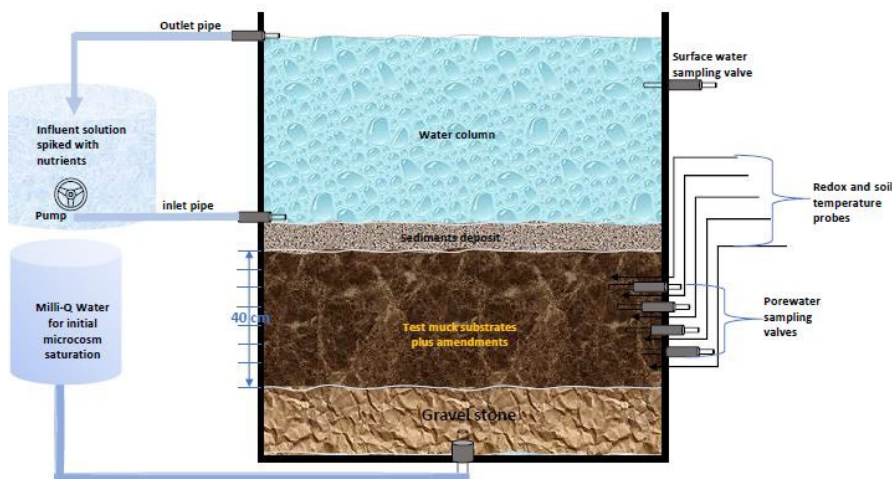


Composition of Constructed Stormwater Wetland Muck Substrate and its Relationship to Nutrient Dynamics and Development of Blue-Green Algae

Constructed stormwater wetlands (CSWs) are designed to collect nutrient-rich runoff water while facilitating sediment and water filtration before subsequent release to downstream aquatic ecosystems. However, the capacity of CSWs to support these functions is failing, often leading to the development of blue-green algae blooms. The goal of this project is to identify the ideal muck and/or amendments that can be added to maximize their nutrient removal efficiency while supporting biogeochemical conditions that minimize risk of algae bloom development. Outcomes of this study will guide the future design of CSWs to achieve their intended functions of water quality regulation.

Figure 2: Conceptual model of microcosm setup testing nutrient removal efficiency of potential muck substrates and amendment



RECIPIENT:
Felix Nwaishi,
Mount Royal
University



PARTNERS:
City of Calgary,
University of
Calgary



TOTAL BUDGET:
\$621,852



AI FUNDING:
\$307,572



PROJECT DATES:
MAY 2023 –
APR 2026

APPLICATION

The City of Calgary has identified nutrient leaching and pollution from urban stormwater wetlands as one of the major risks to Calgary's source water. The outcome of this project will be applied towards the improvement of wastewater quality in constructed stormwater wetlands across municipalities in Alberta.

ALBERTA INNOVATES CLEAN RESOURCES

ENVIRONMENTAL INNOVATION

WATER INNOVATION PROGRAM

PROJECT GOALS

The goal of the project is to address the underlying issues responsible for nutrient pollution and development of blue-green algae blooms in CSWs. The research will achieve this goal by addressing the following objectives:

1. characterize the structure of the wetland bed and evaluate the hydrophysical and biogeochemical properties of the typical muck substrate used to establish the wetland bed of CSWs in Calgary;
2. evaluate the biogeochemical interaction among CSW muck substrate composition, nutrients biogeochemical dynamics and development of blue-green algae;
3. identify the ideal muck substrate composition that would be most effective in mitigating nutrient leaching and development of algae bloom;
4. assess the effectiveness of potential amendments that can be applied to improve the nutrient removal efficiency of conventional muck substrates.

BENEFITS TO ALBERTA

This research will provide the City of Calgary with a framework that will guide the future selection of substrate materials for forming the beds of CSWs. This framework will be valuable to the city as the current method of stormwater wetland construction does not consider the characteristics of wetland bed substrate. Ongoing urban expansion in Calgary and the call to include nature-based climate solutions in the urban environment has informed developers' decisions to integrate aquatic features and green infrastructures in the design of new communities. Thus, it highlights the need for a framework to guide material selection for the construction of stormwater infrastructure. The proposed framework will aid in making these new communities safer, and more resilient to the effects of climate change.



5 Publications



**8 Students
Trained**

CURRENT STATUS

MAY 2024

Milestone 1 is complete. The activities supporting the investigation of objective 1 included the hydrophysical and biogeochemical characterization of muck substrates from 20 wetland sites. The chemistry of the water at these sites has also been characterized. Objective 2 is currently underway. Expected activities in the next milestone include laboratory studies to evaluate biogeochemical interactions among muck substrates from different wetland types, their nutrients, biogeochemical dynamics, and the potential development of blue-green algae.