



VILLAGE OF CUMBERLAND

High Performance Wastewater Lagoon Upgrade Project

Project Summary, March 2022

PURPOSE

The Village of Cumberland has developed an innovative project for upgrading its lagoon based wastewater treatment. Owing to an interesting combination of geography and history, the Cumberland wastewater system faces a unique set of challenges with very high wet weather flows in winter, a receiving creek that virtually dries up in summer, and sensitive downstream habitat to protect. These challenges have hampered the efforts of the last 20 years to design, fund and build a treatment system that can meet them all. After careful study of the existing treatment system, and the water and nutrient behavior in the receiving environment, a solution has been developed. This proposed treatment upgrades will;

- address the regulatory needs,
- provide capacity for future population growth,
- incorporate enhanced treatment of man-made contaminants such as pharmaceuticals,
- restore natural flow conditions to a degraded and drained wetland,
- improve habitat and provide recreational trails, and
- do all this in a sustainable and climate change resilient manner.

BACKGROUND

The Village of Cumberland has a two-cell lagoon wastewater treatment system, which was built in 1968. The sanitary sewer collection system is much older, dating back to the 1920's and includes some areas that were, and still are, served by a combined sanitary and storm sewer system. The combined sewers, some remaining old clay pipes and other incidental sources on inflow and infiltration make for a wastewater collection system that receives very high levels of wet weather flows, peaking at 20 times greater than the dry weather flow. This is much greater than most wastewater systems, where the wet weather flow is typically double or triple the dry weather flow.

The wastewater is treated in a two-cell lagoon system, with the smaller lagoon being aerated and the larger one being a settling lagoon. The treated effluent is currently discharged, without disinfection, into Maple Lake Creek, which is a tributary to the Trent River, which in turn flows into Baynes Sound, a major shellfish aquaculture region. While these streams see very high winter flows, they all but dry up in summer, with the effluent discharge being the only summer flow in Maple Lake Creek, and almost half the flow of the lower Trent River.

The area of the lagoons was a natural swamp area that was drained in the 1930's, by excavating the ditch that is now Maple Lake Creek, to create farmland. Farming in the area was abandoned in the 1960's and since then forest regeneration has occurred on the upland areas, but invasive reed canary grass has established in the low-lying areas, creating a virtual monoculture and preventing a re-establishment of native wetland forest. It has long been a goal of Cumberland to restore this area to a functional and vibrant habitat for plants and animals.

PROJECT OBJECTIVES

The major objective is to improve the treatment to meet current and near future regulatory standards, and the improvements required to achieve this are;

- Optimize the biological treatment to ensure performance under summer and winter conditions
- Phosphorus removal to prevent algae blooms in the downstream creek and river
- Disinfection, for the protection of public health and – especially – the shellfish waters of Baynes Sound
- Designing works to meet industry standards for reliability and redundancy to ensure treatment performance in all conditions
- Provide for Cumberland growth from the current population of 4500 people to 7000.



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Cumberland also seeks to achieve some additional aspirational goals of

- Upgrading the works to meet current seismic protection standards
- Adding tertiary filtration to achieve reclaimed water standards
- Removing pharmaceuticals and other man-made contaminants from the water
- Providing treatment of stormwater flows entering the wetlands area from the Village
- Restoring and enhancing the wetland and forest habitats surrounding the lagoons
- Creating a recreational amenity by providing access trails through the wetland area

The 2016 to 2018 Liquid Waste Management Plan was all about developing a technically feasible project to meet all these objectives and goals.

CONSTRUCTION WORKS

To achieve the objectives and match to grant funding available, the project has been structured into two phases.

Phase 1 is all the lagoon upgrades, the works needed to make the effluent meet regulatory standards, and the bring the treatment system up to current standards for reliability and functionality.

Phase 2 is all the works to achieve the aspirational goals.

- The Phase 1 works are to be constructed in 2022-23 and include;
- Headworks area improvements – full screening of all influent flows (dry and wet weather)
- Lagoon upgrades – addition of sub-surface diffused aeration to both lagoons, and addition of baffle curtains to optimize the flow path.
- Addition of a “Surfactant Assisted Floatation” process on the lagoon effluent to remove suspended solids, phosphorus and algae
- Addition of a sludge dewatering system for the solids from the separation unit, with offsite composting by the CVRD
- Addition of chemical disinfection by Chlorine Dioxide, to meet regulatory standards for dry and peak wet weather flows.
- Operations building – laboratory, workshop, operator amenities
- Process monitoring equipment, SCADA
- Site servicing – roads, fencing, security

The Phase 2 works are planned for 2023-24 and include;

- Adding Tertiary Filtration into the treatment works
- Effluent polishing by a “Biochar Media Reed Bed” – a specially designed constructed wetland with biochar (adsorbent charcoal) and within the soil and wetland plants on the surface. This removes many of the pharmaceuticals and other trace organic contaminants from the treated water.
- A wetland augmentation area – using the reed bed treated water to irrigate an area of the existing natural wetlands for further polishing of the water by dispersed flow into the creek.
- Seismic upgrading of the lagoons by infilling the existing Maple Lake Creek channel that is adjacent to the eastern lagoon berms, and re-grading the berm walls to current design standards.
- Naturalization of the Maple Lake Creek channel by creating a new, naturalized streamform channel on the east side of the wetland area, to replace the infilled section.
- Flow management in Maple Lake Creek by adding natural form weirs and fishways to maintain summer water levels deep enough to create viable fish habitat and prevent elevated water temperatures.
- Creation of a stormwater treatment wetland to the northwest of the lagoons to capture and treat all stormwater entering the wetlands from the Village.
- Use of tertiary treated reclaimed water, in summer, to create flow through the stormwater wetland
- Habitat enhancements by forest plantings, to shade out the invasive reed canary grass and shade the creek banks.
- Creation of recreational walking trails and viewing platforms through the wetland areas.

The reed bed, wetland augmentation and habitat enhancement components are not regulatory requirements but are the actioning of Cumberland’s strategic goals to “remove man-made toxins” from the treated water and to “restore degraded ecosystems.”

They are real world examples of using naturalized treatment systems to treat water, enhance ecosystems and improve the human experience.



FIGURES

The overall arrangement of the project is shown in the following figures 1 to 4.

Figure 1. Site Location



Figure 2. Layout of Phase 1 Works

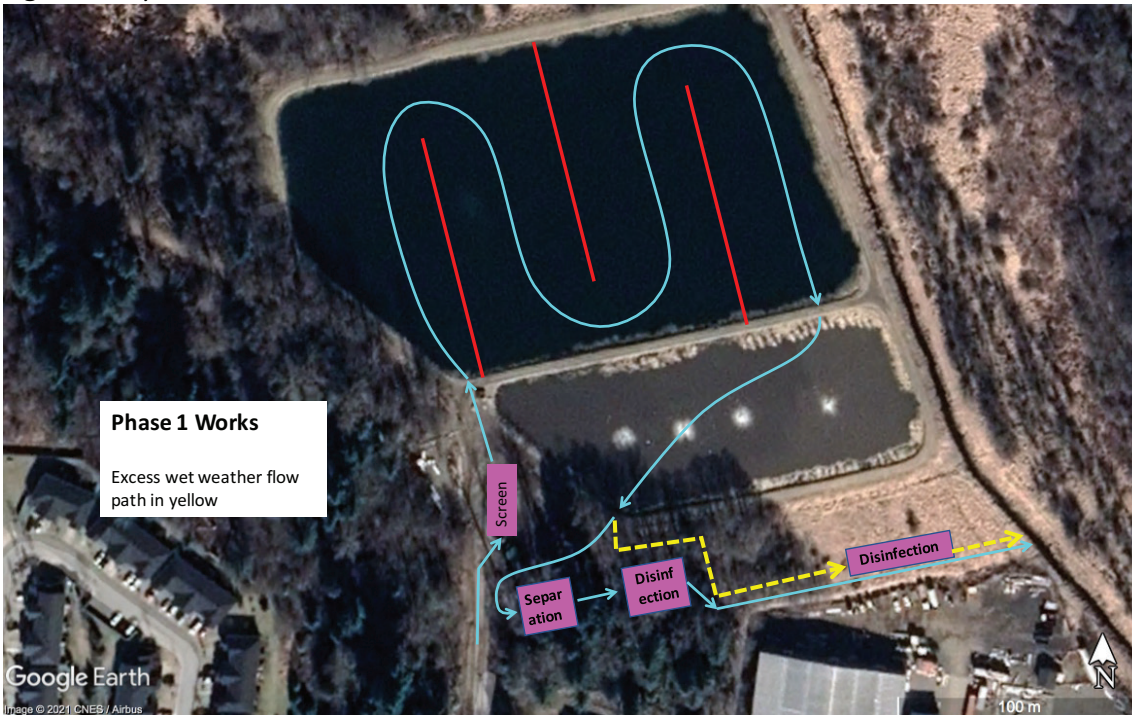


Figure 3. Layout of Phase 2 Treatment Works

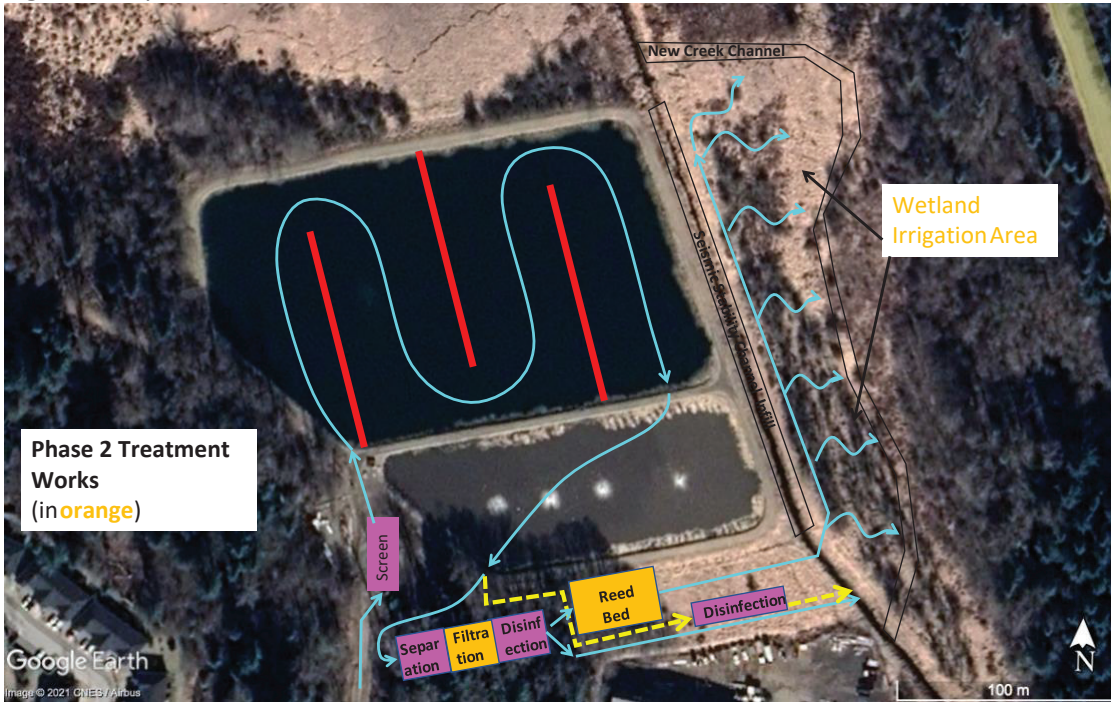


Figure 4. Phase 2 Stormwater Wetland, Habitat Enhancement and Trail Areas



PROJECT COSTS & FUNDING

The project budget for Phase 1 is \$10.7M and \$4.7M for Phase 2, for \$15.4M in total.

Provincial and federal grant funding has been secured for Phase 1 and additional funding is been applied for to assist with Phase 2.

TIMELINE

The planned implementation of the project is as follows:

Activity	2022				2023				2024
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
Phase 1									
Design	■	■	■						
Site clearing		■							
Civil Construction			■						
Process Equipment				■	■	■			
Commissioning						■	■		
Phase 2 (subject to funding)									
Design				■	■				
Earthworks & Channel Relocation (dry season)						■	■		
Habitat Enhancement & Trails							■		
Tertiary Filtration installation and commissioning								■	■

CONCLUSION

Overall, this project represents an innovative solution to a uniquely challenging set of constraints. It is the result of careful consideration of the natural environment in which Cumberland exists, to where the water flows and how to meet the current and future regulatory requirements. It also achieves many of Cumberland’s aspirational goals – for removing man-made toxins, the use of naturalized treatment systems and restoring degraded ecosystems. The proposed solution has been enthusiastically embraced by the people of the Village of Cumberland and will serve the Village for decades to come.