Making a difference...together

APPENDIX B

Business Case for In-Lake Remediation at Elk/Beaver Lake

CRD Environmental Protection

September 2019

Executive Summary

In the early 1980s, significant water quality issues were reported at Elk/Beaver Lake and long-term trends indicate accelerated deterioration of water quality in recent years. Poor water quality at Elk/Beaver Lake is primarily caused by elevated nutrient levels (particularly phosphorus) in the lake. Elevated nutrients in the lake are the result of a long history of activities (logging, farming and urbanization) that have deposited large amounts of nutrients into the lake through run-off and interflow and have accumulated there over time. Today, elevated nutrient levels in the lake come primarily from internal sources, accumulated in the lake sediments (>70%) and from ongoing external sources (<30%) from the land surrounding the lake. This high nutrient load in the lake contributes to frequent cyanobacteria blooms (also known as blue-green algae blooms) and deteriorated aquatic habitat for fish and other wildlife. High nutrient levels also support the proliferation of an introduced invasive aquatic plant, Eurasian milfoil (*Myriophyllum spicatum*), that dominates the aquatic plant community in Elk/Beaver Lake.

In response to issues facing Elk/Beaver Lake, an Intergovernmental Working Group (IWG) was formed by the Ministry of Environment in 2013 with various government organizations to develop a strategy to improve water quality at Elk/Beaver Lake. In 2016, the Capital Regional District (CRD) formed the Elk/Beaver Lake Initiative (EBLI) with the IWG to further understand the lake issues, collect more information and make informed decisions to improve water quality. The remediation of Elk/Beaver Lake will be implemented in phases to ensure a well-informed, scientifically supported action to address both internal and external nutrient loading. The schedule is dependent on the timing related to the approvals and available financial support required to proceed to the procurement phase.

<u>In-lake Remediation</u>

The phased approach to address internal nutrient sources includes the following:

- Phase 1 (January-May 2019) Summarize all water quality data collected to date, identify data gaps and develop plan to address all data and study gaps
- Phase 2 (February-December 2019) Implement the study program to collect all necessary data, and complete critical analysis to better understand lake system dynamics and inform the In-Lake Remediation Plan
- Phase 3 (September 2019-May 2020) Develop an In-Lake Remediation Plan, with detailed selection and design of most appropriate in-lake remediation system
- Phase 4 (May 2020-April 2021) Implement in-lake remediation plan, contingent on Board approval, available funds, permits and adequate engagement

Watershed Management Plan

The phased approach to address external nutrient sources includes the following:

- Build public awareness (January-July 2019) Develop and distribute resources to increase public awareness of lake issues and buy-in for Watershed Management Plan.
- Consult on Watershed Management Plan (May-December 2019) Engage public and government partners in consultation process to identify values, issues, goals and priority actions.
- Develop Watershed Management Plan (September-May 2020) Draft, review and revise the Watershed Management Plan. Identify issues and actions to reduce external nutrient loading.

In the first phase of the in-lake remediation plan, a team of expert consultants, in partnership with the CRD and the IWG, compiled all available reports and data to identify the most appropriate remediation approach to improve water quality. The recommended system to treat internal sources of nutrients in Elk/Beaver Lake is Side Stream Supersaturation (SSS) hypolimnetic oxygenation system. In addition to an in-lake remediation system, the team of experts identified the need for a watershed management plan to address external sources of nutrients through a public engagement process.

The total capital cost is approximated at $1.4 million. Annual operations, maintenance and project management is expected to cost $100,000/year.

This recommendation for in-lake system and watershed management will directly reduce the frequency and toxicity of cyanobacteria blooms, improve habitat for native fish, support management of invasive aquatic plant growth, ensure compliance with provincial and federal guidelines for recreational water quality, improve recreational opportunities, reduce risk to health and safety and increase protection for downstream habitat in the Colquitz river and ocean outflow. The implications of not acting may include reduced environmental health, function and integrity of the lake system, deteriorating habitat quality in the lake and downstream, reduced recreational and social opportunities, such as rowing, fishing, dog-walking and swimming in the lake (e.g., relocation of National Rowing facility), increasing risk to public health with more frequent cyanobacteria blooms, increasing pressure on neighbouring parks and protected areas that are not intended to sustain such high levels of recreation and park use, an economic loss to the region and its residents and a greater cost to the CRD to manage elevated risk to environmental and health and safety.

Recommendation

Elk/Beaver Lake provides significant environmental, cultural, recreational and aesthetic value to our region, and is the most visited regional park in the CRD (1.5 million visitors each year). The economic value generated by various activities, events and park uses around the lake is estimated at over **$10 million annually**. This value does not capture intangible non-monetary values of the lake that provide aesthetic, cultural, environmental and social benefits. In addition to annual income generated by the regional park, the fair market value of the land and amenities at Elk/Beaver Lake Regional Park is over $14 million, and the CRD's annual investment in the operations and maintenance of the park is approximately $875,000/year. Deteriorating water quality threatens these values, in addition to increasing risk to public health. Taking action to improve water quality and protect this lake and its associated values is therefore recommended.

The recommendation of this business case is to invest in an in-lake remediation system and watershed management plan for Elk/Beaver Lake, estimated to cost $1.4 million in capital expenses, and $100,000 annually in ongoing operations and management. This recommendation has support from the intergovernmental working group and third-party expert consultants.

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Purpose

The purpose of this document is to provide a business case for pursuing in-lake remediation at Elk/Beaver Lake.

1. Background

In response to deteriorating water quality, the Elk/Beaver Lake Intergovernmental Working Group (IWG) led by the BC Ministry of Environment, was formed in 2013 to discuss the lake ecosystems and develop a strategy to improve water quality. Membership of this group included the Ministry of Forests, Lands, and Resources Operations, Island Health, the CRD and the District of Saanich, in collaboration with local interest groups like Victoria Golden Rods and Reels. Planning regulations and bylaw enforcement for residential properties in the watershed are within the jurisdiction of the District of Saanich. BC Ministry of Environment and Climate Change Strategy (ENV) is responsible for the lake water and lake sediments. Fish are managed and monitored by the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNR). Water surface activities are regulated by Transport Canada. Elk/Beaver Lake Regional Park is managed by the CRD. Island Health manages issues related to human health at the lake, such as responses to cyanobacterial bloom. Additional government and stakeholder groups include First Nations, non-governmental organizations, academic partners, funding contributors, scientific experts and lake and park users.

In response to concerns for declining water quality at Elk/Beaver Lake, CRD Parks & Environmental Services secured four years of funding ($122,000 per year from the existing 2015-2019 Parks budgets) for a part-time coordinator and a budget for the Elk/Beaver Lake Initiative (EBLI). The purpose of this initiative is to coordinate efforts to reduce high nutrient levels and select appropriate solutions to improve environmental, cultural and recreational values of the lake. The intent of these efforts is to reduce frequency and toxicity of cyanobacteria, improve fish habitat and manage invasive aquatic plants.

The goals of this initiative are to:

- coordinate governmental partners and community stakeholders to support the initiative
- select and implement in-lake remedial actions to reduce internal nutrient loading
- develop a watershed management plan to reduce external nutrient loading
- increase awareness of water quality at the lake to support nutrient reduction actions

1.1 Issues Facing Elk/Beaver Lake

Deterioration of the aquatic environment at Elk/Beaver Lake has been well documented since the 1980s (Nordin, 2015). Multiple stressors on the lake have impacted the health and function of the ecosystem, biodiversity and ecosystem services, which have further implications for the social, cultural and economic values of the park.

1.1.1 Eutrophication

Water quality issues at Elk/Beaver Lake are primarily the result of high levels of nutrients in the lake. Through a process known as eutrophication, a body of water becomes overly enriched in nutrients over time. At Elk/Beaver Lake, this natural process has been accelerated by human-related activities in and around the lake that increase the amount of nutrients that enter the lake. Phosphorus, in particular, is considered to be the most important factor impacting water quality. Eutrophic lakes are often also associated with excessive aquatic plant growth, poor water clarity, reduced oxygen levels, deteriorated aquatic habitat, low biodiversity and frequent cyanobacteria (blue-green algae) blooms. The source of excessive nutrients in a lake is often a combination of internal and external nutrient loading.

External nutrient loading is caused by nutrients carried by water, sediments and dust particles from external sources and deposited into the lake. External sources include human activities, such as land development, road construction, logging and farming that bring additional nutrients into the lake and alter the movement of nutrients across the landscape. Fertilizers, for example, are a significant source of nutrients that can be problematic when they enter lake environments from run-off and interflow. In Elk/Beaver Lake, it is estimated that between 11-29% of total phosphorus in the lake water is attributed to external nutrient sources (Nordin, 2015; Nurnberg, 2016).

Internal nutrient loading occurs when the nutrients in the bottom sediments of the lake are recycled back into the water column. The nutrients in lake sediments accumulate over time and are a direct function of the amount of external nutrients deposited into the lake. This accumulation of phosphorus in lake sediments is a natural process, but it has been significantly accelerated by human activities in and around the lake. Nutrients locked in the lake sediments are released into the water column by a variety of mechanisms and environmental conditions. The dominant driver for the release of phosphorus from sediments is low oxygen levels at the sediment-water interface. Under low oxygen conditions, phosphorus is released from the sediment and made available in the water column, known as p-release. Under high oxygen conditions, phosphorus remains bound to the sediment, known as p-burial. Another important mechanism that influences internal loading of phosphorus is disturbance to sediments by wildlife (bioturbation) or recreational activities. In Elk/Beaver Lake, it is estimated that between 71-89% of total phosphorus in the lake water is attributed to internal nutrient sources (Nordin, 2015; Nurnberg, 2016).

1.1.2 Environmental Concerns

1.1.2.1 Cyanobacteria

Elk/Beaver Lake experiences frequent cyanobacteria (blue-green algae) blooms throughout the year. These native, naturally occurring cyanobacteria are responsible for life, as we know it on earth, by providing oxygen in our atmosphere. In high abundance; however, cyanobacteria produce a visible blue-green scum on the surface of water that may become toxic. The dominance of cyanobacteria in Elk/Beaver Lake can be directly attributed to the high levels of phosphorus in the lake. In Elk Lake basin, blooms typically occur

over the winter months from November to March. Blooms in Beaver Lake have historically occurred from August to September; however, in 2018 and 2019, blooms have continued in Beaver Lake throughout winter as well. Some of the common cyanobacteria species in Elk/Beaver Lake (Microcystis, Aphanizomenon and Anabaena) have the potential to produce cyanotoxins.

In Elk Lake basin, a thermocline forms during the summer separating warm surface waters from cooler deep waters. At the surface, photosynthesis and atmospheric oxygen-exchange occurs and maintains a high level of dissolved oxygen. In deep waters below the thermocline, water becomes very low in oxygen, as it is isolated from oxygenated surface waters. Decomposers like bacteria found in benthic habitat in sediments use any available oxygen to break down organic materials, further reducing available oxygen. In low oxygen conditions, phosphorus is released (p-release) from sediments into the deep lake waters. As surface waters cool in the fall, the thermocline dissolves and the deep and surface waters mix. This allows the phosphorus in the deep water to become available at surface waters and support rapid growth of cyanobacteria. In Beaver Lake basin, a strong thermocline does not form during the summer. Instead, deep and shallow waters mix readily under windy conditions and nutrients are immediately available to promote cyanobacteria blooms. This allows for cyanobacteria blooms to occur throughout the summer and into the fall. Following rapid growth of cyanobacteria and aquatic plants during the summer and fall, decomposition of these organic materials further contributes to excessive nutrients in the sediments. This high level of biological activity also reduces dissolved oxygen levels, perpetuating water quality issues in the lake.

1.1.2.2 Invasive Species

Non-native plants and animals have been introduced to native habitats throughout human history, both intentionally and accidentally. Non-native species that out-compete native species are called invasive species. Invasive species reduce biodiversity and upset natural food-chain dynamics. Once established, many invasive species become ubiquitous and difficult to control or eradicate.

Excessive growth of submerged invasive aquatic plants has become a nuisance in Elk/Beaver Lake, impacting the ecological health of the ecosystem and impacting recreation values. An aquatic plant survey conducted in 2016 found 11 aquatic plant species (compared to 60 species in a previous survey conducted in 1985). Native whorled water-milfoil (*Myriophyllum verticillatum*) and invasive Eurasian water-milfoil (*Myriophyllum spicatum*) were the most dominant, accounting for more than 95% of aquatic plants. These plants grow very long strands (1-3 m long) and float just under the lake surface in a thick mat. The rapid growth of invasive aquatic plants is related to nutrient issues in the lake. This invasive species grows aggressively in the summer, and in the fall decomposes and contributes to nutrient levels in the sediment, later available for release into the water column.

The CRD has harvested invasive aquatic plants annually from Elk/Beaver Lake since 1979, with the exception of a few years. A new weed harvester was purchased in 2016. Reports indicate that, on average, 300-450 tonnes of aquatic weeds are removed from Elk/Beaver Lake each year. The weed harvester improves the recreational values of the lake by clearing surface plant material for boats, rowers and swimmers. However, the weed harvester is not an effective treatment to fully remove the plant material and reduce the environmental impacts to the overall lake health, water quality and wildlife habitat.

In 2017, a fish inventory was conducted to characterize the overall fish community in Elk/Beaver Lake. After employing a variety of sampling techniques at multiple sites around the lake, no native fish species were captured or observed. A total of 732 fish were captured, including yellow perch (55%), largemouth bass (12%) and pumpkinseed (11%), followed by smaller numbers of bullhead, carp, smallmouth, and rainbow trout. The abundance of non-native fish in Elk/Beaver Lake is detrimental to the health of the overall lake ecosystem because it upsets the food web, reduces biodiversity and contributes to poor water quality. Yellow perch, for example, consume native zooplankton and benthic organisms. Largemouth bass are aggressive predators of desirable recreation fish, such as rainbow trout. Common carp consume desirable aquatic plants, facilitating the growth of nuisance plants. Non-native fish also feed on zooplankton. The foraging behavior of non-native fish also stirs up lake-bottom sediments and contributes to nutrient issues in the lake, in a process known as bioturbation.

1.1.2.3 Poor Habitat Quality

As a result of high nutrient levels and low oxygen levels in the lake, the community of organisms that live in the lake are under increased stress. The current conditions support a phytoplankton community that is dominated by cyanobacteria. The zooplankton and benthic community in Elk/Beaver Lake is also reduced in abundance and diversity, as a result of poor food availability, low oxygen conditions and increased predation by invasive fish species. These environmental conditions further impact fish, reptile and amphibian habitat. In particular, fish habitat has been significantly impacted because several species of fish prefer deep, cold, oxygenated waters. As deep waters have become very anoxic in Elk/Beaver Lake, fish are forced to inhabit shallower, warmer habitat where they can access sufficient oxygen. This is well documented in the 2017 study, where no fish were captured in depths greater than 12 m in Elk Lake, likely as a result of anoxic conditions (no available oxygen).

1.1.3 Human Health Concerns

The CRD issues advisories and warning signs for the public to avoid recreational use of the lake when testing confirms the presence of cyanotoxins in concentrations exceeding guidelines for water contact. Ingesting water with cyanotoxins may cause a range of symptoms, including headaches, abdominal pain, damage to liver and brain tissue in humans, and can lead to liver damage or death in dogs and other small mammals.

1.1.4 Stressors

The residence time of a lake is calculated by the amount of time water spends in a lake before being flushed downstream. A long residence time can put added stress on the lake system, as nutrients and water move very slowly through the system. Dams slow the movement of water through the lake system and cause nutrients to settle in the lake sediment more readily and increase internal nutrient loading. The approximate seven-year residence time of Elk/Beaver Lake is a significant driver of high nutrient levels and elevated lake productivity.

Invasive species further stress the natural environment at Elk/Beaver Lake. Invasive animals include yellow perch, largemouth bass, smallmouth bass, common carp, American bullfrogs, Canada geese (introduced sub-species). These species impact natural lake processes by disturbing lake sediments, preying on native species and increasing nutrient inputs into the lake.

Predicted changes in the climate are expected to further stress the lake environment and compound nutrient issues. Increasing temperatures and longer growing seasons will improve growing conditions for invasive plants and cyanobacteria. Heavier winter rains are also expected to cause increased stream erosion and flooding and contribute higher levels of nutrients into the lake.

1.2 Drivers for Change

Concerns for water quality at Elk/Beaver Lake have been voiced since the 1950s, and were reported by the Province in the early 1980s. The issue raised public attention when interest groups expressed concern to the Chair of the Regional Parks Committee and Environmental Services Committee in 2015. Public concern for safety of people and their pets has significantly increased around the lake, as well as concern for the viability of future recreational use, and its associated economic impacts.

Extended cyanobacteria blooms in 2016, 2017, 2018 and 2019 have caused increased beach closures and resulted in the cancellation of key events, park programs, community festivals and sporting events due to health and safety risks, thereby impacting delivery of recreational services and significantly impacting economic revenue. Recreation opportunities, such as fishing, swimming and rowing are also significantly impacted by poor water quality, low oxygen levels and extensive growth of Eurasian milfoil.

1.3 Scope

This Business Case is intended to provide the necessary background history, data and understanding to inform a decision to take a multi-pronged approach to remediate Elk/Beaver Lake and protect its multi-use values into the future. This Business Case outlines the need to address water quality issues to protect an important natural asset, minimize risk and ensure sustainable, improved water quality for generations to come.

1.4 CRD Strategic Fit

This initiative is supported by Capital Regional District (CRD) Board, Corporate, and departmental priorities and plans:

- *CRD Board Strategic Priorities 2019-2022:* This recommendation supports Board priorities by addressing Climate Adaptation and Mitigation, responding to predicted increased frequency of cyanobacteria blooms, drought and flooding events that will further degrade water quality in Elk/Beaver. Remedial action will enhance a natural asset to achieve environmental resilience and support wellbeing of current and future residents, with added consideration for building positive partnerships with First Nations through appropriate consultation. This project is supported under priority areas: Climate Change; Governance; Public Engagement and Communications; Economic Development; and Biodiversity and Ecosystem Health.
- *Corporate and Core Services Priorities:* This project is also supported by priority areas: Education, Outreach and Information; Environmental Protection; Health and Wellbeing; Recreation, Arts and Culture; Regional Infrastructure; and Regional Parks.

2. Need for Investment

Elk/Beaver Lake provides significant environmental, cultural, social and economic values to the region and its residents. Some of these values are intangible and cannot be quantified, while others provide significant economic benefit to the region. All of these values are summarized below.

2.1 Environmental Values

2.1.1 Habitat

Elk/Beaver Lake and the surrounding watershed has wetland, fresh water (lakes and rivers) and woodland habitats. These natural areas provide habitat for a diversity of plants and animals in an otherwise degraded and fragmented urban area. Elk/Beaver Lake Regional Park supports western painted turtles (*Chrysemys picta bellii*), a federally-designated species-at-risk and the only remaining species of native turtle on Vancouver Island. Critical Habitat has been identified for western painted turtles under the *Species-at-Risk Act* . This designation requires protection of habitat values that support the species' survival and recovery. Elk/Beaver Lake also supports bird populations, including American coots, Great blue herons, and many other migratory and resident bird populations.

2.1.2 Downstream Watershed Values

The environmental values of Elk/Beaver Lake extend beyond the park itself, as it supports one of the largest watersheds in the CRD, the Colquitz River Watershed. The Elk/Beaver Lake system drains water into the Colquitz River and plays an important role in flood mitigation downstream. The Colquitz River is an important native fishery for Coho salmon (*Oncorhynchus kisutch*) and Coastal Cutthroat trout *(Oncorhynchus clarkii clarkii).* Lake levels in Elk/Beaver Lake are managed by CRD staff to provide sufficient water for summer recreational activities on the lake and release minimum environmental flows from the lake into the Colquitz River for fish. Increased concentrations of phosphorus, cyanotoxins and altered pH levels in Beaver Lake have implications for water quality downstream, and into the ocean where it flows out at Portage inlet.

2.1.3 Ecosystem Services

Ecosystem services are the many and varied benefits that humans freely gain from the natural environment and from properly functioning ecosystems. Elk/Beaver Lake is an important ecological asset that provides significant provisioning and regulating services to residents of the CRD. The economic value of these systems is significant, providing basic functions like stormwater management, water filtration, and provision of aquatic and riparian habitat for many species in the lake and downstream. Provisioning services, regulating services and habitat services provided by Elk/Beaver Lake are all important to maintaining a healthy and functioning ecosystem that would support further social and economic values.

2.2 Cultural Values

Elk/Beaver Lake and the surrounding Saanich Peninsula have been inhabited and taken care of by the W̱SÁNEĆ (Saanich) Peoples for thousands of years. The W̱SÁNEĆ name for this place is XE̱LOXU̱ELEȻ, which refers to how the Land used to build up where the water runs fastest. Grass and reeds would grow there and even a tree did on one occasion, in recent accounts. Then the land would break off and drift out and sink. Thus, the "drifting off place." The area is still used for hunting, fishing and collecting plants for food, medicine and ceremonial purposes. The Indigenous people of this territory managed the lands in such a way as to provide for many of their cultural, sustenance and economic needs; they developed a deep relationship with the lands and plants and animals that lived there. The CRD recognizes the W̱SÁNEĆ people's relationship to land and water and is committed to working with them to take care of it. Consultation will aim to better understand the history of this lake and adjacent lands, the interests that are ongoing there and how the CRD can best work with the W̱SÁNEĆ peoples on the stewardship of Elk/Beaver Lake. This work will result in a deeper cultural understanding of the lake and surrounding area.

2.3 Social Values

High recreational, economic and environmental values are associated with Elk/Beaver Lake. The regional parks strategic plan (2012-2021) identifies Elk/Beaver Lake Regional Park as the only designated Recreation Park in all of the CRD (CRD, 2012). This means that the park is managed to support a variety of recreational activities and management of the natural environment is focused toward the enjoyment of park users. The park is the most heavily used Regional Park and a focal point for multiple-use outdoor recreation. There were an estimated 1.57 million visits in 2018 and an estimated 15,000 angler days per year. Although the national rowing team is expected to move in spring 2020, the lake is home to numerous competitive and recreational rowing teams. The lakes are also the site of an annual national triathlon and other sporting events. The park also hosts many day camps and nature programs that educate and benefit citizens year-round. The park offers opportunities for social interactions, team building, fitness and overall wellbeing. Elk/Beaver Lake provides opportunities for many outdoor experiences, activities and events, and is managed to accommodate a variety of shoreline and in-lake recreational activities.

2.3.1 Water-Contact Recreation

Elk/Beaver Lake provides a unique, accessible location for outdoor activity for all ages, supports a healthy active lifestyle and overall wellbeing. Recreation activities at Elk/Beaver Lake include swimming, fishing, rowing, canoeing and annual recreation events, such as triathlons and regattas. The lake is a multi-recreational facility not found elsewhere in the region.

- The Greater Victoria Rowing Society (GVRS) offers recreational opportunities for local residents and visitors. The society hosts year-round training and competitions (i.e., regattas) on Elk/Beaver Lake comprised of various rowing groups that include the national rowing team (Rowing Canada Aviron), the University of Victoria rowing team, the Victoria City Rowing Club and high school rowing teams.

The National Rowing Team, which has brought in $3.4 million annually to the region, is relocating from Elk/Beaver Lake in spring 2020. However, all other programs through the GVRS will be maintained as usual.

- **Fishing:** Elk/Beaver Lake is the most fished lake on Vancouver Island, with over 15,000 angler days per year (40-50 angler visits per day). Trout fishing has been of the greatest interest to anglers at Elk/Beaver Lake, targeting two species: rainbow trout and the native cutthroat trout. Freshwater Fisheries Society of BC stocks Elk/Beaver Lake with 19,000 sterile rainbow trout annually to support the recreational fishery (Freshwater Fisheries Society of BC, 2017). Frequent algal blooms, poor water clarity and poor deep-water habitat quality have negatively impacted this fishery in recent years (Nordin, 2015).
- **Trail Use:** The trail around Elk/Beaver Lake is used heavily by hikers, dog walkers and equestrian groups. Cyanobacteria blooms can produce taste- and odour-causing compounds, resulting in foul-smelling water, especially in shallow waters adjacent to lakeshores. Trail use is significantly impacted by poor water quality, as it poses health risks to trail users and their dogs. In 2016, the death of at least four dogs was linked to toxin-producing cyanobacteria blooms in Quamichan Lake, BC.
- **Regional Parks Outreach and Canoe Programs:** The CRD hosts ongoing outreach activities around the park and in the Nature House. The Nature House is open an average of 32 days per year, supported by four-six volunteers annually and visited by an average of over 1,400 visitors every year. CRD Regional Parks hosts several canoe programs in Elk/Beaver Lake each year. Local schools host periodic field trips that include canoeing and kayaking on the lakes, as well. These programs promote outdoor recreation and environmental education. At least 135 residents participated in canoe programs in 2016. However, in 2018, CRD canoe programs were cancelled for 2018, primarily in response to increasing concerns around cyanobacteria blooms.

2.3.2 Community Use & Events

Leases and Permits: Every year, the CRD approves over 100 permits for varied uses in the park, such as recreation, research, and social activities. In 2017, the CRD approved 102 permits, including Shelter Use Permits (75), Special Event Permits (19), Commercial Use Permits (3), Research Permits (4) and Filming Permits (1). These activities provide significant value to the CRD, its residents and visitors.

Community Events: Elk/Beaver Lake hosts numerous water-contact events throughout the year that are attended by over 10,000 participants and spectators. These annual events, summarized in Table 1, are directly impacted by deteriorating water quality. For example, in 2013, the annual New Year's Polar Swim was moved from Elk/Beaver Lake to Thetis Lake, due to significant cyanobacteria blooms (Nordin, 2015).

Table 1 2019 Water Contact Events at Elk/Beaver Lake

Sponsor	Event	2019 Date	Participants	Spectators
UVic Rowing Club	Elk Lake Spring Regatta	March 2-3	700	500
Victoria Model Shipbuilding Society	Beaver Fever	March 15-17	25	10
Victoria City Rowing Club	Dueling Over a Grand Regatta	April 7-8	300	300
Island Outfitters	Take a Kid Fishing	April 13	300	unknown
Youth Paddling Club Society	Canoe Races	April 27-28	300	80
Power to Be	Power to Play	May 25-26	160	50
Iron Man	Triathlon	June 1-4	1,200	800
Victoria City Rowing Club	Corporate Challenge	June 2	125	25
Power to Be	Have a Go- Kayaking	June 9	30	15
Victoria City Rowing Club	Corporate Challenge	June 16	250	250
Victoria City Rowing Club	Challenge West	July 13-15	600	600
Dynamic Race Events	Victoria Triathlon	August 2-4	400	300
Greater Victoria Youth Rowing Society	Regattas	September 30	300	400
Victoria City Rowing Club	Western University Rowing Championships	October 12-14	500	750
Greater Victoria Youth Rowing Society	LVISSAA High School Final Regatta	November 2-4	500	750
Greater Victoria Youth Rowing Society	Island High School Invitational	November 10	50	200
			5,740	5,030
Total annual event participants and spectators estimated to attend community events:			**10,770**	

2.3.3 Public Health

Elk/Beaver Lake provides significant benefits to CRD residents and visitors by providing access to natural areas and outdoor activities that support increased physical and mental wellbeing. Positive experiences and interactions in nature are closely linked with improved mental and physical health. This public health service supports a connected, vibrant and healthy community.

2.4 Economic Value

The economic value of Elk/Beaver Lake is approximated from best available information, and does not account for intangible social, cultural and health benefits to the public that are difficult to monetarily quantify.

The following Table 2 summarizes all available data on sources of economic value. Detailed summaries of these cost estimates are provided below.

Table 2 Annual Economic Value of Elk/Beaver Lake

		Annual Value
Recreation	Rowing	$2.80 million*
	Fishing	$2.35 million
	Triathlon	$5 million
Leases & Permits		$15,300
Total Annual Economic Value		**$10.2 million**

* Excludes the value of the National Rowing Centre ($3.4 million) as it is expected to move in spring 2020

2.4.1 Recreation

Recreational opportunities offered by Elk/Beaver Lake have value that can be monetized. These estimated values exclude investment by park users (boat users, rowers, horseback riders and anglers) who have spent dollars in the cost of travel and equipment for use on Elk/Beaver Lake.

2.4.1.1 Rowing

The **GVRS** supports many rowing programs at Elk/Beaver Lake and maintains a long-term lease with the CRD.

- **Victoria City Rowing Club** supports full-time, part-time and numerous short-term employment positions. The economic value of the club is at least $450,000/year in salaries and expenses to support the Rowing Club. Two annual regattas bring significant tourism to the area, with over 800 participants (30-75% outside of CRD), and increase spending in the capital region. Tourism Victoria estimates the economic value of two regattas is $1.1-1.4 million/year.
- **University of Victoria** rowing team consists of 100-120 student athletes, coaches, and team staff. The value of this team is $600,000/year in operation and training costs and an estimated $300,000/year in regional tourism generated from two annual regattas. The total benefit is $900,000.
- **Regional High School** rowing program currently includes 10 schools for a total of 250 student athletes that row on Elk Lake. The student program contributes an estimated $50,000/year to the local economy.

- Rowing Canada Aviron will be relocating its training centre to Lake Quamichan in 2020. However, currently the value of this program is estimated at $3.4 million/year in salaries, programming, athlete support and operations. This does not include indirect economic benefits related to spending on goods, services (from athletes and staff living and visiting the area). Nor does it include indirect benefits related to camps, trials and other events (accommodation, transportation, food) that would be associated with the National Training Centre. Due to the relocation of the training centre, this value is excluded from the overall economic value of the lake.

2.4.1.2 Fishing

The economic value of fishing at Elk/Beaver Lake can be estimated from the total angler days per year of 15,000. The average amount of money spent is estimated at $157/angler day, equating to an overall value of $2.35 million/year (BC Freshwater Sport Fishing Economic Impact Report).

2.4.1.3 Triathlon

Elk/Beaver Lake is the venue for the Subaru Ironman 70.3 Victoria competition, which brings in an average of 1,600 competitors to the region every July. Surveys conducted by the event coordinators in 2015 found that 50% of participants were from the United States, and 5% were from outside of North America. An estimated 3,500 spectators attend the event. Iron Man Canada estimates that the triathlon brings in $5 million to the local economy, based on average tourist spending of $219 per person/day for a four-day stay.

2.4.2 Lake Visitors

Elk/Beaver Lake provides economic benefits to the CRD through ongoing activities and special events that are hosted at Elk/Beaver Lake, bringing in visitors from outside the CRD. These visitors benefit our economy by staying in hotels, eating local food and supporting local business. The economic value of park visitors can be estimated by the average number of visitors that come to Elk/Beaver Lake from outside of the CRD (~10%), estimated at 150,000 visitors/year (Regional Parks 2016). Based on Tourism Victoria's estimates of spending ($219/day), visitors may contribute up to $32.9 million/year. Accounting for possible double-counting of revenue from tourism at special events already accounted for (regattas and triathlons), and appreciating that not all visitors to the lake come to the region solely for the lake, we expect visitors may contribute up to $25.3 million. However, it is difficult to approximate how many of those visitors to the lake are in the region solely for the lake. Therefore, for the purpose of this business case, we are excluding this potentially significant contribution but suggest it may be a significant source of revenue.

2.4.3 Leases & Permits

Elk/Beaver Lake provides opportunities to lease the land and facilities through partnerships, use permits and lease agreements with key stakeholder groups. This provides a significant value to the community, as well as direct economic income to the CRD. In 2017, the CRD approved 102 use permits for various events

and activities, providing a venue for important community activities and over $5,100 of income to the CRD annually. The CRD holds long-term lease agreements with four partners, totalling approximately $15,000, that would be impacted if Elk/Beaver Lake continued to degrade.

- Greater Victoria Rowing Society maintains a license with the CRD for the occupation and use of the rowing facilities at Elk Lake ($6,000 annually).
- Vancouver Island Retriever Club has a lease at Elk/Beaver Lake, providing an average of $15 revenue annually (5% of gross revenue) to the CRD for use of the Beaver Ponds.
- Elk/Beaver Lake Equestrian Society has held a lease at Elk/Beaver Lake since 1996, providing an average of $56 revenue annually (5% of gross revenue) to the CRD each year.
- Nature-based Preschool (District of Saanich) holds a non-exclusive licence agreement with the CRD for the use of the Nature House. The fall/winter term from September 1 to June 30 is leased at a rate of $375/month, plus $70/session for naturalist services, in addition to a limited summer use licence at $600/summer. Total income from this lease agreement averages $4,200 annually.

2.4.4 Current & Ongoing Investments

CRD Regional Parks invests significantly in the land, amenities and ongoing operations and programming at Elk/Beaver Lake Regional Park. The following approximations provide some insight on existing value of the land, summarized in Table 3.

- Fee-Simple Ownership: The CRD owns the land and amenities surrounding Elk/Beaver Lake Regional Park. The fair market value of Elk/Beaver Lake Regional Park is over $14 million.
- Infrastructure Upgrades: Between 2015 and 2017, the CRD has invested an average of $500,000/year in capital infrastructure at Elk/Beaver Lake Regional Park. Current and upcoming planned capital investments in 2019 include the construction of the liquid waste disposal system, the replacement of three washrooms, hydro upgrades, and an aluminum bridge estimated at $1.6 million. In 2020, infrastructure upgrades include public washroom upgrade, multi-use bridge, fishing pier upgrade, and damn inspection costs valued at $500,000.
- Management, Operations and Programing: The CRD invests significantly in the ongoing management and operations of Elk/Beaver Lake. At minimum, the CRD spends $250,000 annually on staff members' wages. Programming at the Nature House is primarily supported by volunteer effort; however, one CRD staff member is responsible for overseeing the Nature House and coordinating the volunteers.
- Elk/Beaver Lake Initiative Coordination: The CRD has invested $122,000 per year from the 2015-2019 Parks budgets for staff time and expenses.

Table 3 Current & Ongoing Investment Summary

Investments	Average Annual Value
Parcel owned by CRD and leased to Rowing Club	$13,599,000 (land) + $416,000 (amenities)
CRD Infrastructure upgrades (annual)	$500,000 (average 2015-2017)
Staffing and Operations	$250,000 (minimum estimate)
Elk/Beaver Lake Initiative	$122,000 (2015-2019)

2.4.5 Ecosystem Services

Ecosystem services are the many and varied benefits that humans freely gain from the natural environment and from properly functioning ecosystems. Elk/Beaver Lake is a natural asset that provides provisioning and regulating services to residents of the capital region. The monetary value of these services has not been directly quantified for Elk/Beaver Lake; however, it is expected to be very significant for this region.

2.5 Regulation & Guideline Compliance

Currently, Elk /Beaver Lake does not comply with federal and provincial guidelines and regulations for Recreational Water Quality. In order to comply, Elk/Beaver Lake would have to meet the following standards:

Table 4 Regulation & Guideline Compliance

Parameter	Importance	Guideline
Cyanobacteria	Guideline values for cyanobacteria and their toxins (microcystins) have been established to protect against both the risk of exposure to microcystins, as well as any harmful effects that may be possible as a result of exposure to high densities of cyanobacterial material.	The recommended criteria for recreational waters is: Total cyanobacteria < 100,000 cells/mL or Total microcystins: 20 µg/L (expressed as microcystin-LR) (Water Quality Guideline Series)
Dissolved Oxygen (DO)	Oxygen is the single most important component of surface water for self-purification processes and the maintenance of aquatic organisms, which utilize aerobic respiration.	The recommended criteria for the protection of aquatic life for DO is >5 mg/L at 1 m above the sediments. (Ministry of the Environment; Ambient Water Quality Criteria for Dissolved Oxygen)
Total Phosphorus	Phosphorus plays an important role in the survival and growth of many organisms, but exceedances in total phosphorus can be harmful to aquatic life.	5-15 µg/L and maximum of 10 µg/L

2.6 Implications of Not Acting

If action is not taken to remediate Elk/Beaver Lake, declining water quality will lead to increasing cyanotoxin blooms that diminish the habitat value of the lake. Under existing conditions where eutrophication continues to persist at Elk/Beaver Lake, important habitat is increasingly threatened by high levels of deep-water organic decomposition, high biological oxygen demand and increasing release of nutrients from the sediments. In extreme, but increasingly common cases throughout the world, cyanobacteria blooms have decimated fish and wildlife populations, sometimes overnight, and without warning.

The prevalence of toxic cyanobacteria blooms is expected to increase over time, as a result of climate change. More intense precipitation during winter months contributes to higher external nutrient loading from the watershed into the lake. Longer summers with higher water temperatures, longer growing seasons and lower deep-water oxygen levels are expected to promote internal loading of phosphorus, and consequently increase the abundance of cyanobacteria. This will have trickle down impacts on lake communities, from the fish to plankton community. Important habitat for species-at-risk will be negatively impacted, with further implications for downstream species and their habitats in the Colquitz River. Maintaining a healthy and functioning ecosystem through water quality improvements and effective nutrient management is important to ensuring protection for these environmental values.

This deterioration of water quality will have significant impacts on cultural and social values of the lake. Cultural uses will be degraded, and the wide range of social values will also decline. The increasingly poor water quality in Elk/Beaver Lake puts added pressure on nearby parks and protected areas that are not intended to support high levels of recreational/community use. This increase in cyanobacterial blooms will also pose increasing risk to the health of humans and their pets. Waters shown to exceed the established guideline values, or those in which a bloom has developed, may result in human exposure to cyanobacterial material or cyanotoxins in amounts sufficient to be harmful to human health.

Without investing in in-lake remediation action, programs and events will increasingly be cancelled, reducing use for recreation, social and community purposes.

In addition to intangible values of Elk/Beaver Lake, there are economic values that are at-risk if action is not taken to improve water quality. The economic value of the lake and surrounding amenities is estimated at over $10 million of revenue generated each year for the capital regional district. The fair market value of the Regional Park and amenities is $14 million, and the CRD annually invests approximately $875,000 per year to operate and maintain the park. These values are all at risk if no action is taken to remediate Elk/Beaver Lake.

3. Remediation Selection Overview

3.1 Selection Considerations for an In-lake Remediation System

In partnership with expert consultants and the Intergovernmental Working Group (IWG), the CRD has taken a lead role in investigating all available in-lake remediation options to improve the water quality at Elk/Beaver Lake. Through this initiative, CRD staff have reviewed various options and provided an overview of the various technologies available to address high nutrient levels in lakes. In Phase 1 of the in-lake remediation project, the expert consultants identified four appropriate treatment solutions for Elk Lake and three appropriate solutions for Beaver Lake.

The options considered were all aeration or oxygenation systems that deliver air or oxygen, respectively, to the deep water of the lakes. The majority of nutrient issues in these lakes arise under low-oxygen conditions that cause the release of phosphorus from the sediments, and then support growth of aquatic plants and cyanobacteria. By delivering oxygen to the deep waters, the systems reduce internal nutrient loading and therefore reduces frequency of cyanobacteria blooms. These systems also improve habitat conditions for native fish and deep-water invertebrates that prefer deep-water habitat with cold, oxygenated waters.

The consultants ranked the viable remediation options based on the following criteria:

- Ability to meet project objectives: reduce cyanobacteria blooms, improve fish habitat, and manage invasive weed growth
- Proven technology: The in-lake remediation system selected must be proven technology, supported by peer-reviewed journals
- Flexibility/Adaptability: the in-lake remediation system selected should have the ability to adapt and respond to real-time seasonal changes and predicted future changes (climate changes)
- Sediment disturbance: minimize sediment disturbance that could increase internal nutrient loading, or cause lake mixing
- Small physical footprint: low footprint, and minimize footprint in lake
- Recreational values: minimize impact to recreational activities and physical footprint in water and on land
- Protect habitat: minimizes disturbance to in-lake and downstream habitat and species (Western painted turtle and salmonids)
- Health and safety: minimizes risk to public health and safety
- Ease of operation: minimizes technical expertise to operate and maintain system
- Operating and maintenance costs: the selected system will aim to minimize long-term maintenance and operations costs
- Capital costs: minimize capital costs to purchase system or treatment

3.2 In-Lake Remediation Selection

A third-party, independent review of various in-lake remediation options was conducted by technical experts, using a ranking system to evaluate the ability of systems to address the key considerations. The result of this review was a recommendation for the **Side Stream Supersaturation (SSS) hypolimnetic oxygenation system** for both lake basins, Elk and Beaver. This selection by the technical experts supports the CRD's preliminary findings, and has been supported by the IWG and CRD senior management.

This system operates by pumping anoxic water from the deepest part of the lake to a land-based conical-shaped oxygen transfer device. Gaseous pure oxygen is delivered into the cone and completely dissolved, due to the exceptionally large gas/water interface generated by the bubble swarm created inside of the cone. The oxygenated water is then blended back into deep water in both Elk and Beaver Lakes. A separate system for both Elk and Beaver Lake would be required to meet the needs of both systems; however, implementing the same system at both lakes will streamline installation, operations, and system maintenance requirements.

The **Side Stream Supersaturation (SSS) hypolimnetic oxygenation system** ranked the highest, due to its high efficiency, relatively low capital costs and the lowest long-term operations costs. The simple conical design is a proven technology that is used to treat deep and shallow lakes and wastewater systems across North America. It is a land-based system, having minimal impact to recreation and environmental values and minimizing risk to public safety. This system has the highest efficiency of oxygen delivery of all systems, able to respond to increasing oxygen demands seasonally and able to respond to increasing demand under future climate projections. This system also has minimal maintenance needs, with fewer moving parts and increased ease of access for repair and maintenance, as it is a land-based system. The source of oxygen delivery for this system can come from two sources: on-site oxygen generator (higher initial capital cost, but lower operating costs) or Liquid Oxygen (LOX) deliveries from a local gas supplier (low maintenance expenses, but higher operating costs for oxygen delivery). The selection of oxygen sources will be evaluated in the planning and design phase (Phase 3) with consideration for long-term costs, public safety and site feasibility.

3.3 Elk/Beaver Lake Remediation Costing

Costs for implementing the **Side Stream Supersaturation (SSS) hypolimnetic oxygenation system** include capital costs and long-term operations, maintenance and management costs. Capital costs ($1.4 million) for this system include construction of land-based system, filters, valves, piping and oxygen delivery system. This estimates accounts for either the on-site oxygen generator or liquid oxygen delivery system.

Annually, ongoing costs of operations and maintenance, monitoring and project management is projected at ~$100,000. Operational expenses include staff time to operate, maintain and optimize the system, system maintenance and BC Hydro energy costs to run the system, expected to cost $51,200 depending

on the size and operation requirements of the system. The program monitoring and management costs include necessary activities to monitor and analyze water quality data in order to effectively operate and optimize the in-lake system, expected to cost $50,000 annually.

Table 5 Cost of In-lake Remediation

Cost Type	Cost Description	Elk Lake Costs ($)	Beaver Lake Costs ($)
Capital Costs	Construct land-based system, pumps, piping, screens, diffusers	480,000	320,000
	Oxygen storage/injection system or on-site oxygen generator	160,000	48,000
	Monitoring system, line power, electrical system	80,000	80,000
	Installation & commissioning	120,000	120,000
	Total Capital Costs:	**840,000**	**568,000**
Total Capital Costs for both Elk/Beaver Lake:		**1.4 million**	
Operations & Maintenance (annual)	Power (3600 h operation @ 0.10 kWh)	3,200	1,600
	Oxygen (0.20/kg bulk LOX x 150 days x 500 kg/day)	24,000	N/A
	Maintenance	4,800	8,000
	Inspection / Monitoring	4,800	4,800
	Total Operations & Maintenance	**36,800**	**14,400**
Annual Operations and Maintenance (both lakes)		**51,200**	
Annual Monitoring and Management (both lakes)		**50,000**	

3.4 Important Planning Considerations

Additional considerations must be considered in the implementation of this recommended approach, including, but not limited to:

- **Power capacity:** power capacity for dedicated service at the lake and anticipate increasing power costs. Associated costs will be identified through development of in-lake remediation plan.
- **Timing of installation**: to maintain social values and minimize ecological impacts, the timing of implementation is critical and must be fully considered.
- **Impact to environment:** An Environmental Assessment will be conducted under the requirements of the Ministry of Environment (ENV) Section 11 approval. This will assess ecological risk and ensure minimal ecological impacts, protect Species at Risk and mitigate against initial downstream implications.
- **Stakeholder engagement and communication:** to ensure community engagement and well-informed decision-making, an outreach strategy has been developed to coincide with installation

activities. The public will be engaged to provide updates on ongoing decision-making and build public support.

- **Government regulatory compliance:** This initiative aims to meet provincial/federal regulations for recreational water quality.

3.5 Multi-pronged and Adaptive Management Approach

The purpose of the remediation of Elk/Beaver Lake is to reduce frequency of cyanobacteria blooms, improve fish habitat and reduce weed growth. The appropriate approach to address the source of these issues is to manage internal and external nutrient loading of phosphorus into the lakes. The in-lake remediation system is selected to address internal nutrient loading, resulting in reduced cyanobacteria blooms, and improve habitat for fish. However, this solution is not expected to reduce the growth of invasive aquatic plants. There are few studies that report a reduction in aquatic plant growth as a result of reduced nutrient loading in lakes. It is recommended that a more aggressive weed harvesting program would be required to meet the goal of reducing weed growth in the shallow waters in Elk/Beaver Lake, particularly in the channel.

Invasive species and climate change are confounding issues impacting the hydrology and ecology of the lake in unpredictable ways. To address uncertainty and provide flexibility to adapt as better information and technology become available, adaptive management and processes are necessary. An adaptive management framework provides rationale and data to support science-based decision making under uncertainty. This framework is necessary to ensure that comprehensive, effective solutions will be achieved at Elk-Beaver Lake.

4. Implementation Plan

This initiative takes a multi-pronged, phased approach to address both sources of nutrients in the lake, internal nutrient loading and external nutrient loading. The In-Lake Remediation project will address internal nutrient loading issues. The Watershed Management Plan project will address external nutrient loading issues through targeted stakeholder engagement.

4.1 In-lake Remediation

As part of Phase 1 of the in-lake remediation project, the CRD contracted Northwest Hydraulic Consultants to review all available data and reports and make a recommendation on critical gaps in our understanding of the lake. Phase 2 involves the collection and analysis of data that will inform Phase 3, the sizing, siting and design of the in-lake remediation system.

Following Phase 1, Northwest Hydraulic Consultants recommended the collection and analysis of the following:

- sediment core study in Beaver Lake
- a sediment oxygen demand study in Elk and Beaver Lake
- a hydraulic model describing movement of water between systems
- water quality sampling and analysis for Elk and Beaver Lake

The collection of this data is critical to support the design, operation and best location of the in-lake system by better understanding the total oxygen demand of the lake system and the relationship of water quality between Elk/Beaver Lake.

Following the collection of necessary data in Phase 2, Phase 3 will be to draft a detailed In-Lake Remediation Plan and will be completed through a competitive bidding process. Following the support and approval of the In-Lake Remediation Plan by the board (May 2020), and pending available funds, the plan will be implemented in Phase 4 through a competitive bidding process.

4.2 Watershed Management Plan

Through public consultation and engagement, general awareness about the issues, values and vision for water quality at Elk/Beaver Lake will be addressed. Following public feedback, the management plan will be drafted and brought back to the public for review and comment. Key stakeholders, interest groups, First Nations, local government, and landowners will be engaged to identify priority issues and actions to reduce external sources of nutrients. A final draft of the watershed management plan will be completed by May 2020, and brought to the CRD for support.

This plan is currently in the early stages of engagement to build general awareness. An open house on July 31, 2019 engaged the public and brought awareness to this watershed management plan process.

4.3 Schedule

The following schedule is dependent on the timing related to the approvals required to proceed to the procurement phase:

a) Approval of the business case by the IWG, CRD Parks & Environment Committee and the CRD Board;
b) Obtain any required jurisdictional and environmental approvals;
c) Confirmation of funding (CRD funding and external grants).

In-Lake Remediation Project

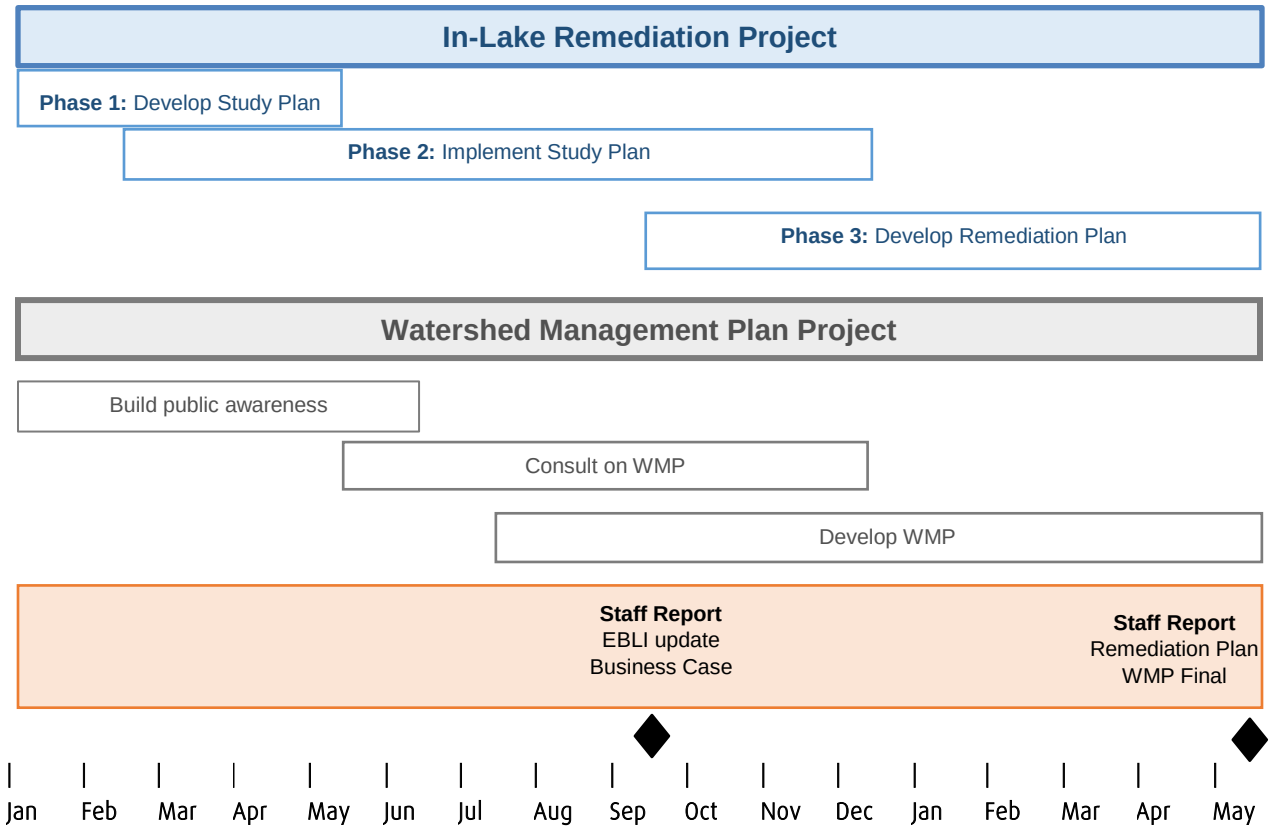
ACTION	COMPLETION DATE	STATUS
Phase 1: Develop Lake Study Plan	January-May 2019	complete
Develop **Business Case** to provide summary of values at Elk/Beaver Lake and justification for future investment in the In-Lake Remediation Project to be presented to the Parks Committee/CRD Board	September 2019	complete
Phase 2: Implement Lake Study Plan	February-December 2019	underway
Phase 3: Develop In-Lake Remediation Plan	September 2019-May 2020	not yet underway
Phase 4: Implement In-Lake Remediation Plan (pending approvals)	May 2020-April 2021	not yet underway

Watershed Management Plan Project

ACTION	COMPLETION DATE	STATUS
Build public awareness: Develop and distribute resources to increase public awareness of lake issues and buy-in for Watershed Management Plan (WMP)	January-July 2019 (ongoing)	underway
Consult on Watershed Management Plan: Engage public and government partners in consultation process to identify values, issues, goals and priority actions	September 2019	underway
Develop Watershed Management Plan: Draft, review & revise WMP. Identify issues and actions to reduce external nutrient loading	December 2019	underway

Table 6 Estimated Project Schedule

Timeline: January 2019-May 2020



4.4 Project Support

- **IWG Support - May 2019:** Since 2015, the CRD has worked with an Intergovernmental Working Group (IWG) to examine water quality issues to determine the cause of the cyanobacteria blooms. This group meets regularly and provided comment and support for the analysis of remediation options presented here. The IWG attended a round table discussion in May 2019, with expert consultants and provided support for this in-lake treatment option.
- **CRD Regional Parks Committee Direction - June 2018:** Regional Parks Committee direction in June 2018 to develop a business case for active lake management for Elk Lake, in order to address the ongoing water quality issues.
- **Direct Stakeholder Engagement and Support:** Mick Collins (Golden Rods & Reels) provided support for Elk Lake investment in June 2017 and June 2018.

The following Table 7 summarizes the organizations provided financial and/or volunteer support to the EBLI. Their contributions were coordinated by the **Victoria Golden Rods and Reels Fishing and Social Club.**

Table 7 Summary of Project Support for Elk/Beaver Lake

National Organizations
Canadian Wildlife Federation
Rowing Canada Aviron
Provincial Organizations
BC Lake Stewardship Society
BC Wildlife Federation and Vancouver Island Chapter
Freshwater Fisheries Society of BC
Habitat Conservation Trust Foundation
Local Organizations
Amalgamated Conservation Society
Aqua-Tex Scientific Consulting Limited
Camosun College Environmental Technology Program
Environmental Law Centre University of Victoria
Haig-Brown Fly-Fishing Association
South Vancouver Island Anglers Coalition
Victoria City Rowing Club
Victoria Fish and Game Protective Association
Victoria Golden Rods and Reels Fishing and Social Club
Vikes Rowing University of Victoria

Moving forward, critical consultation is required with various First Nations.

4.5 Financial Support

Initial discussions with the IWG and other project partners has confirmed that there are limited known sources of financial support to fund the capital, program, operational and maintenance costs associated with implementing this recommendation.

Due to the multi-jurisdictional nature of water quality at Elk/Beaver Lake, there are many agencies responsible for supporting the implementation of the recommended remediation action. In particular, ENV has jurisdiction over the lake water and lake sediments. Advocacy to seek political and financial support from higher levels of government may be required to secure adequate funding for actions to support water quality in Elk/Beaver Lake. FLNR has responsibility for the management of recreational fish in the lake, and may also have an interest in providing financial support for the most fished lake on Vancouver Island.

A number of potential grants have been identified and may be secured to supplement capital costs; however, ongoing program monitoring and operations and maintenance costs are more challenging to fund. Cost-sharing opportunities have been identified through opportunities to establish a volunteer monitoring program at Elk/Beaver Lake through the BC Lakes Stewardship Society and ENV to alleviate long-term monitoring costs. This provides the opportunity to engage local stewards, and gather critical in-lake monitoring data; however, this has associated risks and limitations. Following the approval of the Business Case to pursue in-lake remediation, applications for appropriate grants may be submitted to support the capital costs for in-lake remediation.

5. Conclusion & Decision Request

Elk/Beaver Lake provides significant environmental, cultural, recreational and aesthetic value to our region, and is the most visited regional parks in the Capital District. The economic value generated by various activities, events and park uses around the lake is estimated at over $10 million annually. This economic value is dependent on a healthy lake ecosystem that can support multiple social, cultural and environmental values.

Deteriorating water quality threatens these values, in addition to increasing risk to public health. Taking action to improve water quality and protect this lake and its associated values would require an estimated capital investment of $1.4 million and ongoing operational and management costs of $100,000.

Following an assessment of multiple values of the lake, the significant threat to the lake if no action is taken, and a clear implementation plan to resolve the issues facing the lake, pursuing remediation at Elk/Beaver Lake is recommended. This recommendation fits the CRD's priorities and strategic direction, has significant community and partner support and meets eligibility for a number of favourable grants.

Appendix A – References

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