Associates Ltd. identified deficiencies and challenges in the community's water well system. This project will address these issues through a holistic approach that combines field observations, laboratory experiments, numerical modeling, and community engagement.

Learnings and Recommendations

A subsurface geological model was developed based on well lithological data, providing a conceptual understanding of the area's geological structure. A rigorous monitoring network would support the validation of the groundwater model.

Partners and Linkages

This is a joint project between the University of Northern British Columbia and the Lheidli T'enneh First Nation.

References

Mahmoodzadeh, D., J. Yin, and J. Li, 2025. Impact of Cumulative Groundwater Withdrawal on Surface Water and Groundwater Interaction in the Stoney Creek Watershed. Water Science Series, WSS2025-04. Province of British Columbia, Victoria.

Project Contacts

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Funding Acknowledgements:
NSERC Alliance Advantage Grant,
Lheidli T'enneh First Nation,
Indigenous Funding program (IFP)

Groundwater-Surface Water Exchange Dynamics in Low-Gradient and Tidally-Influenced Streams in the Lower Fraser Valley

Project Description

This study examines groundwater–surface water (GW-SW) exchanges in low-gradient, tidally influenced streams of the Lower Fraser Valley. A three-dimensional, integrated hydrological model—built in MIKE SHE (DHI, 2023) and coupled to an expanded MIKE 11 river network—is being developed to characterize regional groundwater flow, streamflow regimes and GW-SW exchange. An empirical analysis of hydrometric data complements the model by classifying stream behaviour, including the presence or absence of tidal influence and generating stage-variability indices. The joint insights from modelling and empirical work will be related to patterns of aquatic-habitat availability and connectivity, informing evaluations of ecological impacts of water withdrawals.

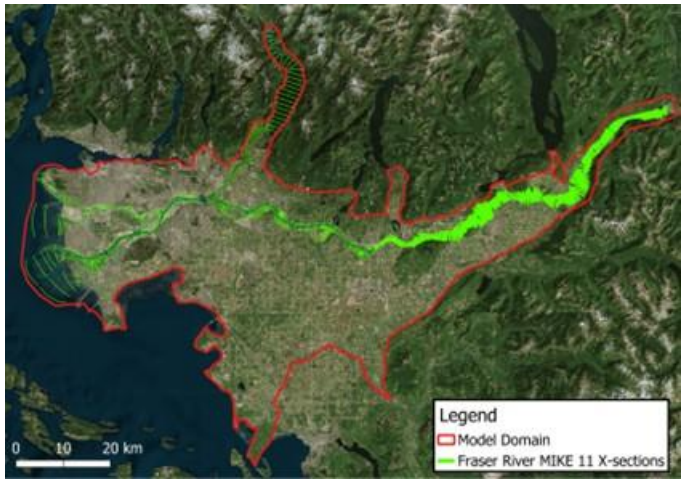

Figure 1. MIKE model domain and MIKE 11 River cross-sections.

Summary of Project Outcome

The overall project goal is to improve understanding of GW–SW dynamics in low-gradient, tidally influenced streams to support Environmental Flow Needs (EFN) assessments in coastal lowland streams.

Relevance

Low-gradient, tidally influenced streams display flow cessation, oscillations, and reversals that preclude use of standard EFN assessment methods. There is currently no BC methodology that supports implementation of the *Water Sustainability Act* (*WSA*) for these tidally influenced channels. Our results will guide groundwater licensing under the *WSA* and advance the South Coast Region's five-year water-management plan.

Learnings and Recommendations

Over the past year we have analysed stage records to detect tidal signals, revealing the inland reach of marine forcing and its influence on GW-SW exchange during summer baseflow periods. New stage-variability metrics are being used to classify stream behaviour, and the tidal test is being applied to nearby monitoring wells to see whether shallow aquifers share the marine signature. In parallel, while the integrated hydrologic model is advancing, the Simpson (2012) geological framework is being expanded east to Surrey, west to Chilliwack, and north of the Fraser.

Partners and Linkages

Department of Earth Sciences, Simon Fraser University
South Coast Region, BC Ministry of Water, Land and Resource Stewardship
B.C. River Forecast Centre

References

DHI. (2023). MIKE SHE User Manual.

Simpson, M. 2012. Assessing Risk to Groundwater Quality Using an Integrated Framework. M.Sc. thesis, SFU.

Project Contacts

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Funding Acknowledgements:
Groundwater Science Fund

Rithet's Bog Groundwater Study, Saanich BC

Project Description

Rithet's Bog, situated within the Colquitz river watershed, is a 42-hectare nature sanctuary, and the last remaining bog ecosystem in the Greater Victoria area. The watershed has been extensively altered to facilitate development resulting in highly variable streamflow and decreased groundwater discharge. Downstream of Rithet's Bog, the watershed hosts several fish species which have declined from historical levels. Rithet's Bog plays a key role within the watershed in buffering seasonal variation in downstream flow through water storage and nutrient uptake while providing important habitat for native plants and wildlife with limited local distribution. Although restoration actions have created some improvements, low summer water levels are an issue, re-establishing native vegetation has been challenging, and further restoration actions are needed.

In Phase 2 of the study, precipitation, surface water and groundwater stations were monitored for water quantity and quarterly water quality monitoring was conducted to integrate water quantity information with water chemistry enriching the understanding of site conditions. This monitoring is now largely complete and results have been provided to the District of Saanich for planning purposes. Limited ongoing monitoring will be carried out at key sites.

GeoBC also collaborated with the District of Saanich to assist with the collection of high-resolution imagery and elevation data using a DJI M350 quadcopter drone and the L1 Lidar scanner and P1 Sony camera payloads. The L1 scanner collected digital elevation point data that was used to create a detailed model of the ground surface. The entire bog area was flown with the P1 camera and a high resolution orthoimage was created.

Figure 1: Groundwater monitoring within an area near the wetland inlet
Photo: K. Rathfelder

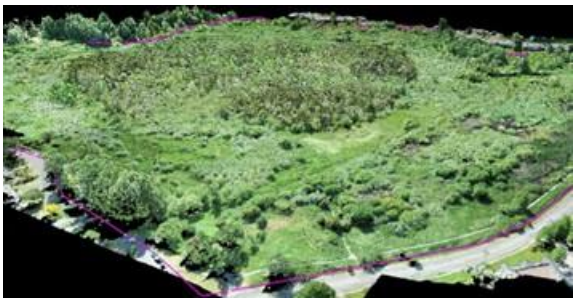

Figure 2: 3D view of LiDAR Survey data

Project Relevance

This research is assisting the District of Saanich with restoration and drainage planning. Results of this study will also inform how the Province characterizes wetlands and groundwater interactions, and can inform how municipalities can better support wetlands in urban planning.

Partners and Linkages

The Province is partnering with the Rithet's Bog Conservation Society and the District of Saanich to provide information and analysis that will support updates to Saanich's drainage planning or additional actions to support restoration. Collaboration with Vancouver Island University and the BC Conservation Foundation has allowed for characterization of 6PPD-quinone concentrations in stormwater.

Project Contacts

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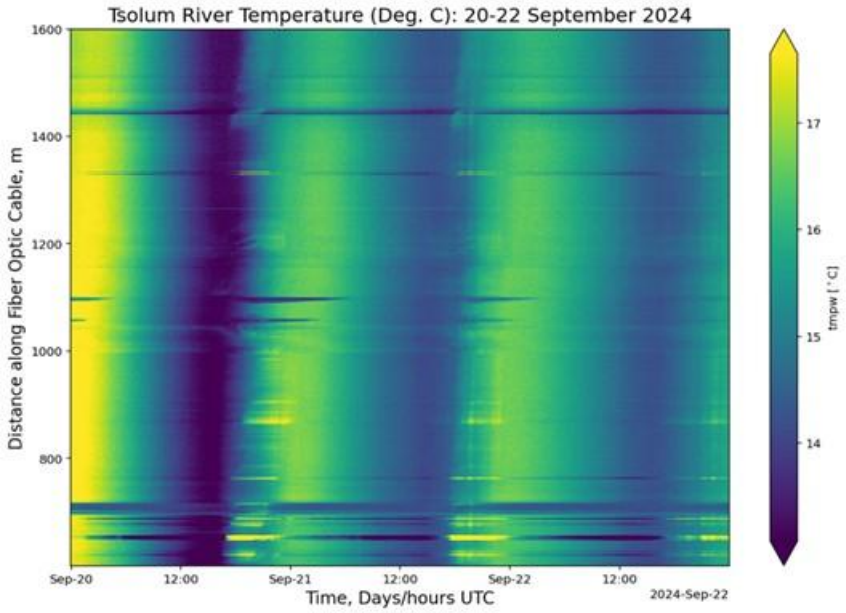
Funding Acknowledgements:
Groundwater Science Fund

Tsolum River Fiber Optic Distributed Temperature Sensing Pilot (Year 1), Comox, B.C.

Project Description

In August 2024, a pilot project was started on the Tsolum River to test the use of fiber optic distributed temperature sensing (FO-DTS) technology for collection of high temporal and spatial resolution stream temperature data. The objectives were to improve understanding of groundwater discharge to the Tsolum River and to inform when and how the FO-DTS technology might benefit water management science across the Province. Staff from the Ministry of Water, Land and Resource Stewardship (WLRS), the K'ómoks First Nation (KFN), and project partners deployed 1750 m of fiber optic cable from August to October 2024 to monitor the transition from low flow to the start of the fall rainy period. Temperature readings were collected at a spatial resolution of 0.25 m along the cable initially at 5-minute intervals.



Data output from the Tsolum River FO-DTS showing temperature distribution over 72-hrs (20-22 September 2024) and 1000 m of cable. Daily river patterns are shown vertically, and constant blue horizontal lines indicate the location of groundwater inputs.

Project Outcomes

2024-25 was the first year of a two-year project. In its first year, the pilot project successfully demonstrated the application of the FO-DTS technology by characterizing the location and temporal variation of three groundwater inputs, which can potentially support restoration and enhancement planning work to provide cold-water refugia for salmon. The temperature data is also intended to support temperature modeling on the Tsolum River being conducted by the Hakai Institute and Nanwakolas Council as part of their "50 Watersheds Project" funded by BC Salmon Restoration and Innovation Fund.

Relevance

The pilot project is trialing an emerging temperature monitoring technology in support of WLRS's and KFN's goal of ensuring the "highest environmental standards through monitoring". The objectives of the pilot are to understand when and how to use this technology, and to collect monitoring data to support co-management decisions on restoration, habitat enhancement, and recovering Tsolum River salmon populations. The characterization of groundwater – surface water interactions also supports drought management activities and water licensing.

Partners and Linkages

The FO-DTS pilot project was conducted in partnership with the WLRS Aquifer and Watershed Unit, West Coast Water Protection Branch, and KFN. Additionally, the project was heavily supported by the Tsolum River Restoration Society , Centre of Transformative Environmental Monitoring Programs, Department of Fisheries and Oceans Canada, and the Pacific Salmon Foundation.

Project Contacts

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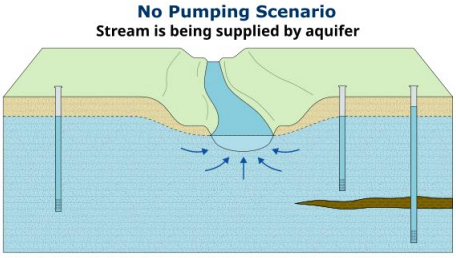
Funding Acknowledgements:
Groundwater Science Fund

Enhancing Access to Provincial Groundwater Science and Data

Project Description

The provincial groundwater team endeavours to share and communicate groundwater data and information to a broad audience including provincial staff, water professionals and the general public. This ongoing effort includes creating new web-based tools, enhancing existing data platforms and publishing scientific research.



The Groundwater, Wells and Aquifers Story Map uses interactive figures to explain groundwater concepts in plain language
Figure: T. Josephy

Project Outcomes

Efforts over the past year to communicate and share provincial groundwater science and data have included:

- Publication of updated aquifer factsheets for nearly 1,300 provincially mapped aquifers. The updated factsheets were published in March 2025 and are available through the Aquifer search tab in GWELLS.
- The review of historical public utility documentation and the upload of hydraulic testing interpretations and raw data files to the associated well records in GWELLS.
- Development of a data sharing agreement so that 3rd party groundwater data can be included and accessed through provincial databases.
- Inclusion of monitoring data from volunteer observation wells, operated by Living Lakes Canada, within the Aquarius database and on the Aquifer factsheets.
- Publication of more than a dozen scientific reports though the Water Science Series.
- The development and publication of the Groundwater, Wells and Aquifers in BC Story Map; an online story map that provides a concise and easy-to-understand explanation of groundwater related concepts that are most relevant in BC.

Relevance

Timely access to provincial groundwater data and research supports sustainable water management and defensible decision making by improving the body of knowledge used by decision makers, academics and water professionals. It also improves transparency and accountability related to water resource management and facilitates the advancement of groundwater science across the province.

Learnings and Recommendations

Alongside making technical data and research easily accessible, it is also important to summarize complex scientific concepts into plain language so that the public can gain an understanding of the groundwater concepts and water regulations.

Partners and Linkages

We worked in collaboration with Living Lakes Canada to integrate 3rd party volunteer observation well data into government groundwater resources.

Project Contacts

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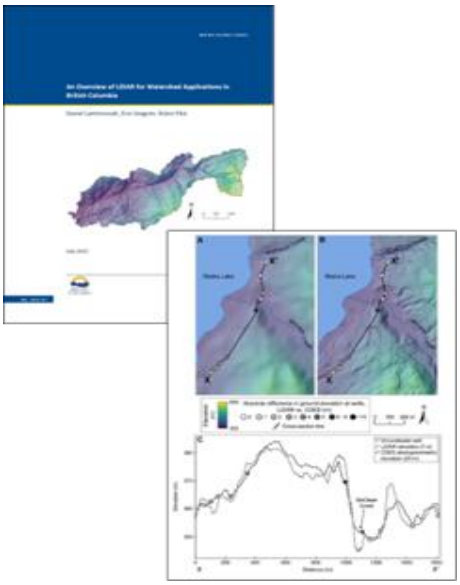
Funding Acknowledgements:
Groundwater Science Fund

An Overview of LiDAR for Watershed Applications in British Columbia

Project Description

This report, part of the Water Science Series, introduces foundational LiDAR (Light Detection and Ranging) concepts and highlights derivative products relevant to watershed applications. It defines commonly used LiDAR terminology and incorporates visualizations to support reader understanding.

The report is organized into two main sections. The first, *LiDAR Background,* introduces fundamental LiDAR concepts, lists LiDAR data sources, and discusses the benefits, requirements and challenges of applying LiDAR in watershed contexts. The second section, *LiDAR Derivative Products,* describes information generated from LiDAR datasets — such as digital elevation models (DEMs), digital surface models (DSMs) and provides examples of how these products can be used to characterize watershed features including applications for groundwater.



Ground elevation data collected by LiDAR used for assessment of hydraulic gradients, and surface water and groundwater exchange

Project Outcomes

The objective of this report is to provide readers with foundational knowledge related to LiDAR and its potential applications within their watershed(s) of interest by facilitating a more thorough understanding of watershed characteristics.

Relevance

High-resolution LiDAR data and derivative products—such as digital elevation models (DEMs) and digital surface models (DSMs)—are becoming increasingly available across most regions of British Columbia. However, the widespread use of LiDAR in watershed characterization remains more limited. This report was developed to encourage broader adoption of LiDAR and its derived products by showcasing a range of practical applications tailored to watershed-focused analyses.

Partners and Linkages

Project partners included a team of subject matter experts in remote sensing and geospatial analysis internal to the Province of British Columbia who reviewed the report. A full list of contributors is included in the report.

References

Alberta Environment. 2011. Alberta Environment Guide to Groundwater Authorization. Government of Alberta.

Lamhonwah, D., E. Seagren and R.G. Pike, 2025. An Overview of LiDAR for Watershed Applications in British Columbia. Water Science Series: WSS 2025-07. Province of British Columbia, Victoria.

Project Contact

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4. SOURCE WATER PROTECTION

In 2023, the Ministry of Water, Land and Resource Stewardship (WLRS) implemented a Source Water Protection Program to manage drinking water sources and protect public health. With approximately 5,000 water systems across British Columbia—most of which rely on groundwater—protecting source water is essential to ensuring long-term drinking water safety.

Historically, source water protection in B.C. has been limited and fragmented, with unorganized data, unclear jurisdictional leadership, and a reactive regulatory approach. These gaps were highlighted in the 2019 Office of the Auditor General Report and continue to pose risks to human health. In response, WLRS is advancing a coordinated, science-based approach to source water protection, which is the first step in the multi-barrier approach to protecting drinking water.

The Source Water Risk Assessment Framework has been designed to identify and manage hazards to drinking water sources. It supports the development of transparent, accessible, and proactive tools to inform planning and reduce risks to source water. The four steps include:

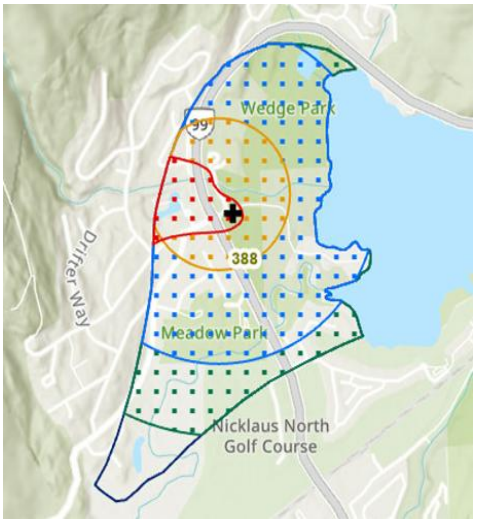
1. Identify drinking water systems and their source waters - locate and map drinking water systems, delineate source areas and protection zones.
2. Identify potential hazards - identify potential hazards near intakes or wellheads and within source areas, assess susceptibility to identified hazards, and document existing protection measures.
3. Assess hazards - evaluate the risk and vulnerability of the potential hazards, review current assessment activities, and prioritize source areas for response.
4. Develop hazard response and planning - identify existing response tools (e.g., policies, plans, guidance) and determine gaps or needs for improved hazard management.

The Source Water Risk Assessment Framework addresses long-standing gaps in drinking water protection by delivering essential data on source waters and potential hazards. Current efforts are focused on Step 1, with the development of the Drinking Water Sources Spatial Dataset (see project summary below). This dataset is foundational to assessing hazards to source waters and will enhance efforts to protect drinking water and public health.

Provincial Drinking Water Sources Spatial Dataset – V1.0

Project Description

This project amalgamates geographic data for British Columbia's drinking water supplies into a single, accessible spatial dataset. The dataset includes point locations representing drinking water intakes and wellheads, and polygon boundaries representing corresponding protection zones and source areas. Intake and wellhead data were primarily extracted from datasets provided by each of the regional Health Authorities, supplemented with data from the GWELLS application and the Water Rights dataset. Protection zones were compiled from various sources including the existing Capture Zones dataset from the BC Geographic Warehouse (soon to be retired), local government protection plan reports, and several regional pilot studies. Source areas comprising aquifer boundaries were pulled from the GWELLS application, while contributing watersheds were pulled from local government protection plan reports or delineated using whitebox tools via python scripts.



View of source area and protection zones for a drinking water supply well

Project Outcomes

The Provincial Drinking Water Sources Spatial Dataset has been created and will be accessible to the public through the BC Data Catalogue once it has been published. This is the first release of this dataset which contains approximately 1,900 intake and wellhead points, 860 protection zone polygons, and 300 source area polygons, each with unique keys for user friendly queries. A standalone ArcGIS Online map will also be available for quick and easy viewing.

Relevance

Locating and mapping drinking water systems and sources represents a significant improvement in how the Province supports all communities in understanding potential hazards to safe and accessible drinking water supplies. These data will enhance existing operations where emergencies or landscape activities have the potential to impact drinking water supplies.

Learnings and Recommendations

While this initial publication represents a subset of all drinking water sources in the province, ongoing efforts to populate this dataset with new information will continue until all drinking water systems and sources across the province have been documented; this includes engaging with First Nation water system owners for inclusion in the dataset, where appropriate. In addition to existing operational outcomes, these data enable initiatives in assessing hazards to drinking water at the individual source level, and at the provincial scale.

Partners and Linkages

This spatial dataset is a province-wide expansion of data compilation and mapping concepts developed in regional pilot studies including the Northeast BC Source Area Delineation Project funded by the Climate Action and Clean Energy Fund and more recently the Regional District of Okanagan-Similkameen Pilot Study funded by the Okanagan Basin Water Board. Project partners include Ministry of Health, and all five Provincial Health Authorities: Interior Health, Northern Health, Fraser Health, Island Health, and Vancouver Coastal Health.

Project Contacts

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5. ACKNOWLEDGEMENTS

The Province would like to acknowledge all the partners that have supported and contributed to advancing these groundwater projects over the last year. These partnerships have spanned ministries, academic institutions, municipal governments, federal agencies, First Nations, and stewardship groups including:

- Ministry of Agriculture and Food
- Ministry of Energy and Climate Solutions
- Ministry of Environment and Parks
- Ministry of Forests
- Ministry of Health
- Ministry of Water, Land and Resource Stewardship
- Environmental Reporting BC
- B.C. River Forecast Centre
- Geoscience BC
- Interior, Northern, Fraser, Island, and Vancouver Coastal Health Authorities
- K'ómoks First Nation
- The K'ómoks Guardian Watchmen
- The Tsolum River Restoration Society
- Living Lakes Canada
- Tsolum River Restoration Society
- Centre of Transformative Environmental Monitoring Programs
- Department of Fisheries and Oceans Canada
- University of British Columbia (Okanagan)
- University of Northern British Columbia
- Simon Fraser University – Department of Earth Sciences
- Vancouver Island University
- British Columbia Institute of Technology
- Pacific Institute for Climate Solutions
- Pacific Salmon Foundation
- Lheidli T'enneh First Nation
- Rithet's Bog Conservation Society
- The District of Saanich
- The BC Conservation Foundation

A special acknowledgement is also provided this year in memoriam of Dr. Andarge Baye, a provincial hydrogeologist and highly esteemed colleague, who passed away unexpectedly on June 10, 2025. Andarge's scientific expertise and dedication to advancing provincial groundwater knowledge contributed to the success of many of the projects highlighted in this compendium.

"Dr. Andarge Baye was born in Ethiopia on August 30, 1970 and came from a large family of 11 children. He completed his Bachelor's degree in Geology and his Master's degree in Hydrogeology at Addis Ababa University in Ethiopia. After working for 13 years in Ethiopia, primarily at the Water Resources Development Bureau, he attended the University of Poitiers in France where he obtained his PhD. In 2010, Dr. Baye was the Deputy Bureau Head at the Water Resources Development Bureau in Ethiopia. He was well known for his dedicated work in bringing critically

needed water supplies to a water scarce country. A friend of Dr. Baye's recounts how when Andarge and his field team were confronted by rebels in the jungles of Ethiopia, he was immediately recognized by the rebels as "the person who drills water wells and brings water to the villages", thereby allowing his passage through the area.

Dr. Baye immigrated to Canada in October 2010 with his family and initially settled in Toronto where he worked as a consultant at GeoHydro Solutions. In 2012, Dr. Baye accepted a position as a regional hydrogeologist with the BC Ministry of Forests based out of the Prince George office. Then in 2013, he moved to Victoria to lead provincial aquifer mapping efforts within the Ministry of Environment (later re-organized to the Ministry of Water, Land & Resource Stewardship) where he worked in various capacities until his untimely passing on June 10, 2025.

Dr. Baye was a very gifted hydrogeologist who served the citizens of BC. His contributions to the provincial groundwater program were plentiful. He oversaw provincial mapping initiatives and led the development of the Aquifer summary tool within GWELLS and the publication of aquifer factsheets for the more than 1200 provincial aquifers. He acted in an advisory capacity for the Provincial Groundwater Observation Well Network and provided technical support for multi-lateral groundwater management agreements. He worked with academia in the development of a provincial Aquifer Stress tool and he designed coding programs and applications to automate the retrieval and analysis of provincial groundwater chemistry data. Dr Baye also co-authored numerous publications including the Liard-Petitot basin Groundwater Assessment project and the Dawson Creek-Groundbirch hydrostratigraphy project in the northeast.

However, for those of us that worked closely with Andarge, we know that there was much more to our colleague beyond being a talented hydrogeologist. Andarge was a kind person who always showed up for work with a positive attitude and had a genuine interest for the people around him. He was viewed as a mentor to many junior staff coming onto the team. Colleagues fondly remember being invited to his Canadian citizenship ceremony and how excited he was to become a Canadian citizen. At the same time, he showed great pride in his roots and sharing his Ethiopian culture. Dr. Baye will be greatly missed, and his impact on our team and legacy of his aquifer work will continue to be felt in Ethiopia and BC for many years. We certainly remember him as a brilliant, hard-working hydrogeologist. However, his ministry colleagues all remember Andarge's generosity, his humility and his ability to help those in need. We will fondly remember Andarge and surmise that by renaming the BC Annual Groundwater Symposium in his honour it will preserve his hydrogeology legacy for many years to come."

Dr. Andarge Baye (1970 – 2025)