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REGIONAL PARKS COMMITTEE
MEETING OF WEDNESDAY, JUNE 21, 2017

SUBJECT **Elk/Beaver Lake Initiative Update**

ISSUE

To update the Regional Parks Committee on remediation options for Elk and Beaver Lakes.

BACKGROUND

Elk/Beaver Lake Regional Park is a significant regional natural asset. It is the most heavily-used park in the region and a focal point for multiple-use outdoor recreation. There were an estimated 1.46 million visits in 2016 and an estimated 14,000 angler-days per year. The lakes are home to Rowing Canada, the national rowing team, and the national triathlon team and related events. For example, the lake is the venue for the Subaru Ironman 70.3 competition, which brings approximately 1,600 competitors to the region every July, generating an estimated $5 million in economic value to the region. The park also hosts many day camps and nature programs that educate and benefit citizens year-round.

Elk/Beaver Lake is subject to seasonal blooms of cyanobacteria, commonly called blue-green algae (BGA). These blooms of naturally occurring bacteria have the potential to release cyanotoxins into the water which are hazardous to people and pets that ingest the water. The lake system is subject to multiple stressors; overall water quality is deteriorating, aquatic weeds are proliferating and BGA blooms have become more frequent and long lasting.

A significant issue is the amount of nutrients (e.g., phosphorous) in the system. An effective remediation strategy involves oxygenating the deep water layer to prevent the release of phosphorous from the sediment. This can be done in shallow lakes (such as Beaver Lake) and ponds with simple aeration (such as a fountain or bubbler). Deeper lakes need to maintain separate temperature layers in the summer to support a healthy fish population. Given the importance of recreational fishing in Elk Lake, some form of aeration (that is, adding oxygen to the deep water layer without mixing the lake) is required to produce improved water quality.

Beginning in 2015, an intergovernmental working group (IWG) consisting of representatives from the Ministry of Environment, BC Ministry of Forests, Lands and Natural Resources, Island Health, Capital Regional District (CRD) and the District of Saanich, met periodically to discuss the implications of past water quality monitoring results and potential in-lake remedial options to deal with annual blooms of BGA.

In 2016, CRD Parks & Environmental Services secured 4-year funding for a part-time coordinator and a budget for the first phase of this project: continued water quality monitoring, research, the selection and implementation of an in-lake remediation option, and preparation of a watershed management plan.

Work to date

Staff monitored deep lake water quality between October 2016 and May 2017. Water temperatures were exceptionally cold this year through the end of February. There were no cyanobacteria blooms reported during the cold weather period of December-February, and both Elk and Beaver lakes had significant ice cover for the first time in many years.

Spring monitoring for stratification and oxygen levels is necessary to understand and manage for the reduction of cyanobacteria blooms in Elk Lake. The lake had warmed by April and began to stratify in early May. Phosphorus levels remained below average at all lake depths with the exception of the deepest 18 m pocket, which had very high phosphorus concentrations. Seasonal variation in lake temperature will result in variation in oxygen levels in the deep part of the lake.

Staff conducted stormwater sampling to identify incoming drainages (most of which are seasonal) and identify any areas where phosphorus inputs were exceptionally high. Two inputs, O'Donnell Creek and an unnamed drainage entering the lake from the north, conveyed very high concentrations of phosphorus to Elk Lake from January to March 2017. Five seasonal drainages, including three on the east side of the lake, were identified and conveyed moderate concentrations of phosphorus to Elk Lake. Further investigation is planned through May 2018.

Elk Lake

The IWG met in October 2016. Staff presented a technical summary of existing information and explored several in-lake treatment options for the reduction of internal phosphorus in Elk Lake. Options explored included dredging, a range of aeration options, and a bentonite clay cap for the sediments. The IWG met again in April 2017 to review and narrow down the remediation options under consideration. Out of this review, the group's preferred option is a specific aeration approach known as high-efficiency hypolimnetic oxygenation.

This technique will improve water quality by reducing the release of sediment phosphorus and maintaining cold deep water to ensure a healthy fishery. It will not adversely affect recreational uses on the lake. The addition of pure oxygen to the lake bottom will immediately and significantly reduce the release of phosphorus from lake sediments, and thus reduce BGA bloom frequency, duration and toxicity, and improve overall water quality.

Beaver Lake

Beaver Lake also suffers from occasional BGA blooms and aesthetic concerns of non-toxic scum and excessive plant growth. Due to the profile of the lakes' bottoms, Elk and Beaver function as separate systems. Beaver Lake is shallow, completely mixed and mostly separated from Elk Lake. Staff have identified some simpler oxygenation options that may assist in minimizing algae growth, promote native aquatic plants, discourage invasive weeds and improve the recreational use of the lake. Such an option can be installed relatively easily, produce results in a short timeframe and is relatively inexpensive (~$40,000).

ALTERNATIVES

Alternative 1

That the Regional Parks Committee recommend to the CRD Board:

That staff be directed to include up to $40,000 in the 2018 Regional Parks service plan to install and operate an oxygenation system for Beaver Lake, and develop a business case for a high-efficiency hypolimetic oxygenation system for Elk Lake.

Alternative 2

That the Regional Parks Committee direct staff to report back more information.

ENVIRONMENTAL IMPLICATIONS

BGA blooms are primarily the result of the release of phosphorous from the lake bottom sediments during the summer, when the surface water layer is much warmer than the deep water layer. The difference in temperature creates a barrier between the two layers and, because the water at the bottom of the lake is low in oxygen, phosphorous is released into the water from the lake sediments. The phosphorus accumulates in the lower layer and when surface water cools in the fall, that layer mixes with the upper layer (called "turnover"), and high amounts of phosphorous become available for use by BGA. This results in sudden population growth or "blooms" of BGA and greatly increases the potential for the production of cyanotoxins.

A discussion of the various remediation options considered for Elk Lake is provided in Appendix A.

Successful remediation of Elk Lake will result in:

- summer deep water temperature and oxygen levels suitable for fish
- summer deep water and fall total phosphorous concentrations consistent with winter/spring concentrations
- cyanotoxin levels below the recreational limit once the lake ecosystem stabilizes
- visible bloom days reduced by 50% after 3 years and by 75% after 8 years
- long-term biological shift so that cyanobacteria no longer dominate the algae population
- better water quality for recreational uses; and
- better habitat for native plant and animal species.

INTERGOVERNMENTAL IMPLICATIONS

Several levels of government are involved with the lake system. The Province owns the lake bottom, sediments and water column; Transport Canada, on behalf of the federal government, manages activities on the lake surface; the CRD is responsible for the surrounding park lands; and the watershed is contained predominately within the District of Saanich, discharging through the Colquitz River into Portage Inlet. As well, Island Health monitors the beaches for recreational health purposes.

FINANCIAL IMPLICATIONS

This work is coordinated through the Elk/Beaver Lake Initiative and funded at $122,000 per year from the existing 2017-2019 Parks budgets.

Preliminary estimates of an aeration system suitable for Beaver Lake indicate a capital cost of under $40,000 with minimal operation and maintenance costs. Proceeding with this will require the project to be included in the 2018 Regional Parks Capital Plan, of which $36,000 would be funded from the existing Elk/Beaver Lake Initiative operating reserve and, if needed, the remaining balance from the 2018 operating budget.

Initial rough estimates for the preferred aeration system in Elk Lake include a capital cost of $700,000 for purchase and installation of equipment, and a cost of $0.6–1.1 million for 10-year operation and maintenance, equaling a total of $1.3-$1.8 million over the 10 years. A business case analysis will further refine costs and look at funding opportunities (such as grants and external funding sources) to reduce the capital cost for the CRD.

CONCLUSION

The Elk/Beaver Lake system is a significant regional asset enjoyed by users from all over the CRD and outside the region. Overall water quality in the lakes is declining and with cyanobacterial blooms increasing in frequency and duration in Elk Lake, the risk to health of humans and pets is rising. An intergovernmental working group (chaired by the CRD) has identified preferred remediation options for both Beaver Lake and Elk Lake. For Beaver Lake, staff identified a simple aeration option that can be included in the 2018 Regional Parks Capital Plan using funds already allocated to the project. Staff are also recommending the development of a business case to support the remediation of Elk Lake.

RECOMMENDATION

That the Regional Parks Committee recommend to the Capital Regional District Board:

That staff be directed to include up to $40,000 in the 2018 Regional Parks service plan to install and operate an oxygenation system for Beaver Lake, and develop a business case for a high-efficiency hypolimetic oxygenation system for Elk Lake.

Submitted by:	Glenn Harris, Senior Manager, Environmental Protection
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DG:cam

Attachment: Appendix A – Remediation Options