



BCLSS



An Integrated Lake Monitoring Framework for British Columbia

Summary



Prepared for:



Ministry of
Environment and
Climate Change Strategy

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The BC Ministry of Environment & Climate Change Strategy (ENV) contracted with the BC Lake Stewardship Society (BCLSS) to develop an integrated framework that incorporated the existing BCLSS volunteer monitoring framework, known as the BC Lake Stewardship and Monitoring Program, with the BC Lake Monitoring Network. A joint proposal was developed and submitted by the BCLSS and Living Lakes Canada (LLC), which formed the terms of reference for this report. The following is a summary of the report.

Existing Lake Monitoring Programs in BC

Existing lake monitoring programs in BC were reviewed to ascertain whether they could contribute to an integrated monitoring framework. In addition, First Nations and lake stewardship organizations' activities related to monitoring in the province were also looked at. Programs reviewed included the Provincial Lakes Monitoring Network, the Department of Fisheries and Oceans, Lake Pulse Canada, Living Lakes Canada, the University of BC Okanagan, and the Fraser Basin Council.

In April 2017, the BC Water Funders Collaborative commissioned a BC Water Monitoring Landscape Scan to inform discussions on a shared vision for water monitoring and reporting in BC. The scan compiled readily available information on who is collecting data and where, however, it was noted that there are many additional programs managed and delivered by industry, individuals, and academic institutions that are not included. The scan emphasizes the need for collaboration and information sharing in order to fill important water data needs for the province. A map from the scan report was included that shows the location of long-term surface water quality programs in BC delivered either via the BC Lake Monitoring Network (BCLMN) or by stewardship groups.

This year (2018) is the 4th year of the BCLMN and the 3rd year of coordinated province-wide sampling. The lakes were prioritized by using a priority ranking tool based on values (e.g., drinking water supply, fisheries, recreation, tourism), risks (e.g., development), and known or potential impacts. At times, ENV has had difficulty in delivering the entire program due to limited resources, and currently, only approximately half of the program lakes are being monitored.

It was found that there could be an opportunity for collaboration with the Department of Fisheries and Oceans (DFO) with more formal communication with DFO biologists. There is potential for some efficiencies but this would have to be explored further between these agencies.

Lake Pulse Canada is currently conducting research that the network hopes will directly benefit the stewardship of Canadian lakes while advancing the science of limnology. These outcomes include a large database of lake characteristics obtained through an extensive sampling program covering most of southern Canada and some parts of northern Canada; pan-Canadian

and regional assessments of the current health of Canadian lakes and the most important drivers of changes in these lakes; and predictions of changes that may occur in these lakes in the future, given realistic scenarios of land use and climate change. The Lake Pulse program has the potential to compliment the BCLMN in a number of ways including providing complimentary information to BCLMN lakes where there is overlap, aiding in the assessment of how climate change is affecting BC lakes, providing baseline data on lakes not currently part of the BCLMN, and adding trophic status indicators to supplement the lakes in BC's trophic status map.

The BCLMN could contribute to the Lake Pulse Program in a number of ways including provision of local knowledge, bathymetric maps, and data previously collected on lakes. However, the Lake Pulse Program has different objectives, methods and protocols than the BCLMN, so it will not replace network lakes (i.e., will not result in it becoming unnecessary for the BCLMN to sample an overlapping lake in the network).

Living Lakes Canada (LLC) is a growing network of community organizations working to build capacity for the effective protection of Canada's freshwater resources. LLC facilitates collaboration in education, monitoring, restoration, and policy development initiatives for the long-term protection of Canada's lakes, rivers, wetlands and watersheds. It was found that there is potential for stewardship groups in the Kootenay region to sample some lakes for the BCLMN through LLC conducting training, enhancement of monitoring programs to follow BCLMN methods and protocols, as well as conducting regular audits.

The BCLSS ran a province-wide program from 2003 to 2013 in partnership with the Ministry of Environment & Climate Change Strategy (ENV) entitled *The BC Lake Stewardship and Monitoring Program (BCLSMP)*. The program was a great success and surpassed many of the deliverables set out in the original program. Under the BCLSMP, BCLSS staff trained volunteers and provided them with equipment and support to facilitate the collection of water quality data and observations from lakes in BC. The BCLSMP resulted in a 4:1 return on dollars invested by the province in core funding for BCLSS.

Under the BCLSMP, there is considerable potential for volunteers to take on sampling some of the BCLMN network lakes. BCLSS would have to conduct training, enhance monitoring programs to follow BCLMN methods and protocols, as well as conduct regular audits. Furthermore, through the promotion of stewardship throughout BC under a revitalized BCLSMP, there is potential to supplement the BCLMN in the years ahead.

UBC Okanagan (UBCO) led a high-elevation lake study in 2015-2016 that was part of a Columbia Basin Glacier Loss Study, with a focus on climate-driven hydrologic regime shift in the Canadian Columbia Basin. UBCO sampled 35 high elevation lakes above 1,000 m across the Basin and the lakes sampled as well as parameters collected are included in this report.

The Fraser Basin Council (FBC) is a charitable non-profit society that brings people together to advance sustainability in the Fraser Basin with a focus on climate change and air quality;

watersheds and water resources; and local sustainability and resilience. They administer and co-ordinate many programs in the basin. FBC emphasizes the importance of stewardship and engaging the individuals and groups who contribute in a variety of ways to sustainability. The FRB has provided a Stewardship Award since 2007 to outstanding stewardship groups and individuals to acknowledge and encourage stewardship. FBC is particularly interested in identification and engagement with stewardship groups in the Shuswap area.

Current Needs of Lake Stewardship in BC

A table was developed illustrating what different groups are doing in the way of monitoring in BC. The table included lakes in the BCLMN and potentially being added in 2019, as well as lakes that are not currently part of the BCLMN, but have the potential to be monitored by stewardship groups and included in the BCLMN. In addition, the table indicates whether there is a local lake stewardship group and whether they are actively monitoring.

The needs of the BC stewardship sector were reviewed based on experience at ENV, BCLSS over the course of the BCLSMP, and other CBM groups surveyed by LLC. Major needs identified were found to be:

- Support with forming a stewardship group
- Training on how to do monitoring correctly
- Personal contact for training and other aspects of lake management
- Information on lake ecology including enhanced training
- Auditing to correct problems
- Timely reporting (annually in some cases) on the data they have collected to help keep them engaged
- Connections with other groups who may have experience with similar lake management issues
- Assistance with identifying funding sources for projects and equipment
- Equipment available to borrow e.g., DO/T meters and/or assistance with purchasing equipment (i.e., type of DO meter, funding sources, and where to purchase)

It was determined that expansion of the work of the volunteer sector will require more support in generating interest in and forming stewardship groups, and a number of required tasks were identified with regard to working with stewardship groups:

- Determine resources, time commitment
- Develop model/structure for adding/interacting with stewardship groups
- Develop tools
- Training to ensure data is collected properly/accurately (BC Field sampling manual)

- Develop a systematic audit program to evaluate sampling techniques and ensure quality control and quality assurance
- Develop data management & reporting out

Capacity for Lake Monitoring in BC

The capacity for lake monitoring and stewardship was reviewed. In cooperation with the BCLSS, 80 stewardship groups and 39 individuals have taken part in volunteer lake monitoring on 119 lakes throughout the province. Lake stewardship is variable throughout the province and there are many individuals who conduct monitoring but are not part of a stewardship group.

A potential area of stewardship capacity is the First Nations of BC. Indigenous communities in Canada hold a wealth of traditional environmental knowledge (TEK) on water and environmental health. This knowledge is valuable and important for Citizen Based Monitoring (CBM), whether it is combined with other forms of knowledge or not. Increasingly, CBM programs are endeavoring to bring together traditional knowledge and western science to develop rich, robust and holistic programs that draw on the strengths of both forms of knowledge.

Indigenous communities are well positioned to monitor and collect data, collaborate with other entities, and create binding agreements with other parties. Building capacity and trust are key issues affecting the extent of water monitoring and data sharing by First Nations. The Centre for Indigenous Environmental Resources (CIER), is a national First Nation directed environmental non-profit organization that offers research, advisory, and education and training services to Indigenous communities, governments and private companies through four program areas: Taking Action on Climate Change, Building Sustainable Communities, Protecting Lands and Waters, and Conserving Biodiversity. First Nations groups involved in community based monitoring efforts in BC were summarized in a table.

Training and Support Needs for Volunteers

Training and support needs of the volunteer sector were identified as the need for support for stewardship initiatives, assistance with forming and running a group, safety training as well as technical training for monitoring. Resources for the forgoing training were reviewed and updated to assist the volunteer sector in these areas going forward. These resources were developed as manuals and power point presentations. The success of the BCLSS LakeKeepers training course was noted through which the BCLSS held 24 multi-day sessions throughout the province from 2011-2016.

Some common areas where ENV is falling short due to lack of resources emerged:

- Staff are generally able to meet the sampling commitments to the BCLMN with some exceptions where temporary staff shortfalls arise for a variety of reasons

- There is difficulty in most regions with timely data entry and conducting QA/QC checks on the data collected under the BCLMN
- Summarizing the existing network data into spreadsheets is currently being done by contractor and reviewed /supported by the lake program coordinator
- Reporting on the data is difficult for staff to do, given other commitments
- Staff in most regions have difficulty adequately supporting stewardship groups conducting monitoring
- Staff have little time to promote the formation of new stewardship groups that have the potential to help with some of the BCLMN lakes
- There is difficulty with adequately auditing the monitoring activities of stewardship groups and individuals
- There is difficulty with responding, or staff are unable to respond to public inquiries about lake problems (i.e., algal blooms)
- There is currently no capacity to expand the number of lakes in the program

Review of the BC Lake Monitoring Network

The BCLMN was reviewed. Enhancements were discussed and it was suggested to include some high elevation mountain lakes that might provide insight into issues like climate change, long-range transport of contaminants, and provide a reference point for relatively undisturbed lake ecosystems. It was recommended that ENV consider an enhanced quality assurance/quality control (QA/QC) program for non-Ministry samplers (stewardship groups, volunteers, or other government agencies) until there is assurance that the data coming out of this sampling is judged to be consistently of high quality. It was also recommended that ENV consider a flexible and responsive model for what QA/QC measures are used to adapt to any issues that arise – rather than a fixed QA/QC program. If QA/QC issues are identified, there needs to be a process in place to correct any problems in a timely period.

Reporting

Reporting of lake data was discussed and it was noted that it is important that the data receive some level of written interpretation, so that the results are made available to the public, the partners in the sampling program, and other agencies. A number of possible ways of doing this were suggested including an overall report on the sampling for a calendar year posted on the ENV website in a reasonable time. This could include summary tables for each lake with water chemistry results.

Also discussed was that the BCLSS prepared four to twelve page, illustrated summary reports of the lakes that were sampled during the BCLSMP as well as lakes that were subsequently sampled by ENV and other member groups. These summaries provided a very effective

communication and reporting tool and are recommended as an example that has worked very well.

Two options for reporting the water quality results for each lake in the network are recommended. The first option is that for each lake sampled, a standard format report (in pdf) would be prepared with summary tables and interpretation of data for each lake for each year. At regular intervals (i.e., 5 years), overall summaries for each lake would be prepared which would provide the range of data and any apparent trends. The second option would have the partners (BCLSS and LLC) prepare the reports and post the lake reports on the BCLSS or LLC website which could be mirrored on the ENV website. This would make maintaining the content much more efficient – especially if BCLSS / LLC were tasked with writing the lake reports (with review and input from ENV). The model used would be the BCLSS lake reports enhanced with whatever additional data is deemed appropriate.

Information on individual lakes provides information on individual lakes but it is also useful to have an overall evaluation for the program from a provincial perspective. Overview of where lakes might fit in the range of data gathered or how a lake might be characterized by a classification scheme or in a lake quality index is also useful.

The use of the Canadian Council of Ministers of the Environment (CCME) Water Quality Index for lakes of the BCLMN was reviewed and is not recommended at the present time as in most cases insufficient data are available. The preferred option for an index of four reviewed, would be the development of a Trophic State Index (rather than an Index of Water Quality Change or of Water Quality Vulnerability). This would require further development work.

Data Base Integration

Data base integration was reviewed. With so many agencies and groups collecting water quality information for different purposes, a central water quality data hub for the province would have many advantages. This concept was proposed and discussed at a conference organized by Living Lakes Canada in Invermere in 2017. There was overall consensus for the concept, but no concrete suggestions as to how to implement a central data hub for the Columbia Basin. A data hub for the province would be a significantly larger challenge and would require substantial work and cost, and is not feasible at present. It is therefore recommended for the purposes of the BCLMN at this time, it would seem prudent to use EMS as the repository for water quality information collected by the BCLMN. It is established and available to the public and is by far the largest water quality database in the province.

BC Lake Monitoring Framework – Recommended Option for BC

Examples of how various jurisdictions, including BC, have worked with and funded the volunteer stewardship sector for lake monitoring and assessment were examined. Options for integrating the volunteer sector with the BCLMN are presented.

Many different state and provincial jurisdictions were reviewed and common to all of these was a level of core funding provided by the province or state, to the volunteer sector. The results of this review was three options for the province to consider with regard to how to integrate the existing BCLSS volunteer monitoring framework with the BC Lake Monitoring Network. Option 1, the preferred and recommended option, is a modified BCLSMP.

The collaborative partnership between the ENV and BCLSS that was in place from 2003 - 2013 was a successful and efficient program that achieved several goals. It increased the Ministry effectiveness to deal with lakes for which there were public concerns about water quality when government resources were limited and not sufficient to gather the data that is necessary to properly manage and protect the lakes that the Ministry is responsible for – and at present are under the same resource constraints. Another major and important benefit of the program was to engage and motivate stewardship groups who contributed to the collection of data and provided many resources and much information on lake water quality.

The circumstances at present are different and the needs are different as well. In communication with the Ministry of Environment and Climate Change Strategy (ENV) staff, there appears to be four major areas that BCLSS / LLC could assist with the implementation of the BCLMN.

The BCLSS / LLC could provide staff that could assist in several areas:

- (a) Assistance with field sampling when ENV staff is not available. BCLSS / LLC staff could be thoroughly trained in the details of the BCLMN and be available on short notice to either do the lake sampling independently or assist ENV staff if a second team member were not available. This assistance could be set up to provide a trained technical person on 1-3 weeks' notice to assist with time sensitive water quality sampling.
- (b) Establishing stewardship contacts. As part of the expansion or optimization of the BCLMN, BCLSS / LLC could develop and facilitate contacts and training of community monitoring groups so that they might be integrated efficiently into the Network. This might involve LakeKeepers workshops or training for specific sampling to develop water quality guidelines.
- (c) Data organizing, checking editing and data entry. A notable gap in the BCLMN is a capability for data compilation and editing, data quality control assessment, and data entry. BCLSS could provide a trained staffer with appropriate background, education, and experience to review BCLMN data as it is reported
- (d) Report write-up, public reporting, and community interaction. BCLSS has been involved in writing lake reports that summarize water quality sampling results for many years as part of the BCLSMP.

Costs

The cost for this option would be approximately \$100,000/year and would include one full time staff member for the BCLSS / LLC partnership – an individual with appropriate university training, as well as training for the specific tasks that would be undertaken (field sampling, data analysis, report writing). This amount would also cover the cost of a part time office employee who would also be technically trained but specifically responsible for tasks like data entry, co-ordination, communication, and general administration. It is anticipated that this funding would come to BCLSS as lead organization, and a network of lake groups in the province, but that LLC may cover the Kootenay region where they are based. In this case funding sampling would be by grant from BCLSS to LLC.

Potential Funding Sources

Several options for long term funding of the preferred option were suggested:

1. Grants from ENV – this is apparently an option for 2018/19, but there is uncertainty about the long-term sustainability of on-going grants due to budget fluctuations and changing priorities for ENV.
2. Water Related Revenue – the report provides a discussion of the options and benefits of the establishment of a fund specifically to assist with the management of water resources in the province of BC. One percent of the annual income from water license fees collected by the province could be placed in a special fund to collaborate with non – government agencies and others to help manage water resources in BC. It is envisioned that this fund would be administered by an Independent Trust Agency and funds dispersed to projects that are vetted by a Trust Committee.

The precedent for this proposal is the system that exists for the management of fish and wildlife. Under an agreement signed between the Province and the Freshwater Fisheries Society of BC in 2015, 100% of the revenue generated from fishing licences directly benefits recreational fisheries. Funds goes into research, conservation and education programs, improving angler access and stocking programs. The Habitat Conservation Trust Foundation receives 100% of the surcharge revenue collected from angling license sales to provide grants for fish conservation projects.

There is also precedent for this proposal in other jurisdictions.

3. Creative sentencing – this enables presiding judges to use sentencing alternatives where courts can order offenders to invest in measures to protect the environment. This is a significant source of funds for the BC Habitat Conservation Trust Fund (HCTF) who invests the funds in conservation projects. To date, HCTF has invested over 1.3 M dollars in projects throughout the province

Furthermore, to 2009, 46% of the total value of court awards was from the provisions of the Waste Management Act and its successor, the Environmental Management Act. 2.1 M dollars was received by HCTF from court awards up to 2009 (HCTF, 2011).

If only a small portion of this money was invested in lake stewardship, core funding would be available for BCLSS with a 4:1 return on dollars invested.

Conclusion

The report concludes with a proposal for set up of the integrated program following the recommended option (Option1) and specific deliverables are proposed for 2018/19, subject to funding by ENV to BCLSS.

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