



Angela Lambrecht

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At the request of RDCO, Larratt Aquatic is pleased to present this proposal for a study designed to determine the impact of septic fields on the foreshore of Okanagan Lake in the Killiney Beach and Westshore Estates area.

The study will include periphyton analysis and water chemistry with sampling occurring from June to October 2020. At the completion of the study period, LAC will prepare a final report that will be supplied in draft to RDCO in December 2020.

The project is designed to be cost scalable with a summer only and a summer + fall option for more rigorous statistical results. The expected cost of the full project is \$16,020 for the field work and reporting phase with lab costs of \$4,109 while the summer-only option has a price estimate of \$11,650 for field work and reporting with lab costs of \$2,054.52.

If you have any questions or comments on this proposal, please don't hesitate to contact us.

Proposal prepared by: Larratt Aquatic Consulting Ltd.

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**Cost Estimate Proposal for
Killiney and Westshore Source Protection Plan – Septic Impact to
Okanagan Lake**

Prepared for: Regional District of Central Okanagan

Study Background:

Regional District of Central Okanagan is engaged in a site selection program to determine the most ideal location for a new intake that will replace two shallow intakes and serve Killiney Beach and Westshore Estates. The shoreline throughout much of the area is developed with residential and all residences are on septic systems.

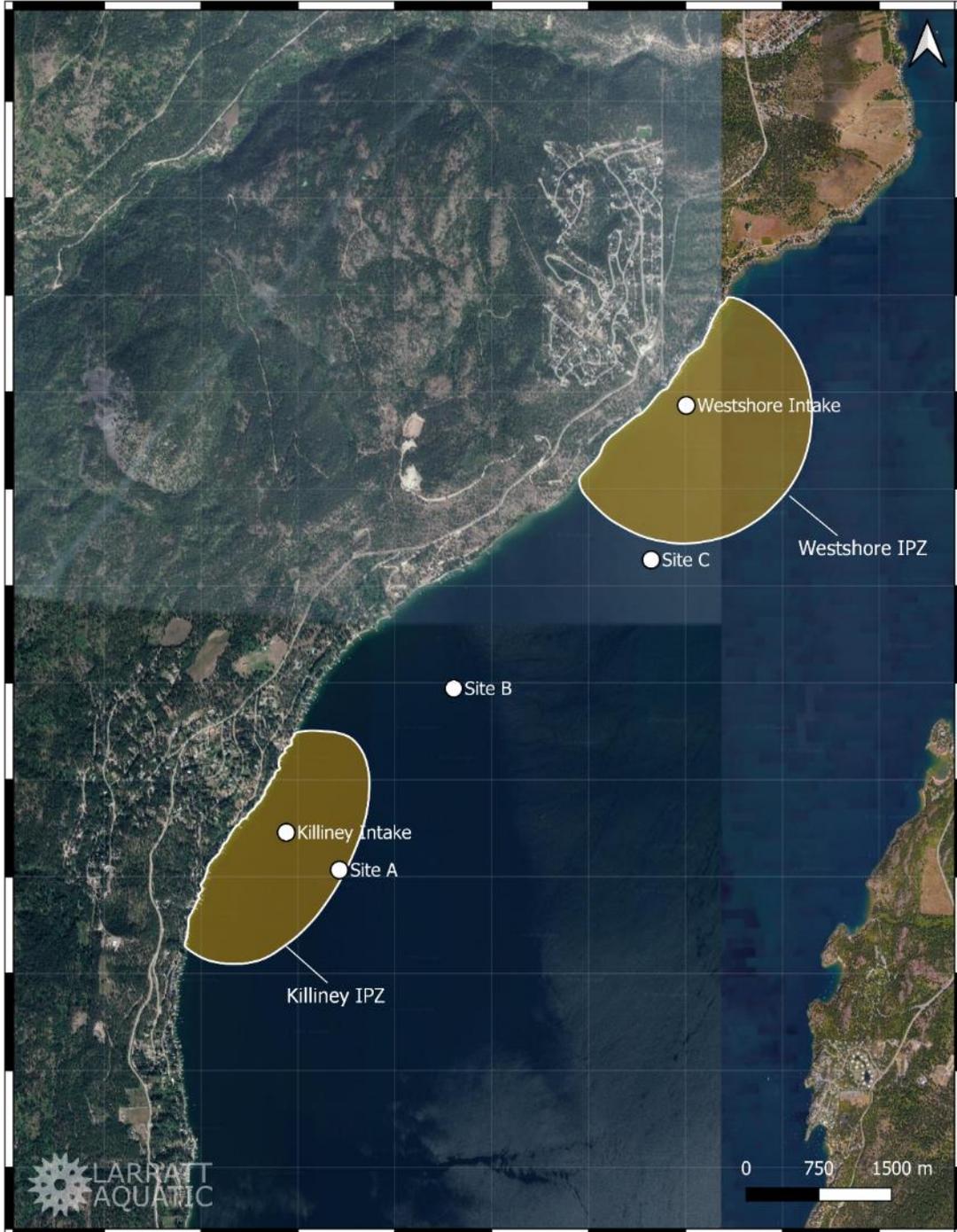


Figure 1: Overview map of study area with sample sites, intake locations, and intake protection zones indicated

Study Purpose:

The proposed study involves a water quality sampling program and a periphyton monitoring program in Okanagan Lake from Killiney Beach to Westshore Estates to determine if there is any influence or impact from septic systems in this area (Figure 2).

The proposed sampling would assess periphyton growth during the summer and fall periods (two deployments) and water chemistry collected three times during each deployment to enable statistical assessment of the data. Periphyton studies measure generalized cumulative nutrient impacts over weeks, while water samples measure instantaneous concentrations of specific septic-influenced parameters.

Proposed Study Design:

LAC proposes to base the sampling methodology on the successful 2014-2015 Cosens Bay study for RDNO (report can be requested). Chemistry samples will go to Caro Labs, Kelowna and water chemistry parameters should include biologically available nutrients (Ns and Ps), chloride, and pathogen-indicating bacteria while periphyton will be assessed taxonomically and by chlorophyll-a as a second measure of algae density (full list of parameters in Table 4). Algae/microflora samples will be identified to species by LAC, along with cell density and biovolume calculations.

Sampling will focus on three zones in 1-2 m depth upslope of the proposed intake locations and one control zone along a stretch of undeveloped shoreline (Figure 2). Within each zone, five periphyton samplers (Figure 3) will be deployed as close to shore as possible; permission of homeowners is sought to ensure samplers are not disturbed. Composite water chemistry samples will be collected within each zone three times during the summer and three times during the fall deployment to measure septic impacts. Each sampler will be equipped with four honed stone tiles as a uniform substrate for periphyton samples, and with temperature + light sensors. The temperature and light data will allow us to statistically control for these drivers and allow statistical focus on nutrient impacts on periphyton growth.

We propose that the summer deployment begin in June and end in August to span the active cottage/high use season while the fall deployment begin in August and end in October to span the low-use season while Okanagan Lake is still stratified.

Table 1: Schedule of Sampling

Time	Periphyton Samples	Chemistry Samples
Early-June	Deploy	Summer 1
Early-July		Summer 2
Early-August	Collect	Summer 3
Late August	Deploy	Fall 1
Mid-September		Fall 2
Mid-October	Collect	Fall 3

Table 2: Number of samples

Time	Periphyton Samples	Chemistry Samples
Summer Deployment	5 x 4 = 20	4 x 3 = 12
Fall Deployment	5 x 4 = 20	4 x 3 = 12
Total Samples	40	24

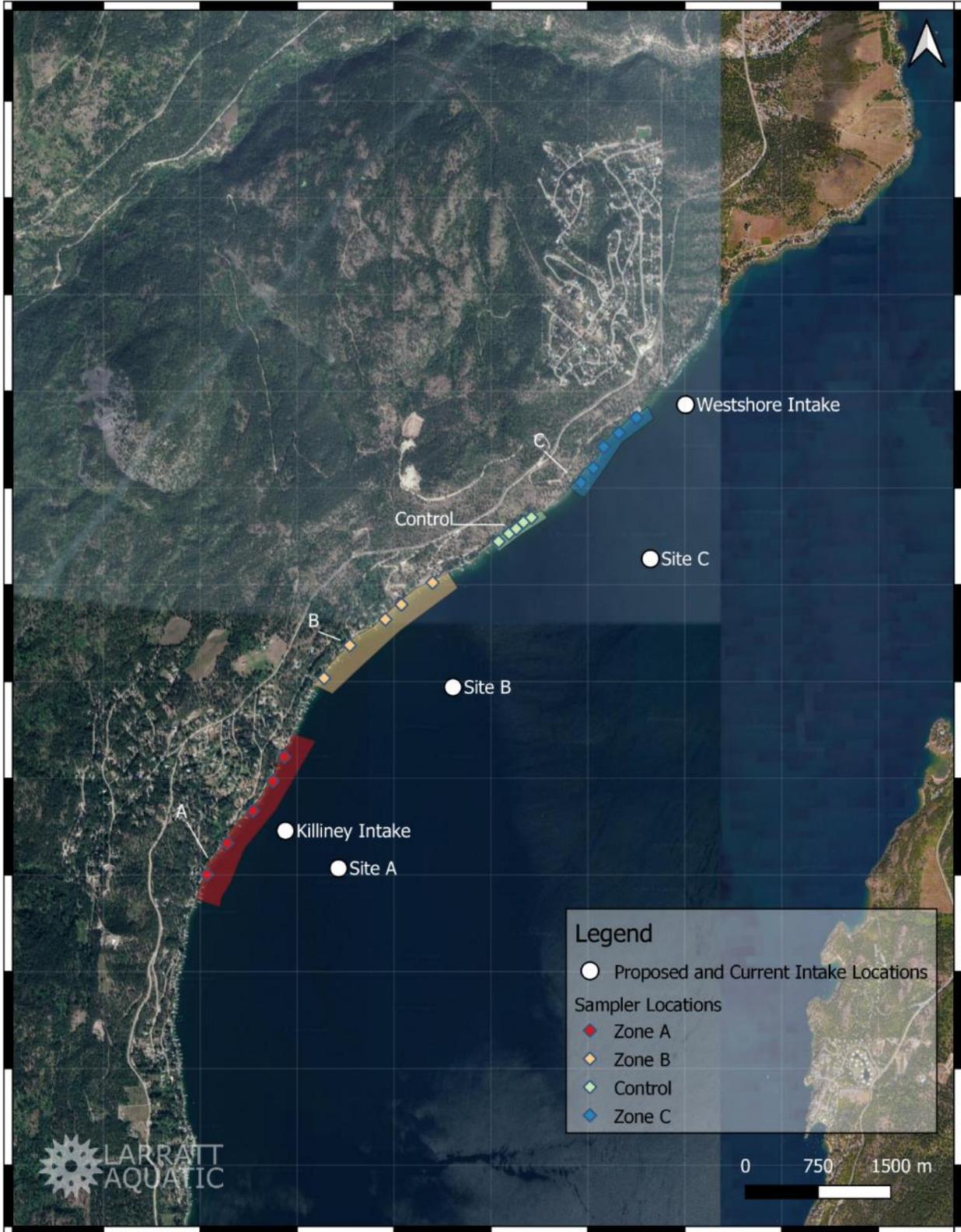


Figure 2: Map of proposed sampling program with locations of sampling zones



Figure 3: Example of Periphyton sampler

Deliverables:

At the completion of the sampling program, LAC will prepare a report detailing the findings. The expected completion date for the draft of the report is December 2020.

Proposed Study Cost:

A summary of expected costs is outlined in Table 3. The study has been designed with a summer and fall phase to provide more thorough analyses and rigorous results, but the program could be reduced to only a summer deployment if costs are restricted. The budget outline below breaks down the total cost and the cost if only a summer deployment is chosen. Lab estimates are included in the estimate but would be directly billed to RDCO by Caro (Table 4).

Table 3: Proposed sampling program budget


Lake Proposal	Task	60 85 45 40 100					Total Cost
		BL	JS	SK	FS	HL	
Admin	Project Admin	4					\$ - \$ 240 \$ -
	Periphyton deployment			16	16		\$ 1,360
	Periphyton retrieval			16	16		\$ 1,360
Field Work	Summer Chemistry*			6	6		\$ 510
	Fall Chemistry*			6	6		\$ 510
	Summer taxonomy					25	\$ 2,500
	Fall taxonomy					25	\$ 2,500
Periphyton Analysis	Database Management		8				\$ 680
	Analyses		32				\$ 2,720
	Annual Report		24			16	\$ 3,640
	Total						\$ 16,020.00
							Summer Only Total \$ 11,650.00

Estimated Caro Costs

Total	\$2,961.84
Summer Only Total	\$1,480.92

*Trips additional to periphyton sampler deployment/retrievals for chemistry sampling

BL= Bruce Larratt, JS = Jamie Self, SK = Sara Knezevic, FS = Field Staff, HL = Heather Larratt

Table 4: Caro Lab Estimate of Analyses



Parameter	Lab Cost	Status
Ammonia	\$ 15.14	Req
Chloride	\$ 12.26	Req
<i>E. coli</i>	\$ 18.44	Req
TN, TKN, NO3, NO2	\$ 35.95	Req
TP	\$ 20.81	Req
TDP	\$ 20.81	Req
Chl-a	\$ 37.80	Optional

Req Cost: \$ 123.41 \$/sample
 Optional Cost: \$ 161.21 \$/sample

Req Cost: \$ 2,961.84 2 deployment lab costs
 \$ 1,480.92 1 deployment lab costs

Optional Cost: \$ 3,869.04 2 deployment lab costs
 \$ 1,934.52 1 deployment lab costs

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