SHUSWAP
watershed council

2019

WATER QUALITY REPORT

Photo Credit: Darren Robinson Photography

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Photo Credit: Victoria Haack/Shuswap Tourism

In the Shuswap watershed water quality is monitored at several locations, at different times of year, and by different organizations for different reasons.

There are many reasons why water quality is monitored:

- To observe and record water quality, repeatedly over a period of time, to create a baseline—a set of conditions against which future measurements can be compared
- To protect public health and manage risk by ensuring water is safe for drinking and recreation
- To identify change, trends, and existing or emerging water quality problems
- To identify sources of pollution
- To ensure compliance with pollution regulations or permit requirements
- To gather information so that pollution prevention or remediation programs can be designed
- To measure how goals or targets for water quality are being met
- To understand how specific activities affect water quality.

SHUSWAP watershed council

The Shuswap Watershed Council (SWC) is **a partnership of many organizations** with a responsibility for or an interest in **monitoring and enhancing water quality**. The SWC is pleased to present a summary of water quality monitoring results, research, and general information about the Shuswap watershed on behalf of its partners for 2019.

In this fourth annual report on water quality from the SWC, you'll find results and information about:

- Shuswap Lake, Mara Lake, Mabel Lake, and Adams Lake
- Shuswap River and Salmon River
- Popular beaches
- Research in the Salmon River, Shuswap River, and Mara Lake
- Algal blooms and cyanobacteria
- Salmon in the Shuswap
- Aquatic invasive species, and how to prevent their spread
- Tips for how residents and home owners can reduce their impact on water quality.

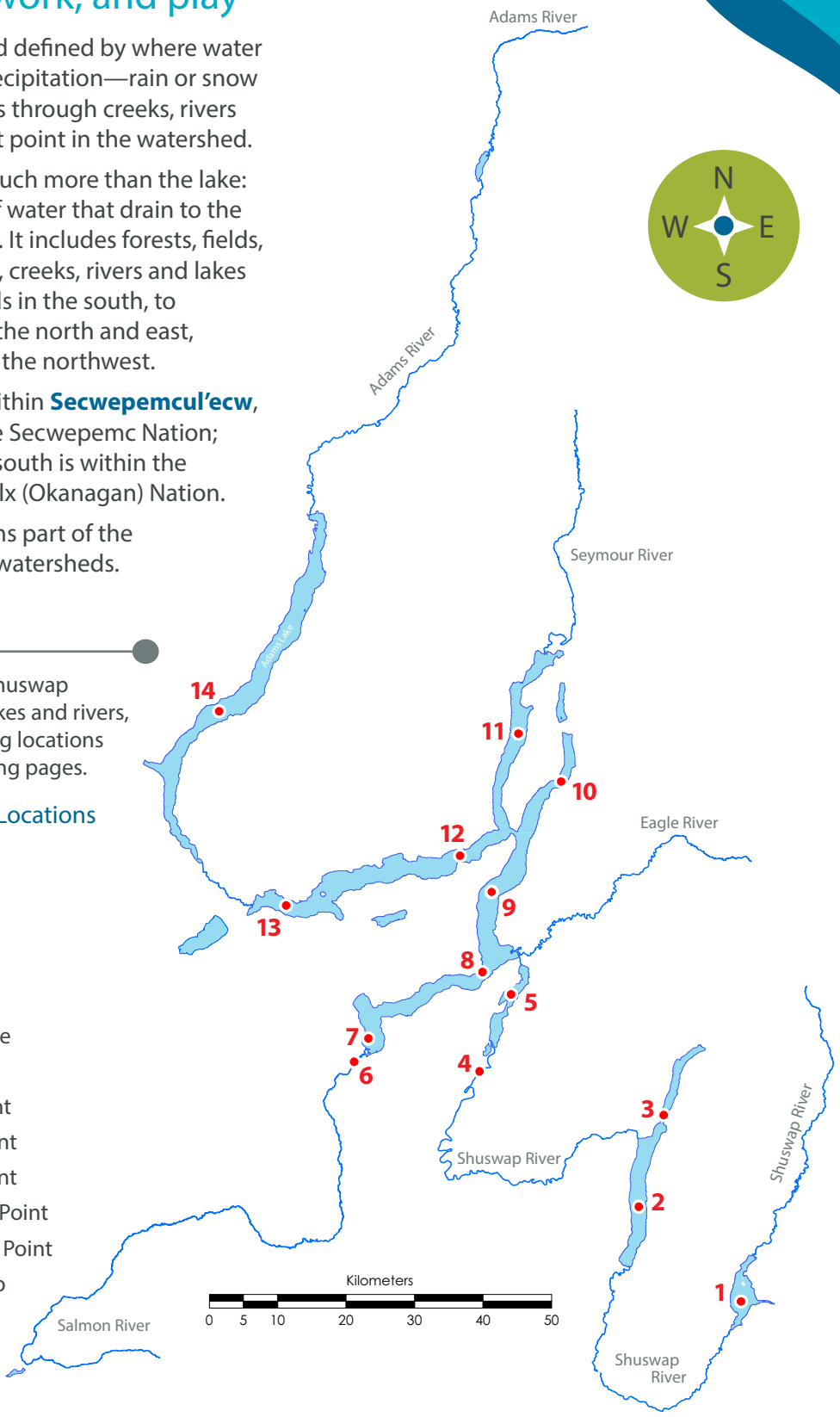
The Shuswap watershed —where we live, work, and play

A watershed is an area of land defined by where water flows. Watersheds receive precipitation—rain or snow—and over time, water drains through creeks, rivers and lakes to the single lowest point in the watershed.

The Shuswap watershed is much more than the lake: it is all the land and bodies of water that drain to the outlet of Little Shuswap Lake. It includes forests, fields, hillsides, wetlands, meadows, creeks, rivers and lakes from the Okanagan Highlands in the south, to the Monashee mountains in the north and east, to the Shuswap Highlands in the northwest.

The Shuswap watershed is within **Secwepemcul'ecw**, the traditional territory of the Secwepemc Nation; part of the watershed in the south is within the traditional territory of the Syilx (Okanagan) Nation.

The Shuswap watershed forms part of the larger Thompson and Fraser watersheds.



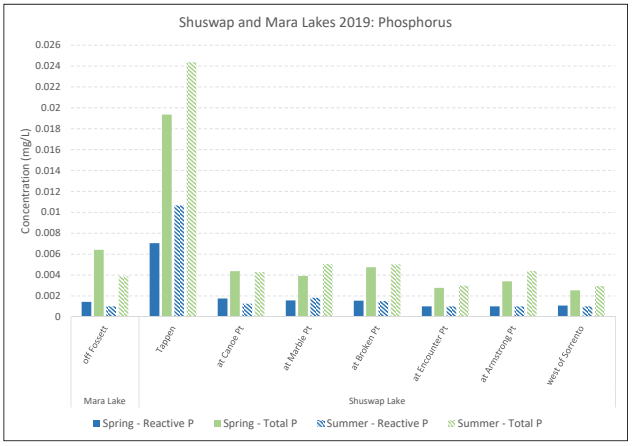
This is a simplified map of the Shuswap watershed. It shows the large lakes and rivers, and the water quality monitoring locations that are reported on the following pages.

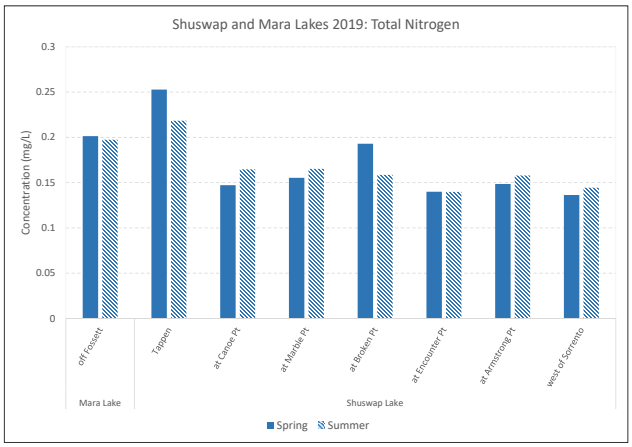
Select Water Quality Sample Locations

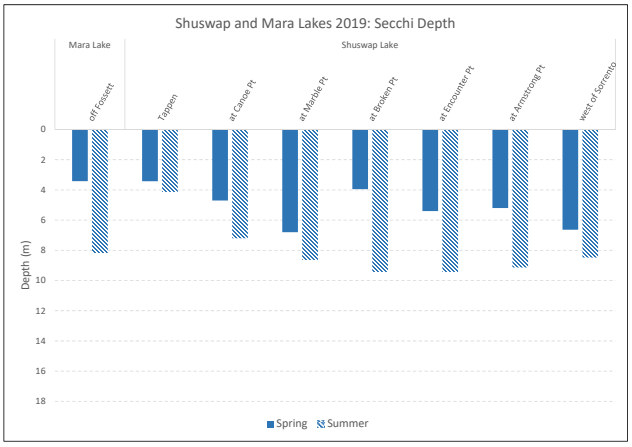
1. Sugar Lake
2. Mabel Lake—South End
3. Mabel Lake—Tsuius Creek
4. Shuswap River
5. Mara Lake—Fossette
6. Salmon River—Hwy 1 Bridge
7. Shuswap Lake—Tappen
8. Shuswap Lake—Canoe Point
9. Shuswap Lake—Marble Point
10. Shuswap Lake—Broken Point
11. Shuswap Lake—Encounter Point
12. Shuswap Lake—Armstrong Point
13. Shuswap Lake—W. Sorrento
14. Adams Lake

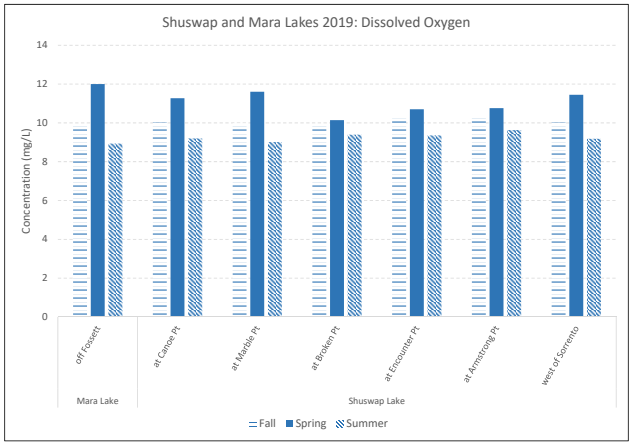
The BC Ministry of Environment and Climate Change Strategy monitored water quality at the lakes covered in this report. Here is a snapshot of water quality monitoring results from 2019.

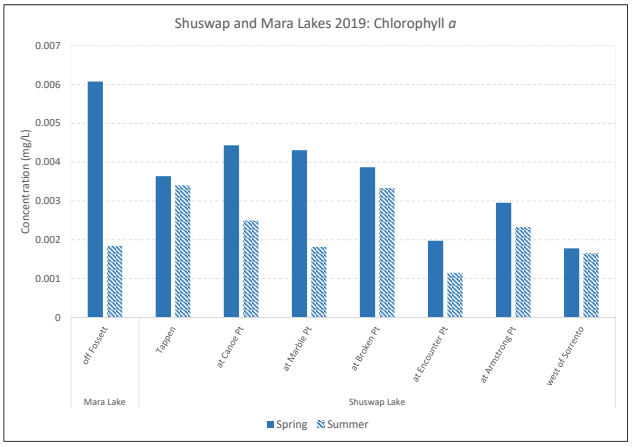
Shuswap and Mara Lakes











Why monitor nutrients?

Did you know that Phosphorus (P) and Nitrogen (N) are vital nutrients in an aquatic ecosystem? That's one of the reasons why they're routinely monitored. Aquatic life such as algae, invertebrates and fish need these nutrients to grow and reproduce. Aquatic ecosystems are defined, in part, by the amount of nutrients in them. Limnologists (lake biologists) refer to this as **"trophic condition"**. In a healthy ecosystem, the give-and-take of nutrients is balanced. But, excessive nutrients in an aquatic ecosystem can upset the balance and lead to algae growth, a reduction in water clarity, odours, and compromise the quality of water for drinking and recreation.

There are two types of P reported: Reactive P and Total P. Reactive P is a form of phosphorus that's immediately available (also known as "bioavailable") to plant life, such as algae and aquatic plants. Therefore, Reactive P is the form of P that has the potential to trigger an algal bloom.

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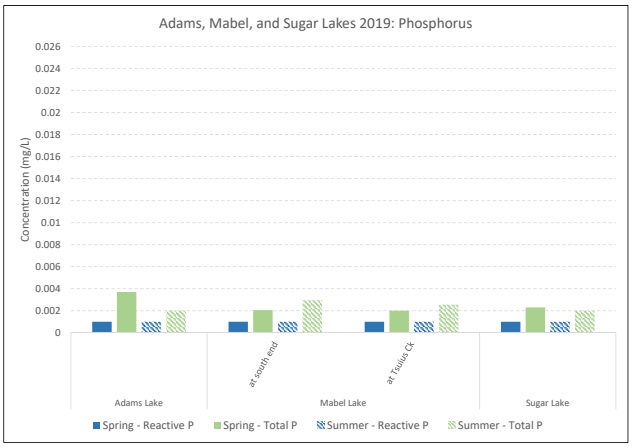
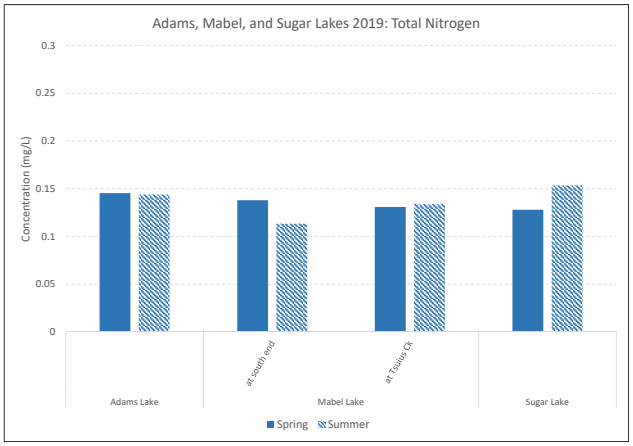
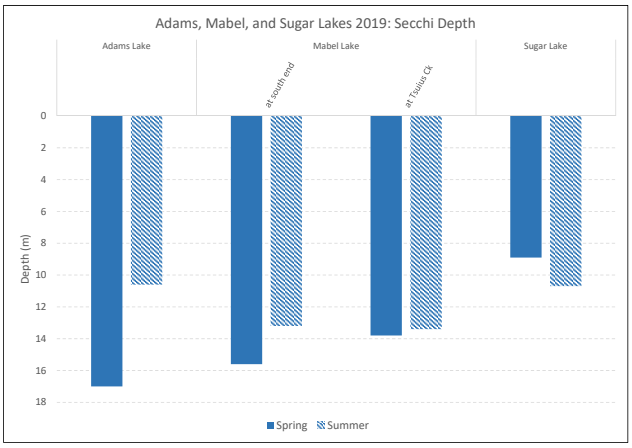
A 'junior helper' prepares to lower a **Secchi Disk** at a monitoring site in Scotch Creek. A Secchi disk is a circular device with alternating black and white wedges. It is lowered into the water on a rope until the contrasting wedges are no longer visible beneath the surface. The depth of the disk is the Secchi depth measurement. It is a low-tech, relative measurement of water clarity. Generally speaking, a lake's water clarity can be reduced by a number of factors such as fine silt, algae, or dissolved compounds in the water such as tannins. Shuswap and Mara Lake typically have high Secchi depth measurements in most locations. The spring measurements tend to be smaller due to the influence of spring run-off on water clarity, particularly at the Tappen site which is relatively shallow and heavily influenced by the Salmon River.

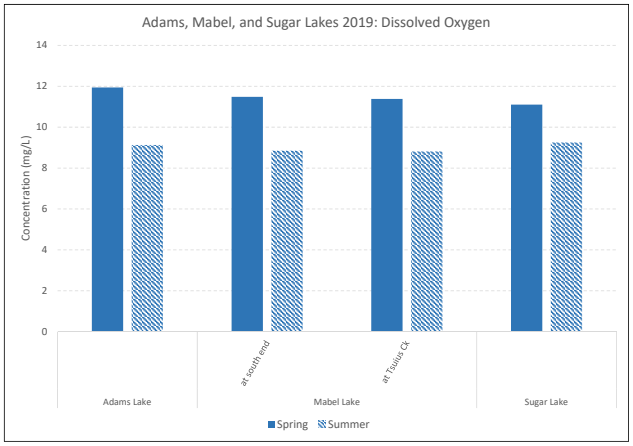
Photo Credit: Erin Vieira

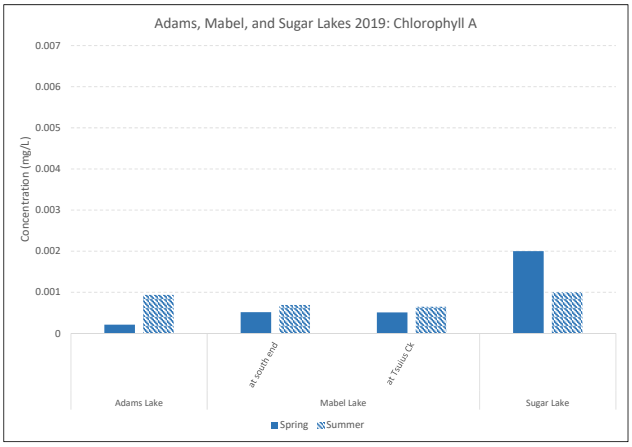
Adams, Mabel, and Sugar Lakes











Are you wondering where these sites are located? See the map on page 4 to find out.

Natural vs. anthropogenic nutrient sources

In a watershed there can be many sources of nutrients. Some are natural, and some are anthropogenic (created by people). Of the latter, these include municipal wastewater effluent, septic drain fields, domestic and commercially used fertilizers, such as those in agriculture, horticulture and forestry, and agricultural wastes.

Notice the differences in phosphorus and Chlorophyll *a* between the lakes reported on this page, and Shuswap and Mara Lakes reported on the previous page. The values are lower for Mabel Lake, Sugar Lake and Adams Lake —this is indicative of the naturally very low-nutrient water quality in the upper reaches of the Shuswap watershed.

Photo Credit: Victoria Haack/Shuswap Tourism

Lakes and rivers—an explanation of the monitoring programs

Shuswap and Mara Lakes

The BC Ministry of Environment and Climate Change Strategy (MOE) routinely monitors several locations in the Shuswap watershed twice per year—spring and summer/fall—to identify long-term water quality trends in the lakes. As the data base grows, assessments yield a better understanding of seasonal and year-to-year variations in the watershed.

The water quality parameters reported here—nutrients, chlorophyll *a*, dissolved oxygen, and Secchi depth—relate to lake productivity (essentially, the ability of the lake to support plant growth) to assess the environmental health of the lake. In addition to what's reported here, the MOE also routinely monitors water quality parameters that relate to human health and safety, including bacteria and algal taxonomy (different species of algae). Furthermore, the monitoring program includes a suite of routine water chemistry parameters to support data interpretation and provide a comprehensive record of water quality trends over time. Some of these parameters include pH, temperature, turbidity, total suspended solids, hardness, sulphate, and alkalinity to name a few.

A special quadrennial monitoring program for the Shuswap

Every four years, in the year following a dominant Sockeye salmon return to the Shuswap, the BC MOE and Shuswap Watershed Council work together to conduct an enhanced monitoring program on Shuswap Lake that involves collecting and analyzing water samples on a more frequent basis than the twice-per-year program described above. This enhanced monitoring program allows for a more thorough examination of changes or trends in Shuswap Lake. 2019 was one such year, following the 2018 salmon return. The results show no change to lake productivity—dubbed 'trophic status' by biologists—except in Salmon Arm Bay around the Tappen monitoring site (see the map on p. 4) which is showing periods of increased algal growth and localized algal blooms.

What is trophic status?

Did you know that lakes' condition is classified according to its productivity, or ability to support plant growth? This is referred to as its 'trophic status' or 'trophic condition'. Trophic condition ranges from oligotrophic (low levels of nutrients and productivity) to mesotrophic (moderate levels of nutrients and productivity) to eutrophic (high levels of nutrients and productivity). Most of Shuswap Lake is oligotrophic, due to the naturally low levels of nutrients in the watershed. 'Eutrophication' is the progress of a lake's condition toward a higher trophic status, which can naturally occur very slowly over time, and can also be sped up by anthropogenic activities (people-caused) such as settlement and agriculture.

Salmon River Attainment Monitoring

If you've been reading the SWC's water quality summary reports since 2016, when it published its first summary report, you may have noticed that previous reports showed water quality monitoring data for the Salmon River at five sites as opposed to one site reported in this summary. From 2016–2018, the SWC and BC MOE worked together to conduct a more thorough monitoring program on the Salmon River. This served two key purposes:

- To assess if the water quality is meeting water quality objectives that were set by the BC MOE for the Salmon River in 1998; this is referred to as 'attainment monitoring'
- To provide support for the nutrient research partnership with UBC-Okanagan that was carried out on the river during the same time period (see p. 13 for more information).

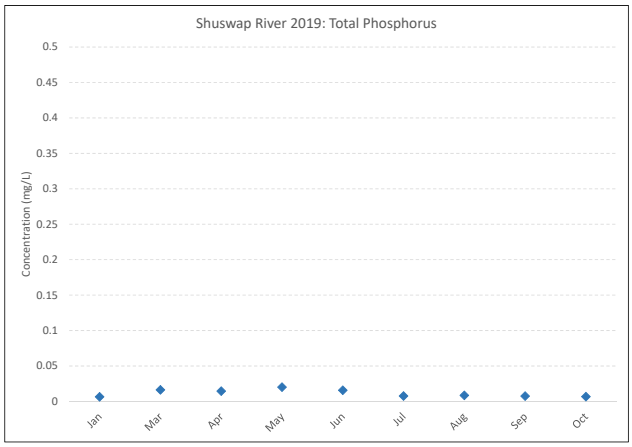
2019 monitoring data are currently being assessed by MOE staff, and an attainment report describing how well the monitoring results meet water quality objectives will be available later this year.

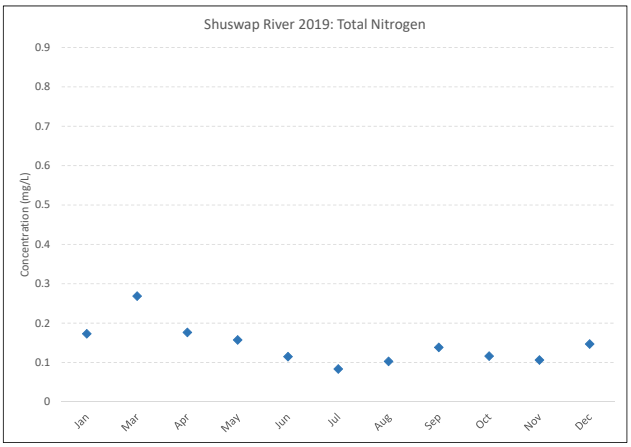
Find the SWC's previous water quality summary reports for 2018, 2017, and 2016 on their website.

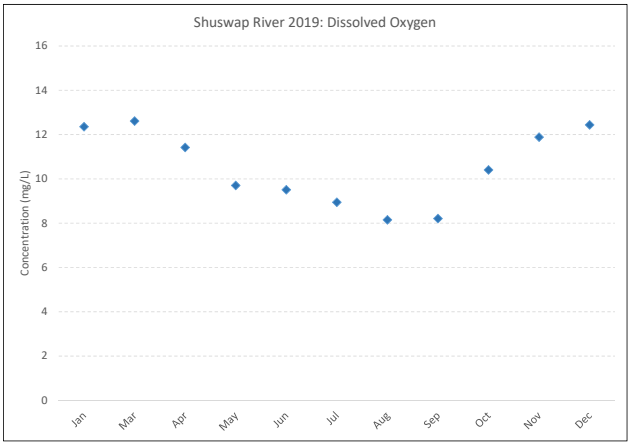
Did you know?

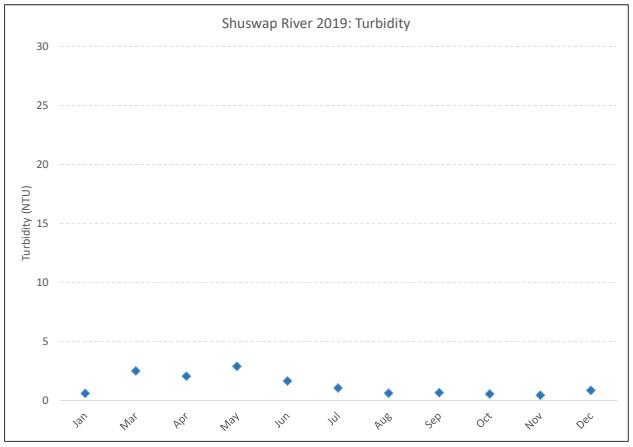
In the Shuswap, decaying spawned salmon are a natural source of nutrients, especially nitrogen.

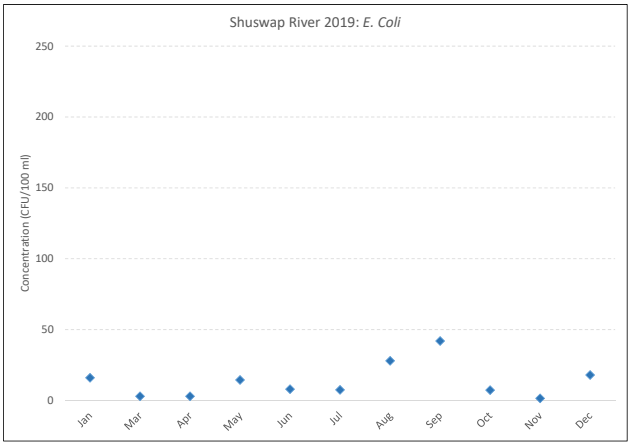
Shuswap River











Salmon and the Shuswap watershed

Did you know that the Shuswap watershed is important migration, spawning, and juvenile rearing habitat for four species of Pacific salmon? The Lower Adams River is perhaps the most well-known salmon habitat in the Shuswap, with a world-famous sockeye run and a quadrennial festival, the "Salute to the Sockeye", hosted at Tsutswecw Provincial Park. Many other rivers and creeks are important migration and spawning sites. In particular, the South Thompson River and Little River are 'salmon highways' into the Shuswap watershed, and both are significant for chinook, sockeye, and pink salmon spawning.

Some of the other the dominant spawning sites include Salmon River for sockeye, chinook, and coho; lower Shuswap River for sockeye and chinook; middle Shuswap River for chinook; Eagle River for sockeye and coho; Scotch Creek for sockeye; and Seymour River for sockeye and chinook.

Additionally, smaller streams such as Bessette and Duteau Creeks in the Shuswap River drainage and small, groundwater-fed pools are very important for juvenile coho salmon. The nearshore zones of Mara, Shuswap, and Little Shuswap Lakes are also important for juvenile salmon rearing and lake trout spawning.

As you can see, the Shuswap watershed with all its rivers, streams, and shorelines is very important in the various stages of the salmon life cycle.

Photo Credit: Darren Robinson Photography

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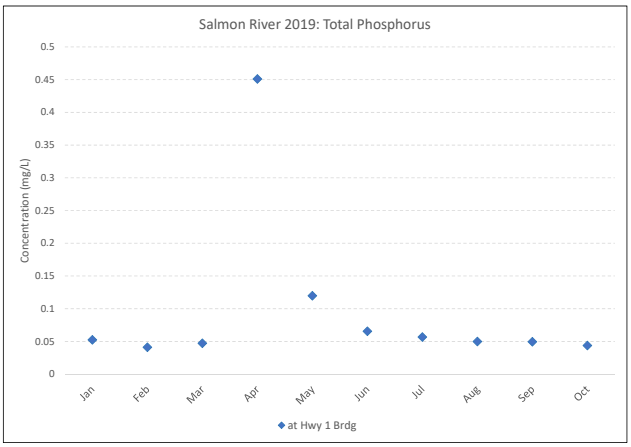
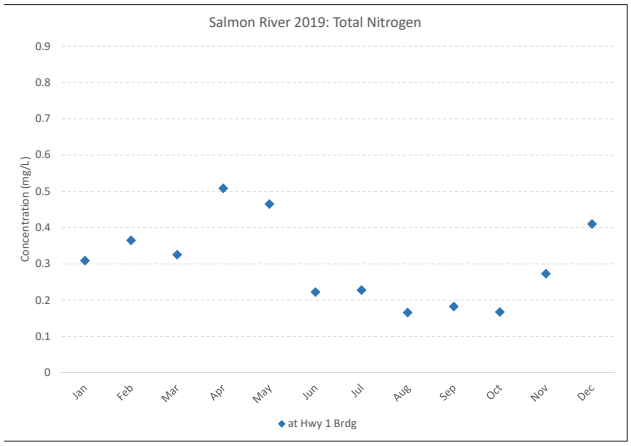
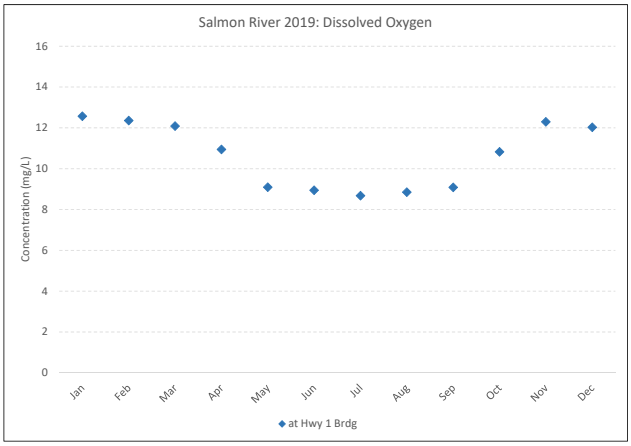
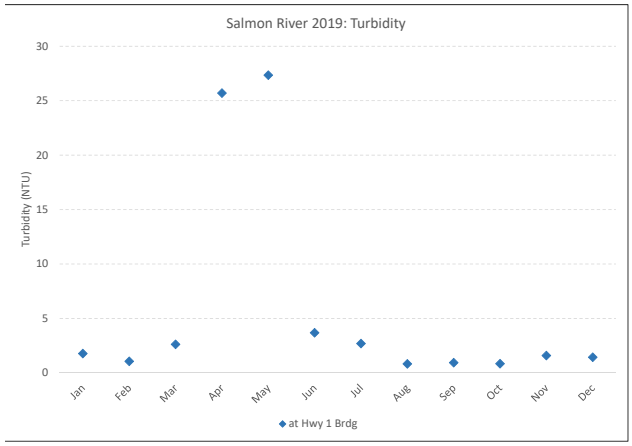
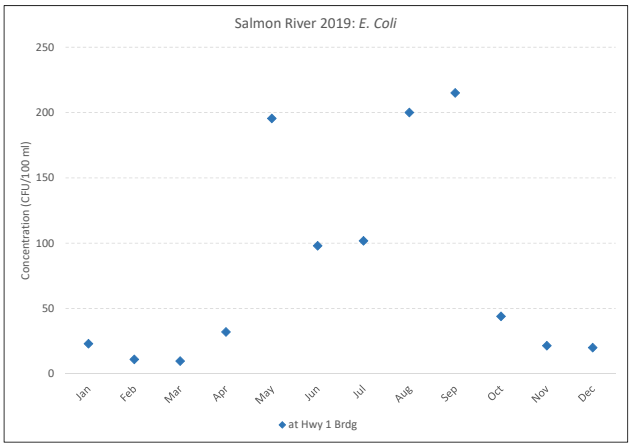
Salmon River











Notice the scale on the y-axis (vertical axis) of the charts on these two pages. We chose to use the same scale for both rivers, for easy comparison.

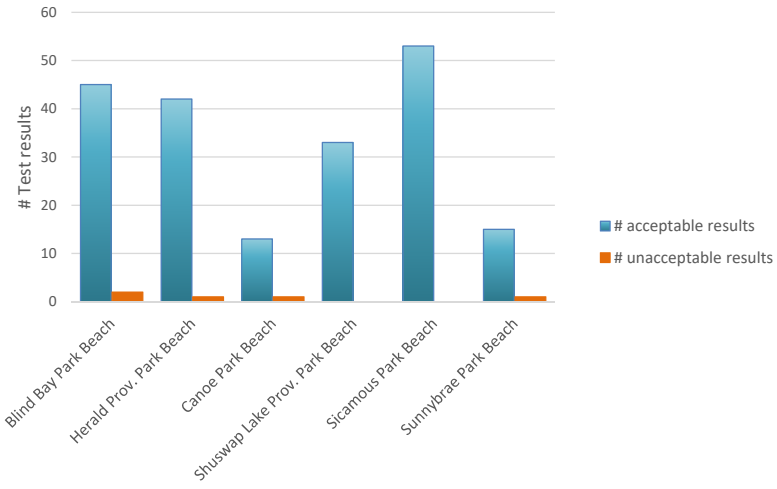
Did you know?

The Secwepemctsin (Shuswap language) word for water is **séwllkwe**; the word for salmon is **sqlélten**.

Photo Credit: Victoria Haack/Shuswap Tourism

Swimming Beaches

Interior Health Authority is the regulatory agency that oversees water quality monitoring at popular swimming beaches in the Shuswap. Water samples are collected and tested throughout the summer months for *E. coli*, a type of bacteria that is an indicator of water contamination. Here are the results from their beach sampling program in 2019.



What is an acceptable or unacceptable result?

There are federal guidelines for water quality for swimming and recreation (these are different from guidelines for aquatic life, or drinking water). They recommend that a safe bacteria level is less than 400 *E. coli* in a 100 mL sample, or an average of less than 200 *E. coli* in five consecutive 100 mL samples collected on a weekly basis. If results are above these, a swimming advisory may be issued.

Some beaches are tested more frequently than others. **Out of 201 water quality samples collected from these six popular beaches in 2019, all but six met the federal water quality guideline for swimming and recreation.**

About algal blooms

Algae are a natural and important part of an aquatic ecosystem. An algal bloom occurs when the number of algae rapidly increases, usually due to a change in environmental conditions such as an influx of nutrients or increased sunlight. Sometimes these changing conditions are natural, other times they are caused by people through land use activities such as agriculture and horticulture, or by industrial or domestic waste waters.

There are many different species of algae, with different impacts. An algal bloom can discolour the water and create an unsightly scum; in a worst-case scenario, an algal bloom can produce toxins harmful to people, pets, livestock, and wildlife.

It's not uncommon for small isolated pockets of algae to occur in Shuswap Lake or any of the smaller lakes in our region, especially in spring and early summer when water levels rise and a fresh supply of nutrients enters the lakes. That time of year there can also be organic debris in the lakes, which can make identifying algae a challenge.

What about blue-green algae?

Blue-green algae, also known as cyanobacteria, are **naturally-occurring but can form toxic blooms** in water bodies that are nutrient-enriched. People can be exposed to blue-green toxins by drinking or swimming in water with blue-green algae. Pets and livestock can also become sick by drinking water with blue-green algae.

In BC, there is a provincial protocol for monitoring and testing water quality for blue-green algae, for both drinking and recreational purposes. In the event of a blue-green algae bloom, the local health authority may recommend or require a public notification. It is the responsibility of the drinking water provider or beach owner/operator to post public notifications.

In the Shuswap, blue-green algae blooms are rare but they can happen. You can reduce your risk of becoming exposed to blue-green toxins by never drinking untreated water from lakes or ponds, and never swim or recreate in water with a visible bloom.

If you've spotted an algal bloom, call the Provincial RAPP line at **1-877-952-RAPP** (7277).

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Eurasian Water Milfoil in the Shuswap

Eurasian water milfoil (EWM) is an invasive aquatic plant that grows in water depths up to approximately 5 meters. Although aquatic plants are, in most cases, an important component of a lake's ecosystem, EWM is problematic because it forms dense mats of plants which adversely affect swimming, boating, tow sports, fishing, fish spawning, irrigation, and drainage. Additionally, it spreads easily and rapidly to new areas, and it's almost impossible to eliminate once it establishes.

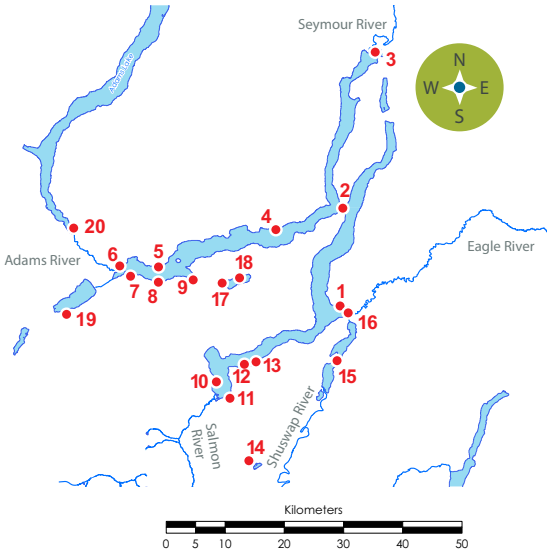
Fortunately, the Shuswap is not as badly infested with EWM as other lakes in BC but it does exist in Shuswap Lake, Mara Lake, Little Shuswap Lake, and the Shuswap River. The largest infestation of it is in Salmon Arm Bay.

The Columbia Shuswap Regional District (CSRD) is working to keep infestations of EWM under control, and prevent its spread to new areas. The CSRD manages infestations with a combination of harvesting and rototilling treatments. Harvesting takes place in the summer to provide short-term relief in swimming and boating areas. Rototilling takes place in the autumn and winter, when EWM is dormant; it lifts the plants from the lake bottom so they can float ashore to dry out and die. Rototilling is proven to be very effective in reducing plant density.

What can you do?

You can prevent the spread of Eurasian water milfoil by always cleaning, draining, and drying your boat or watercraft whenever you leave a lake or river.

I CLEAN DRAIN DRY
to prevent the spread of aquatic invasive species
cleandraindry.ca



ZQM Monitoring Sites

1. Shuswap Lake—Old Town Bay
2. Shuswap Lake—Cinnemousun Narrows
3. Shuswap Lake—Seymour Arm
4. Shuswap Lake—Anglemont
5. Shuswap Lake—Captain's Village Marina
6. Shuswap Lake—Cottonwood Cove Resort
7. Shuswap Lake—Little River Boat World
8. Shuswap Lake—Sorrento
9. Shuswap Lake—Blind Bay
10. Shuswap Lake—Sandy Point
11. Shuswap Lake—Salmon Arm Wharf
12. Shuswap Lake—Canoe Beach
13. Shuswap Lake—Canoe Wharf
14. Gardom Lake
15. Mara Lake—Swansea Point
16. Mara Lake—Sicamous Narrows
17. White Lake—Sunny Shores Resort
18. White Lake—Provincial Park
19. Little Shuswap Lake—Memorial Park
20. Adams Lake—Indian Point Resort

CSISS collected samples from 20 sites on six lakes throughout the Shuswap in 2019. Invasive mussels weren't detected at any of these locations!

Keeping invasive Zebra and Quagga Mussels out of the Shuswap

Zebra and quagga mussels are two species of fresh-water mussels native to Europe and Asia with tremendous destructive potential due to their ability to attach to any object in the water: boats, water supply pipes, irrigation systems, dock pilings, hydro-electric facilities, and more. They also litter beaches with their small razor-sharp shells, pollute water quality, impact aquatic food webs, reduce biodiversity by out-competing native species for food and space, and produce foul odours.

Fortunately, **zebra and quagga mussels don't exist in the Shuswap**—or anywhere in BC—but they do occur in Ontario, Manitoba, and as far west as California. Since they arrived in North America in the 1980s in ship ballast water, they have spread to new water bodies by 'hitch hiking' on boats and other watercraft.

With financial support from the SWC and others, the Columbia Shuswap Invasive Species Society (CSISS) has monitored several sites throughout the Shuswap for invasive mussels for the past five years. All their test results have been negative, meaning that invasive mussels have not been detected.

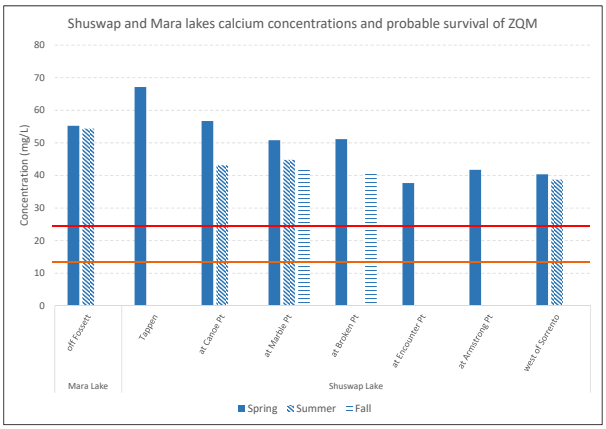
In 2019, **invasive Asian clams** were found on the shores of Shuswap Lake. At this time, only dead specimens have been found. Nevertheless, this new detection of an invasive species is a reminder to:

- Clean, drain and dry watercraft when moving from one waterbody to another
- Stop for watercraft inspection when travelling
- Avoid the use of invasive species as fishing bait
- Never release aquarium plants or animals.

Asian clams have a light brown triangular shell, usually less than 2.5 cm in length with visible growth rings. They pose many of the same threats as Zebra and Quagga mussels, including the potential to clog pipes, pollute water quality, and reduce biodiversity. Monitoring for Asian clams is continuing in the Shuswap in 2020 to determine if there is a living population.

Did you know?

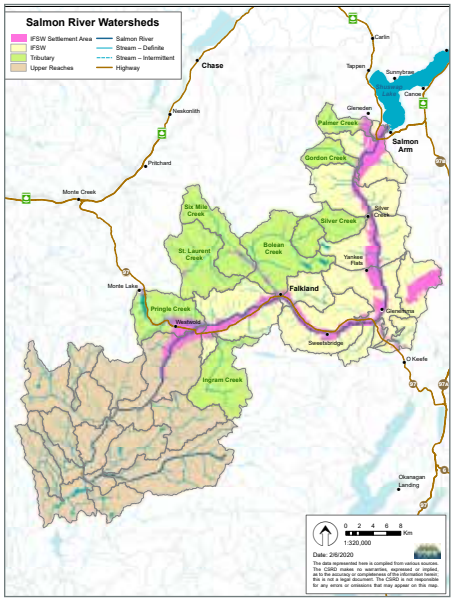
Shuswap Lake and many other lakes in our region are especially at risk of an invasive mussel infestation because of our water quality. The temperature, pH, and calcium concentrations are well suited to mussel survival. Additionally, the high influx of water-craft that we typically see in the summer from nearby provinces and states also puts our lakes at greater risk of an invasion. As you can see in the chart, the calcium concentrations in Shuswap and Mara lakes allow for very high probability of survival.



Above 24 mg/l calcium ZQM **have a very high probability of survival**

Above 13 mg/l calcium ZQM **have a high probability of survival**

Water quality research in the Shuswap



This map of the Salmon River watershed shows the upper reaches of the watershed in light brown, the major tributaries of the watershed in green, and seasonal streams and ditches (known as incremental flow sub-watersheds, or IFSWs) in the valley bottoms in pale yellow. The pink areas represent the settled areas of the watershed. The research team determined how much nutrients each of these regions of the watershed contributes to the Salmon River. A similar analysis was done for the Shuswap River.

Water quality monitoring in the Shuswap over the past several years has indicated that generally, water quality is good in most locations at most times of year. It has also shown us that the largest loads of nutrients to the lakes—phosphorus, in particular—are coming from the Shuswap and Salmon Rivers. Because of the significance of nutrients to water quality, the Shuswap Watershed Council wanted to understand this better, and gain answers to the following questions:

- Are there excess nutrients in the rivers that are not from the natural environment?
- If so, where are they coming from and how are they getting into the rivers?

The SWC worked with researchers at UBC-Okanagan to answer these questions. Two phases of research were carried out, beginning in 2016.

Phase 1

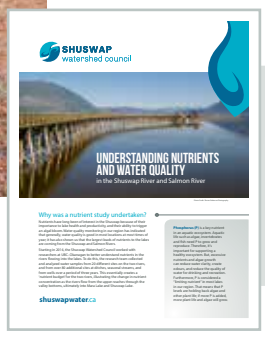
Phase 1 of the research took place from 2016-2019, and it involved the collection and analysis of water samples by the research team from 20 different sites on the Shuswap and Salmon Rivers, and from over 80 additional sites at ditches, seasonal streams, and wells.

This work created 'nutrient budgets' for the two rivers, illustrating the changing concentrations of nutrients in the water as the rivers flow through their watersheds and accumulate nutrients off the landscape. Specifically, the results show that the highest concentrations of nutrients come from the settled valley bottoms, which are the areas of the watershed most impacted by housing, agriculture, and commercial development. Therefore, these are the areas of the watershed that we should focus our efforts at mitigating, or decreasing, phosphorus inputs to the rivers to protect water quality for the long term.

Phase 2

Phase 2 of the research was carried out in 2018-2019, and it involved the collection and analysis of a sediment core (a long tube of lake-bottom mud) from Mara Lake. Using a type of science called **Paleolimnology**, the research team determined the historic nutrient conditions in Mara Lake and illustrated how nutrient-loading to the lake has changed over the past 150 years, since the time of settlement and land use changes in the Shuswap River valley. The results show that nutrient concentrations in Mara Lake have fluctuated in recent history, and that nutrient concentrations have been trending upward since the 1990s.

A member of the research team holds the 2-metre sediment core collected from the bottom of Mara Lake.



Learn more about the water quality research by the SWC and UBC-Okanagan in this mini-report: **Understanding Nutrients and Water Quality in the Shuswap River and Salmon River**. Find it on the SWC website.

Help keep the Shuswap clean

Here's what you can do as a resident of the Shuswap to help maintain our water quality:

- Make sure you know where your wastewater goes. Is your household on a septic system, or connected to sewer? If it's septic, you're responsible for keeping it in good repair. The Septic Smart Homeowner's Guide is a good place to start: **csrd.bc.ca/septicsmart/**
- If you're a farmer or have an agricultural operation of any kind, get familiarized with the new provincial *Code of Practice for Agricultural Environmental Management*. This new regulation was enacted by the Ministry of Environment and Climate Change in February 2019, and it aims to ensure agricultural practices are consistent with the protection of clean, safe drinking water and clean air. Learn more at **https://bit.ly/2ToGpu2**
- If you're a boat owner or have a watercraft of any kind, take the necessary steps to avoid accidentally moving invasive species from one waterbody to another. Always clean, drain, and dry your watercraft. When you travel, stop at watercraft inspection stations.
- Properly dispose of unused medications. Don't throw them out or flush them—return them to a pharmacy
- Don't ever flush personal care products such as wipes, floss, masks, gloves, swabs or hygiene products—not even if it says 'flushable' on the package!
- Don't put fats, oils or grease down the drain. Cool it, scrape it, and dispose of it in your garbage. Large quantities of liquid fats and oils should be dropped off at a hazardous waste facility (e.g., Salmon Arm landfill).

Acknowledgments

Thanks go to members of the SWC's Water Quality Monitoring Group for their contributions to this summary. In particular, the SWC wishes to acknowledge the BC Ministry of Environment and Climate Change Strategy, the CSRD, Interior Health Authority, Gardom Lake Stewardship Society, the City of Salmon Arm, and the Columbia Shuswap Invasive Species Society.

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Update from the City of Salmon Arm about the Water Pollution Control Centre Upgrades

In order to fulfill the commitment in their 2012 Liquid Waste Management Plan Update, the City of Salmon Arm is working on upgrades to its Water Pollution Control Centre (WPCC). At the time of publishing this water quality report, the City has engaged a consultant, WSP, to complete a site selection study to confirm the long-term location of the WPCC. A list of nine potential sites was initially identified by the study. These were presented at a public open house for feedback in February 2020. Four potential sites have now been short-listed for further evaluation based on environmental, social, technical, and cost considerations. A second public engagement session is being planned for in Summer 2020 to obtain additional feedback before a recommendation is presented to Salmon Arm City Council. The City will then begin the process of a preliminary design for the WPCC upgrades, which will increase the plant capacity to meet population growth and introduce new technologies to improve the treatment and quality of the effluent.

What do you think?

Would you like share your feedback on this water quality report with us? Please contact the SWC, care of the Fraser Basin Council in Kamloops:

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Photo Credit: Darren Robinson Photography

SHUSWAP watershed council

Who We Are

About the Shuswap Watershed Council

The SWC was established in 2014 as a watershed-based partnership to enhance water quality and safe recreation in the Shuswap. There are 18 members that represent three regional districts, two municipalities, the Secwepemc Nation, two provincial government agencies and Shuswap communities. The SWC is a collaborative, non-regulatory group. It works alongside organizations that have regulatory roles in managing the Shuswap watershed, complimenting their work and carefully avoiding duplication.

Staff

The Fraser Basin Council, a provincial non-government organization, provides staff services to the Shuswap Watershed Council.

Our Vision

Enhanced water quality that supports human and ecosystem health and the local economy in the Shuswap watershed.

What We Do

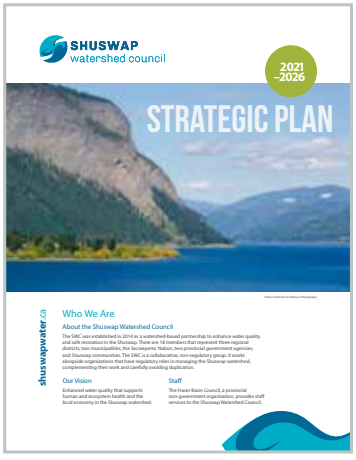
Our Objectives

The SWC's objectives are to maintain and enhance water quality in the Shuswap watershed through collaboration with water quality monitors; to coordinate and report on water quality in the Shuswap; to inform residents and visitors about water quality in the Shuswap, and advocate for good practices to prevent water quality degradation; and to encourage safe behaviour by recreationists on and near water.

The Work

The SWC's work on water quality and safe water-based recreation is guided by its five-year plan.

The SWC recently published a new Strategic Plan for 2021–26. Find it on their website: shuswapwater.ca



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