

Report

Date October 7, 2025
Subject Quamichan Lake Water Quality and Aerator Trial

File:

PURPOSE

To provide an update on the status of water quality in Quamichan Lake and seek direction on the program to trial aeration to improve lake water quality in lake enclosures in spring/summer 2026. A staff presentation will be provided at the meeting.

BACKGROUND

Creation of the Water Quality Monitoring Program

In response to the death of four dogs due to a cyanobacteria bloom in Quamichan Lake in 2016, North Cowichan established the Quamichan Lake Task Force to advise on what could be done to improve water quality in the lake and mitigate cyanobacteria blooms. Based on direction from the task force, North Cowichan initiated a research program in 2018 to assess lake water quality and provide advice on management actions. This research and assessment resulted in the presentation of two reports for North Cowichan in 2019:

1. Management Options and Monitoring Programs for Persistent Blue-Green Algae Blooms in Quamichan Lake (D. Preikshot); and,
2. Restoring a Culturally Eutrophic Shallow Lake: Case Study on Quamichan Lake in North Cowichan, British Columbia (K. Moore).

Water Quality Monitoring and Research

Based on recommendations in the 2019 reports, North Cowichan initiated a regular program of water quality monitoring and research in Quamichan Lake in 2019. The goals of the monitoring and research program are to learn about the biological, chemical, and physical processes in the lake that lead to cyanobacteria blooms and to use this information to develop management actions that mitigate cyanobacteria blooms in the lake. Milestones for the monitoring and research program include:

- 2020 summer: Installation of data loggers that take hourly measurements of temperature and oxygen in the lake at the surface, 3m, and 6m depths.
- 2021 summer: Initiation of regular sampling for nutrients in the lake (surface, 3m, and 6m) and tributary streams and phytoplankton in the lake. Nutrients sampled include nitrogen and phosphorus compounds. Sampling is twice per month in the summer and once per month in the winter.
- 2022 February: Assessment of lake sediment by Dr. Maira Mucci to determine phosphorus load in lake sediment and the relative contribution of these nutrients to lake cyanobacteria blooms.

- 2024 spring: High precision mapping of Quamichan Lake bathymetry to help assess water volume and oxygen quantity required for remediation of anoxia in deep lake water.
- Assessment of chemical processes in the lake and oxygen requirements to mitigate the release of phosphorus from the lake sediment by Gantzer Water LLC.
- 2024 fall: Initiation of a sampling program for *E. coli* in Quamichan Lake to assess potential effects of feeding waterfowl. Sampling is done in conjunction with the nutrient sampling.

Important observations from the monitoring program can be seen in the attached presentation. The 2022 sediment study confirmed the finding of the 2019 study by Preikshot that the lake sediment contributed approximately 90% of all the nutrients that fuel cyanobacteria blooms in Quamichan Lake. The 2024 sediment chemistry study demonstrated that a combination of aeration and the addition of iron and/or aluminum compounds would be required to mitigate the release of phosphorus from lake sediment.

In late 2024, North Cowichan staff presented the evidence from the monitoring and research program to regulators at the Ministry of Water, Land and Resource Stewardship (WLRS) and Ministry of Environment and Parks (MEP) to secure authorization for conducting a small-scale trial of the aeration system in lake enclosures. After several meetings between North Cowichan staff and Provincial regulators, North Cowichan was advised in summer 2025 that staff would be authorized to conduct the aerator trials.

This report and the attached presentation provide Council and the community with:

- a summary of what staff have learned about Quamichan Lake water quality,
- the design of the aeration study to remediate cyanobacteria blooms, and
- next steps on completion of the aerator trials.

DISCUSSION

Quamichan Lake has been subject to undesirable cyanobacteria blooms since at least the 1930s and possibly even before European settlement in the Cowichan Valley in the 1860s. The cyanobacteria blooms appear to have become longer and more intense over the past two decades. The increasing intensity of cyanobacteria blooms in the lake has contributed to fish kills, such as those in fall 2020 and fall 2025, caused by a combination of effects from high temperatures, low oxygen concentrations, and high pH levels. Cyanobacteria blooms pose risks to human health and caused the deaths of four companion animals in 2016.

The root cause of these cyanobacteria blooms is the high concentration of phosphorus in the lake, especially during summer. The high concentration of phosphorus is largely due to phosphorus that has been stored in the lake after 150 years of runoff from forested, farmed, and developed lands in the Quamichan watershed. This 'internal loading' contributes over 90% of the phosphorus in Quamichan Lake during the summer.

To mitigate cyanobacteria in Quamichan Lake, the primary goal is, therefore, controlling phosphorus from being liberated from the sediment. Although runoff from land is understood to be a minor source of the total phosphorus causing cyanobacteria blooms, remediation of runoff should be considered an important component of the long-term management of blue-green algae. In pursuit of managing nutrient runoff, particularly phosphorus, North Cowichan dedicates staff resources to maintaining and restoring stormwater detention ponds, natural ponds, wetlands, and swales to improve the quality of runoff water from developed lands in the Quamichan watershed and other water courses in North Cowichan.

Proposed Aerator Trials

North Cowichan staff are proposing to do an enclosed trial of aeration using oxygen saturation technology (OST) with an accompanying metal amendment of iron and/or aluminum chlorohydrate (ACH) to determine the potential effectiveness of this type of system in Quamichan Lake. It should be noted that the system in the trial is not a bubbler, but one that supersaturates the water with oxygen in a mixing chamber, then releasing the oxygenated water to the deep part of the lake to prevent anoxia. This supersaturated water does not destabilize the water column like a bubbler would, which negates the potential of raising water temperature and turbidity throughout the lake. The addition of metals in one trial is to examine how this may help bind phosphorus in the lake sediment, given that Quamichan Lake has been noted as having low levels of metals in its sediment. The trial will use three 8-metre diameter "limno corrals" (cylindrical enclosures isolating the water column and sediments) to simulate and compare three treatments under real lake conditions:

1. Control: No intervention
2. OST Only: Aerobic zone maintained to reduce phosphorus liberation from the sediment
3. OST + Metal Amendment: Aeration combined with iron and/or ACH to chemically bind phosphorus

Each enclosure is 8 m diameter (~50 m² surface area), constructed of UV-stable PVC with a weighted flexible base sealed to sediments. A floating dock will be anchored to the bottom to hold the aeration equipment and provide a space for staff to collect water samples (see Figure 1).

The enclosures will be monitored for nutrients and metals twice per week at the surface and near the sediment immediately post-treatment and once per week as conditions stabilize. Dissolved oxygen and temperature will be monitored hourly at the surface and near the sediment by data loggers.

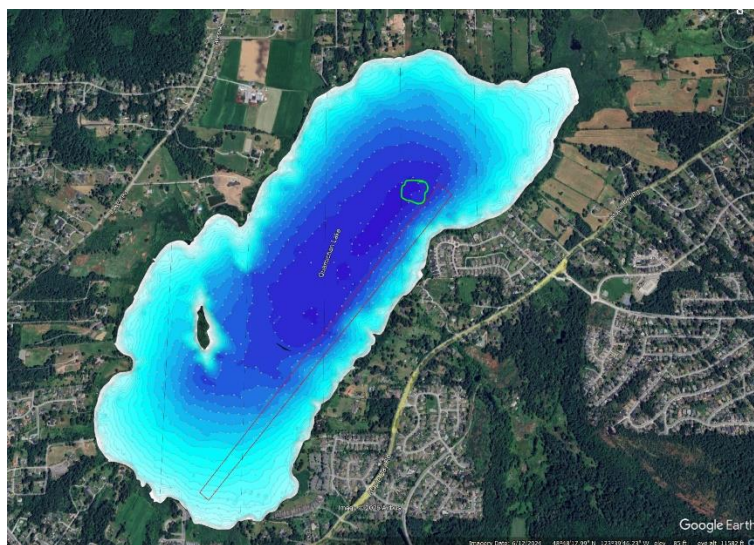


Figure 1: Map of Quamichan Lake with updated bathymetry (2024) and approximate trial location in green. The red rectangle is the location of the Rowing Canada Aviron laneways.

Results from the trials will be analysed to assess:

- the success of the OST and OST plus metal amendment to remove phosphorus from the water column,
- the ability of the OST to sustain dissolved oxygen >3-5 mg/L just above the lake sediment, and
- the relative changes in phytoplankton production in the trial enclosures versus the control enclosure chlorophyll-a and cyanobacteria density in L2 and L3.

Rowing Canada Aviron has offered material and staff support to conduct the aerator trials and will provide North Cowichan staff with docks to anchor the limno corrals as well as provide access to RCA dock facilities as a base of operations during the aerator trials.

An estimate of the costs associated with the aerator trial is presented in Table 1 below. There are sufficient funds within the Quamichan Lake Water Quality Reserve (currently holding \$952,000, projected to December 31, 2025) to cover these costs. Staff would like to expand our current partnership with the Cowichan Valley Regional District (CVRD) under the Drinking Water and Watershed Protection Program (DWWP) to fund the aerator trial in whole or in part. This would continue and extend collaboration between North Cowichan and the CVRD. In 2024, the CVRD board approved a transfer of funds to North Cowichan to support the service agreement between North Cowichan and the Somenos Marsh Wildlife Society to provide water quality monitoring, removal of in-stream invasive species, and restore riparian habitat in the Somenos Watershed. North Cowichan staff has also requested funding under the DWWP for monitoring work in the Quamichan watershed but the CVRD board rejected that request given that CVRD staff indicated that North Cowichan could be supported as a partner under the DWWP. North Cowichan staff would like to reapply for a funding partnership with the CVRD under the DWWP to support the Quamichan Lake aerator trials in whole or in part. Such funding support could also be used to augment funds in the Quamichan Lake Water Quality Reserve in the purchase and installation of a full-scale aeration system if one is deemed to be appropriate by the trials.

Table 1: Estimated costs for summer 2026 aerator trial

Item	Estimated Cost
Three 8m x 8m Limno Corrals	\$28,000
Clarity Water Resources / Pure Water Engineering- Aerator Design and rental	\$50,000
Divers for installation	\$7,500
Sampling Cost – 2 Depths Per Mesocosm	\$70,000
Power connection	\$5,000
Contingency	40,000
Total	\$200,500

Next Steps After the Trial

After the aerator trials, North Cowichan staff will collaborate with researchers from Pure Water Engineering and Clarity Water Resources to assess trial results. If trial results indicate that a full-scale OST system has a reasonable probability of remediating phosphorus and cyanobacteria blooms in Quamichan Lake, then staff will return to Council to seek direction on developing a full-scale aeration system for the lake. Given that such a system will likely cost between \$1-\$2 million, development of the system will likely require collaboration with the Federal and/or Provincial government, and possibly the CVRD (e.g., under the DWWP).

OPTIONS

(Recommended Option) THAT the Committee of the Whole directs staff to:

1. conduct aerator trials as described in the report of the Senior Environmental Specialist, dated October 7, 2025, and report back to Council upon completion of the trials with an assessment of results and advise on the efficacy of full-scale aerator installation, and,
2. seek support from the Cowichan Valley Regional District under the Drinking Water and Watershed Protection Program to fund in whole or in part the Quamichan Lake Aerator trials.

IMPLICATIONS

Council direction now to conduct the trials in 2026 will allow staff to have the design completed and products ready for installation early in the new year, minimizing unforeseen delays that could otherwise jeopardize the timing of the work.

Pilot projects like this are necessary because natural systems are all somewhat unique and may respond differently than other examples to the same treatments. This underscores the need for robust sampling and analysis. A successful pilot project provides a greater level of certainty that a large-scale project will provide the desired outcome and is likely to be more credible when seeking funding.

North Cowichan has sufficient funds in the Quamichan Lake Water Quality Reserve to pay for the anticipated costs of aerator trials. Contribution from the CVRD would demonstrate the importance of Quamichan Lake to the region and strengthen the meaningfulness of the DWWP function. It would also show regional support for future funding applications.

RECOMMENDATION

THAT the Committee of the Whole directs staff to:

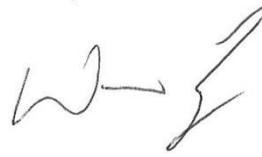
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Report prepared by:



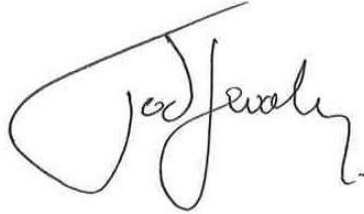
Dave Preikshot, PhD, RPBio
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Report reviewed by:



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Approved to be forwarded to Council:



Ted Swabey
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Attachment:

- (1) QL update PowerPoint Presentation