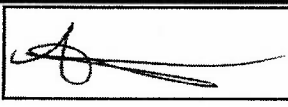


Notice of Alteration Form



Client File No.: 914.20	Environment Act Licence No.: 2704R
Legal name of the Licencee: VILLAGE OF DUNNOTTAR	
Name of the development:	
Category and Type of development per Classes of Development Regulation: <SELECT> <SELECT>	
Licencee Contact Person: JANICE THEREVOT	
Mailing address of the Licencee: Box 321	
City: MATCOCK	Province: MANITOBA Postal Code: R0C 2B0
Phone Number: 204-389-4962	Fax: 204-389-4946 Email: cao@dunnottar.ca
Name of proponent contact person for purposes of the environmental assessment (e.g. consultant): CHRIS PENNER	
Phone: 204-927-3444	Mailing address: SUITE 1120, 11TH FLOOR 201 PORTAGE AVENUE WINNIPEG, MB R3B 3K6
Fax:	
Email address: cpenner@scatliff.ca	
Short Description of Alteration (max 90 characters): TESTING FLotation RAFTS & LEMNA IN LAGOON FOR PHOSPHOROUS REDUCTION	
Alteration fee attached: Yes: <input checked="" type="checkbox"/> No: <input type="checkbox"/>	
If No, please explain:	
Date: APRIL 8, 2019	Signature: 
Printed name: J.M. THEREVOT	
<p>A complete Notice of Alteration (NoA) consists of the following components:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Cover letter <input checked="" type="checkbox"/> Notice of Alteration Form <input type="checkbox"/> 2 hard copies and 1 electronic copy of the NoA detailed report (see "Information Bulletin - Alteration to Developments with Environment Act Licences") <input type="checkbox"/> \$500 Application fee, if applicable (Cheque, payable to the Minister of Finance) 	
<p>Submit the complete NoA to:</p> <p>Director Environmental Approvals Branch Manitoba Sustainable Development 1007 Century Street Winnipeg, Manitoba R3H 0W4</p> <p>For more information:</p> <p>Phone: (204) 945-8321 Fax: (204) 945-5229 http://www.gov.mb.ca/sd/ea/</p>	
<p>Note: Per Section 14(3) of the Environment Act, Major Notices of Alteration must be filed through submission of an Environment Act Proposal Form (see "Information Bulletin - Environment Act Proposal Report Guidelines")</p>	

SCATLIFF + MILLER + MURRAY

visionary urban design + landscapes

Richard-Gamble - Mayor
Village of Dunnottar
Box 321, 44 Whytefold Road
Matlock, MB. R0C 2B0

December 14, 2018

RE: Floating Treatment Wetland (FTW) Platform and Duckweed (*Lemna sp.*) Nutrient Capture Demonstration in a Manitoba Municipal Lagoon.

The following is a brief proposal to undertake a pilot project with the aim of assessing combined capability of Floating Treatment Wetland (FTW's) bio-platforms, and duckweed (*Lemna sp.*) biomass harvest, to reduce phosphorus concentrations in a municipal lagoon. Scatliff+Miller+Murray Inc. (SMM) and the International Institute for Sustainable Development (IISD) propose to undertake this project for the Village of Dunnottar. We are seeking the support of the Village of Dunnottar to undertake this work. Kindly review and consider this proposal as outlined in the sections below.

Background and Objective

Municipal lagoons are required to meet Provincial guidelines of 1.0mg/l before releasing treated municipal effluent waste water. This guideline is difficult to achieve for many lagoons that are overloaded beyond design capacity. Chemical treatment, such as the use of aluminum, is an effective method commonly used in Manitoba to remove excess phosphorus in waste water thereby allowing lagoon operators to achieve the Provincial guideline.

The repeated use of aluminum in wastewater however, contaminates the sludge rendering it ineligible to be spread as a soil amendment in nearby farm production fields. Local Rural Municipalities (RM's) must therefore incur the cost to haul contaminated sludge to approved disposal facilities. The rate of sludge accumulation also increases with aluminum additions, therefore more frequent sludge removal is required, further increasing the average cost of lagoon operation.

The use of treatment wetlands are employed as a reliable biological solution to the challenge of meeting local effluent guidelines, however not all lagoon facilities have the space or infrastructure required for a wetland-based system to be effective. In-situ biological approaches to the phytoremediation of lagoon water have not been demonstrated in Manitoba. We propose to undertake a pilot study to demonstrate and provide an assessment of the following;

- The capability of BioHaven floating treatment platforms populated with wetland macrophytes, to remove excess phosphorus in municipal lagoon effluent, and,
- The capability of Duckweed (*Lemna sp.*) to remove excess phosphorus in municipal lagoon effluent.

Floating Treatment Wetland Deployment

The nutrient uptake capabilities of cattails and other large wetland macrophytes are well documented in a variety of applications in different regions of the world. The hydrology, side-slope conditions, and size of most existing lagoon facilities in Manitoba however, do not favour wetland macrophyte cover to be an effective biological approach to remove excess phosphorus. To overcome these limitations, we propose to deploy FTW platforms; specifically BioHaven FTW platforms. This particular FTW product is designed to provide an extensive surface area matrix for bio-film development in addition to the surface area provided by plant roots suspended under the platform. The combination of nutrient uptake by the macrophytic vegetation and biofilm provides significantly greater phosphorus sequestration capacity than earlier FTW design iterations and likely exceeds the phosphorus removal capacity of natural wetlands on a 'per area' basis.

Duckweed (*Lemna* sp.) Bio-Harvest

Duckweed biomass harvest will provide an added means of phosphorus removal capability. This tiny aquatic flowering plant, sometimes mistaken for algae, thrives on the surface of quiescent, nutrient-enriched water where it produces extensive 'mats'. Literature suggests that the phosphorus removal efficiency of duckweed may exceed that of wetland macrophytes, particularly when biomass is harvested and removed off-site. The deployment of FTW bio-platforms in a small test location within a lagoon secondary cell can create sheltered and stable water surface conditions which will favour duckweed growth.

Duckweed harvest is a proven means of capturing and removing significant quantities of phosphorus. Devil's Lake, North Dakota, for example, uses duckweed biomass harvest in an engineered facility to treat municipal effluent. Duckweed growing on municipal wastewater may sequester phosphorus at a rate of 700lbs/acre/year. Biomass may be harvested every 3 – 5 weeks depending on water chemistry and prevailing local weather conditions. The proximity of the North Dakota facility to southern Manitoba strongly suggests that duckweed biomass harvesting in Manitoba is not limited by regional climate.

Proposed Methods and Scheduling

Field work for this pilot project will be undertaken in 2019 and 2020. A total of 5 FTW platforms will be populated with locally-sourced shallow marsh species and deployed by early-mid May 2019 in the lagoon secondary cell. A total of 5 FTW platforms will be deployed within the lagoon in a manner that creates a small sheltered test site (120.0m² – 150.0m²) for duckweed to proliferate. To ensure that a duckweed mat forms within the study area, duckweed will be 'transplanted' into the test site if necessary.

Duckweed and cattail biomass will be sampled from the test site and analyzed for phosphorus concentration. Duckweed biomass may be sampled 3 – 5 times per growing season due to this plant's propensity to rapidly recolonize the water's surface via asexual budding.

Lagoon water chemistry testing will be provided by the RM of Dunnottar. Biomass production and phosphorus removal rates will be compared to the findings in other research. The data emanating from this pilot project will then be extrapolated to provide a preliminary assessment of potential nutrient removal capacity of full scale implementation in a municipal lagoon.

A second monitoring year shall be undertaken in 2020 during which plant tissue and biomass sampling will be repeated.

Communication and Reporting

Project partners will be kept informed of on-going work on a monthly basis through written monthly updates. It is anticipated that project partner meetings will be held either by phone or in-person. A preliminary report will be provided by October 31, 2019. It is anticipated that 3 project partner meetings will be undertaken either by phone or in-person. A final report on the findings of this pilot project will be submitted to project partners by December 15, 2019.

Ancillary Benefits

It is worth noting here that duckweed biomass is used elsewhere as high-protein livestock feed, a plant-based source of protein for human consumption and as and as a readily compostable and highly fertile organic amendment in food production soils. These are practical secondary uses for harvested biomass for future consideration by the Village of Dunnottar pending the results of this project.

Should the methods tested in this project eventually be widely implemented, additional benefits could potentially include;

- a significant reduction nutrient inputs into Lake Winnipeg,
- the offset of costs incurred by local governments to haul and dispose of contaminated lagoon sludge, and,
- more efficient uses of sludge as an organic soil amendment.

Preliminary Budget

For your consideration, the following is a preliminary budget to conduct this work. The figures below do not include applicable taxes. As part of this proposal we have provided a budget for the involvement of a graduate student of the applied environmental sciences.

Budget Item	Year of Project 2019	Apr 2020 / Mar 2021
Biomass/tissue Sampling and Analysis	\$3,500.00	\$3500.00
FTW Bio-platforms (including shipping)	\$22,500.00	
SMM/IISD Professional Services	\$20,000.00	\$20,000.00
<ul style="list-style-type: none"> • FTW bio-platform sourcing, vegetation placement, FTW deployment • Meetings, data analysis, reporting 		
Graduate Student Researcher	\$5,000.00	\$5000.00
<ul style="list-style-type: none"> • vegetation placement, FTW deployment • Data analysis 		
Miscellaneous Disbursements	\$700.00	
Total Preliminary Budget/Year (before tax)	\$51,700.00	\$28,500.00
Total Budget for 2 Years (before tax)	\$80,200.00	

Other Potential Funding

We propose that the Village of Dunnottar, as the proponent of this project, provide in-kind and financial support for this pilot project. We have also identified other possible funding partners, listed below, along with a potential portion of funding;

Revenue	Cash/ in-Kind	Requested/ Confirmed	Apr 2019 / Mar 2020	Apr 2020 / Mar 2021	Apr 2021 / Mar 2022	Total
Lake Winnipeg Basin Stewardship Program	\$48,120.00	TBD	\$31,020.0	\$17,100.00	\$0.00	\$48,120.00
RM of Dunnottar	\$8,020.00	TBD	\$5,170.0	\$2,850.00	\$0.00	\$8,020.00
Lake Winnipeg Foundation	\$8,020.00	TBD	\$5,170.0	\$2,850.00	\$0.00	\$8,020.00
Province of Manitoba and/or others	\$16,040.00	TBD	\$10,340.00	\$5700.00	\$0.00	\$16,040.00
Total Revenue	\$80,200.00	TBD	\$51,700.00	\$28,500.00	\$0.00	\$80,200.00

<u>Potential Funding Source</u>	<u>Portion of Funding</u>
The Lake Winnipeg Basin Stewardship Program	60% of expenses
RM of Dunnottar	10% of expenses
The Lake Winnipeg Foundation,	10% of expenses
The Province of Manitoba and/or others	20% of expenses

Thank you for considering this proposal. We feel that this research is timely and has the potential to transform the way future lagoon facilities are designed, and may reveal ways to enhance the sustainability of existing lagoons. We look forward to discussing this further with you in the near future.

Sincerely,



Chris Penner
Biologist, Scatliff+Miller+Murray Inc.

CC: Richard Grosshans (IISD)
Curt Hull, Climate Change Connection
Michael Scatliff, Principal, Scatliff+Miller+Murray Inc.