McElhanney

CANADA BEST MANAGED COMPANIES



Village of Cumberland

High Performance Wastewater Lagoon Project

Liquid Waste Management Plan - Stage 3 (R2)

August 11, 2025

Prepared by:
Dragan Rokić, P.Eng., Senior Project Engineer

Project Review:
Mark DeGagne, P.Eng., M.Sc.

Our file: 2241-24007-00

Your Challenge.
Our Passion.

McElhanney
500 – 3960 Quadra Street, Victoria BC Canada, V8X 4A3
Tel. 250-370-9221 | Fax. 1-855-407-3895 | www.mcelhanney.com

Statement of Limitations

Use of this Report. This report was prepared by McElhanney Ltd. ("**McElhanney**") for the particular site, design objective, development and purpose (the "**Project**") described in this report and for the exclusive use of the client identified in this report (the "**Client**"). The data, interpretations and recommendations pertain to the Project and are not applicable to any other project or site location and this report may not be reproduced, used or relied upon, in whole or in part, by a party other than the Client, without the prior written consent of McElhanney. The Client may provide copies of this report to its affiliates, contractors, subcontractors and regulatory authorities for use in relation to and in connection with the Project provided that any reliance, unauthorized use, and/or decisions made based on the information contained within this report are at the sole risk of such parties. McElhanney will not be responsible for the use of this report on projects other than the Project, where this report or the contents hereof have been modified without McElhanney's consent, to the extent that the content is in the nature of an opinion, and if the report is preliminary or draft. This is a technical report and is not a legal representation or interpretation of laws, rules, regulations, or policies of governmental agencies.

Standard of Care and Disclaimer of Warranties. This report was prepared with the degree of care, skill, and diligence as would reasonably be expected from a qualified member of the same profession, providing a similar report for similar projects, and under similar circumstances, and in accordance with generally accepted engineering, planning and scientific judgments, principles and practices. McElhanney expressly disclaims any and all warranties in connection with this report.

Information from Client and Third Parties. McElhanney has relied in good faith on information provided by the Client and third parties noted in this report and has assumed such information to be accurate, complete, reliable, non-fringing, and fit for the intended purpose without independent verification. McElhanney accepts no responsibility for any deficiency, misstatements or inaccuracy contained in this report as a result of omissions or errors in information provided by third parties or for omissions, misstatements or fraudulent acts of persons interviewed.

Independent Judgments. McElhanney will not be responsible for the independent conclusions, interpretations, interpolations and/or decisions of the Client, or others, who may come into possession of this report, or any part thereof. This restriction of liability includes decisions made to purchase, finance or sell land or with respect to public offerings for the sale of securities.

Table of Contents

Statement of Limitations ii

Executive Summary 5

LWMP Process History and Public Consultation 5
Wastewater Collection System 5
Existing Lagoon Treatment 6
Discharge Permit Status 6
Wastewater Treatment Upgrade 7
Wastewater Upgrade Configuration 7
Effluent Discharge 7
Cost Estimates 7
Project Funding 8
Implementation Timeline 8
Source Control and Wastewater Volume Reduction 8
Stormwater Management 8
Integrated Resource Management 8
Plan Monitoring Committee 9
Recommendations 9

1. Introduction 11

2. Summary of LWMP Stage 1 and 2 12

2.1. History 12
2.2. LWMP Stage 1 Summary 13
2.3. LWMP Stage 2 Summary 15
2.4. Post-stage 2 project implementation (2019-2024 activities) 17

3. LWMP Stage 3 20

3.1. Stage 3 Objectives 20

4. Public Consultation 21

4.1. Stage 3 engagement 21

5. Wastewater Management System 23

5.1. Wastewater Collection System 24
5.1. Capital Plan – collection system 26
5.2. EXISTING LAGOON TREATMENT 29
5.3. Conceptual WWTF Upgrade Design 30
5.4. Effluent Discharge 37
5.1. EOCP Classification 37

6. Cost Estimate 38
6.1. Costing Assumptions 38
6.2. Cost Estimate 38
7. Project Funding 41
7.1. LWMP Costs per Parcel 43
7.2. Contributions from Infrastructure Grants 44
7.3. Contributions from DCC's 44
8. Implementation Timeline 45
9. WWTF Operational Certificate 45
10. Source Control and Wastewater Volume Reduction 46
10.1. Source control 46
10.2. Wastewater Volume Reduction 47
11. Stormwater Management 49
11.1. Overflow Elimination Plan 49
12. Integrated Resource Recovery/Management 52
12.1. reclaimed water reuse 52
12.2. Beneficial Use of Biosolids 53
12.3. Energy Recovery 55
13. Plan Monitoring Committee 56
14. Recommendations 57
References 58

Table of Figures

Figure 1 Village of Cumberland – Wastewater Lagoon Location and Configuration 23
Figure 2 Village of Cumberland – Wastewater Lagoons Environmental Setting 24
Figure 3: Village of Cumberland Collection System 27
Figure 4 Village of Cumberland – Existing Wastewater Lagoon Treatment Configuration 29
Figure 5 Upgraded Treatment Facility Layout 35
Figure 6 Process Schematics 36

Table of Tables

Table 1 Summary of Stage 1 LWMP Activities and Major Events 14
Table 2 Summary of Stage 2 LWMP Activities and Major Events 15
Table 3 Stage 2 Options Summary 16
Table 4 Post Stage 2 Public Consultation 18
Table 5 Post Stage 2 Public Consultation with K'omoks First Nation 19
Table 6 Sanitary System Historical Flow Conditions 25
Table 7: Capital Costs for Collection System Expansions 28
Table 8 Design Flows and Loadings 30
Table 9 Treated Effluent Water Quality Objectives 32
Table 10: Capital Cost Summary 38
Table 11: Capital Cost Updates from 2018 to 2025 39
Table 12: Operating Cost Estimate 40
Table 13: WWTF Upgrade Budget 41
Table 14: Costs per Parcel 43
Table 15: Implementation Timeline 45
Table 16: Historical Trend of Cumberland Per Capita Wastewater Volumes 47

Appendices

Appendix A - Stage 3 Wastewater Advisory Committee Meeting Minutes (Mtgs 18-21)

Appendix B - MOE Stage 2 LWMP Approval Letter

Appendix C - Consent Order

Appendix D - Engagement Summary

Appendix E - Combined Sewer Separation Strategy

Appendix F - MOE Discharge Permits (PE-0189 (1997) and PE-0189 (2019))

Appendix G - Climate Change Poster

Appendix H - Detailed Design Brief

Appendix I - Capital Cost Estimate – WWTF

Appendix J - Development Cost Charges

Appendix K - Municipal Sanitary System Regulation and Fees Bylaw No. 1025, 2015

Appendix L - Municipal Stormwater System Regulation and Fees Bylaw No. 1024, 2015

Appendix M - Water Conservation Bylaw No. 807

Appendix N - Stormwater System Summary

Appendix O - Receiving Environment Monitoring Program

Appendix P – Council Resolutions

- Approval of the Stage 3 LWMP Report
- LWMP Amendment - Adaptive Mitigation Strategy; LWMP Monitoring Committee Commitment
- LWMP Amendment - Recommendations for Implementation Commitment

Executive Summary

The Village of Cumberland is nearing completion of a process to upgrade its wastewater treatment system. Due to a 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, sensitive downstream river/estuary habitat with an aquaculture industry to protect. To address these challenges, the project has been structured in two phases.

The first phase requires necessary upgrades (nutrient removal and disinfection) to meet existing Permit requirements, as the existing lagoon treatment system is out of compliance.

The second phase includes development of a reed bed for effluent polishing prior to discharge to the receiving environment, as well as the relocation of the existing discharge, which is currently directly to Maple Lake Creek, to the adjacent wetland to allow for further polishing. Phase 2 also includes seismic improvements to the lagoon berms.

The result of the combined phases will be a High-Performance Lagoon (HPL) system followed by secondary clarification, tertiary filtration, effluent UV disinfection, and polishing via the reed bed / wetland, thus bringing the entire treatment process up to and beyond current day standards and regulations.

LWMP PROCESS HISTORY AND PUBLIC CONSULTATION

The Stages 1 and 2 of the LWMP planning process ran from May 2016 to October 2018. During this time there was extensive public consultation with a Wastewater Advisory Committee formed to guide the overall process and various engagement activities, with numerous open houses and site tours. The summaries of the LWMP process history and extensive public consultation are provided in Sections 2 and 4, respectively.

The Stage 3 LWMP report provides a summary of the liquid waste management process to date and focuses on the detailed implementation of the preferred option from Stage 2. Additional requirements were addressed as provided by the Ministry of Environment and Climate Change Strategy as part of the feedback from the Stage 1&2 Report review.

WASTEWATER COLLECTION SYSTEM

The Village of Cumberland, served by a partial combined sewer system, treats wastewater collected within the community in two wastewater treatment lagoons generating secondary effluent quality. The Cumberland sanitary sewer system dates back to the early 1900's. It was originally constructed as a combined storm-sanitary collection system.

Most of the old combined system has been separated and replaced with major works occurring in 2017 and thereafter. However, as of 2025, there remains approximately 18 ha of area within the village core that is on combined sewer. This area of combined sewer contributes to significant wet weather flow. A

comprehensive sewer separation plan has been developed to fully separate the remaining combined sewers by adding new sanitary sewers and stormwater infrastructure.

While Cumberland is making continued progress on reducing peak wet weather flows, they are expected to remain high into the future. The highest flows typically occur only for one to three days at a time but can occur several times in any given year.

Future expansion areas of the wastewater collection system include Union Road, Cumberland Road (between Hope Rd to Union Rd), and a connection of the Bevan Road industrial lands. These planned expansions will add approximately 18% to 20% of new sewers. Capital costs of future expansions are estimated in Section 5.1.

EXISTING LAGOON TREATMENT

The existing wastewater treatment system consists of a single headworks screen followed by a flow splitting structure that directs the incoming wastewater to a small lagoon with four (4) 5 HP surface aerators. The flow is then directed from the smaller aerated lagoon into a larger facultative lagoon which, in turn, discharges treated effluent to Maple Lake Creek over a flow measuring weir.

DISCHARGE PERMIT STATUS

The current discharge is authorized by the provincial government with a Discharge Permit PE-00197, initially issued in 1967, a major amendment in 1997, and last amended in 2019. The Discharge Permit authorizes a discharge of secondary effluent to Maple Lake Creek and stipulates the following effluent quality:

- an Average Dry Weather Flow (ADWF) up to 1,000 m^3/d;
- Maximum Daily Flow (MDF) of 2,710 m^3/d;
- maximum $cBOD_5$ and TSS of 30 mg/L;
- Fecal Coliforms (FC) of less than 200 MPN/100 mL; and
- total phosphorus concentration of less than 1 mg-P/L.

The existing WWTF does not have treatment processes in places that specifically target phosphorus removal and effluent disinfection, thus resulting in regulatory non-compliance with the discharge permit. The wet weather flows frequently exceed the 2,710 m^3/d threshold, making for another source on non-compliance.

WASTEWATER TREATMENT UPGRADE

The overall WWTF upgrade objective is to treat up to 7,200 m^3/d through the entire wastewater treatment process (i.e., headworks, aerated lagoons, solids-liquid separation, tertiary filtration, and UV disinfection) to meet the effluent water quality requirements outlined in Section 5.3Table 9.

Extreme wet-weather flows, exceeding the combined processing capacity of 7,200 m^3/day and lagoon storage capacity, will be screened, treated through the aerated lagoons to a secondary treatment level, disinfected using chlorine, then dechlorinated and discharged to Maple Lake Creek.

The design objectives for the upgraded wastewater treatment process are:

- In Phase 1 before adoption of the LWMP - to meet the current discharge Permit water quality requirements and federal Wastewater Systems Effluent Regulations (WSER) water quality requirements, and
- In Phase 2 after adoption of the LWMP – to meet the BC Provincial Municipal Wastewater Regulations (MWR) Greater Exposure Potential (GEP) reclaimed wastewater reuse water quality requirements.

The design flows, loadings, and treated effluent water quality objectives for the upgrade of the wastewater treatment system are summarized in Section 5.3.

WASTEWATER UPGRADE CONFIGURATION

The design basis is for flows up to 7,200 m^3/d to be treated in the existing lagoon cells, upgraded with additional aeration and improved flow pattern, followed by the additional mechanical treatment consisting of the two parallel trains that include the SAF solids-liquid separation unit process systems, tertiary filters, and UV disinfection. Each SAF, filter, and UV disinfection unit has the capacity to process up to 3,600 m^3/d. The upgraded treatment facility layout and process schematics are provided in Sections 5.3.2 and 5.3.3, respectively.

EFFLUENT DISCHARGE

Upon adoption of the LWMP, the existing permitted discharge from the larger lagoon to Maple Lake Creek will be abandoned. A discharge point for flows up to 7,200 m^3/day will be a natural wetland located in the north-west corner of the larger lagoon. Extreme wet weather flows through the lagoons, exceeding the combined processing capacity of 7,200 m^3/day and lagoon storage capacity, will be discharged to Maple Lake Creek.

COST ESTIMATES

The total capital costs of Phase 1 and 2 upgrades are estimated at $17.617 million and $4.36 million, respectively. Additional details are provided in Section 6 that also include an estimate of O&M costs, currently estimated at $600k/year.

PROJECT FUNDING

Details related to various sources of project funding are provided in Section 7.

IMPLEMENTATION TIMELINE

The start-up and commissioning of Phase 1 wastewater treatment upgrades is planned for 2026 Q2 followed by Phase 2 works slated for completion in 2026 Q4. A more detailed implementation timeline is provided in Section 8.

SOURCE CONTROL AND WASTEWATER VOLUME REDUCTION

Sanitary and storm sewer connections are currently regulated by sanitary and stormwater bylaws. New commercial and industrial developments are required to install storm oil/grease separators for the removal of sediment and oils contained in stormwater discharged from parking areas, driveways for all multi-family, commercial, institutional, and industrial properties. Cumberland also has a water conservation bylaw that requires that all residents and businesses be metered for water consumption. Additional information on these programs and initiatives is provided in Section 10.

STORMWATER MANAGEMENT

The Cumberland stormwater catchments are split over a watershed divide that traverses the center of the Village. The existing drainage system is responsible for road drainage, conveyance of stormwater away from residences, and foundation drainage. Some areas within Cumberland currently lack stormwater infrastructure, leading to localized drainage issues. These are primarily areas with combined sewers.

Several recent developments have added dedicated stormwater systems while the community also initiated work on separation of the combined sewers. As Cumberland continues to redevelop and expand, stormwater infrastructure investments should prioritize improving combined sewer separation and integrating new development into the stormwater network. Cumberland is also in the process of updating its stormwater management plan in 2025.

INTEGRATED RESOURCE MANAGEMENT

The relatively small scale of the Cumberland wastewater treatment facility combined with the lagoon-based options does not provide significant opportunities for resource recovery, but consideration has been given to potential opportunities during all three stages of the LWMP.

Using the reclaimed water to augment the adjacent wetland areas was identified as the preferred option from Stage 2. With the inclusion of tertiary treatment in the upgrade project, the effluent water will meet the Greater Exposure Potential (GEP) category and be suitable for use in the publicly accessible wetland area to the north of the lagoons. This will become the permanent discharge path for all effluent except Excess Wet Weather Flow.

Sludge produced in the treatment process will be disposed of at the Comox Valley Regional District composting facility that processes biosolids from its Brent Road WWTF and produces a Class A biosolids compost. A servicing agreement has been developed between Cumberland and the CVRD.

Energy recovery was conceptually considered during Stage 2. There is insufficient biosolids volume for any standard technology (e.g. anaerobic digestion) energy recovery. But, there is potential for heat recovery from the effluent water. Currently, residual heat from aeration blowers will be used for heating of a tent housing mechanical treatment components.

PLAN MONITORING COMMITTEE

Following completion of the LWMP process, the Plan Monitoring Committee will be formed to monitor implementation of the LWMP. Monitoring is critical to the long-term success of the LWMP. Establishing timelines for deliverables and conducting assessment activities for determining the effectiveness of specific actions will ensure that Cumberland receives high value for their commitment to the LWMP planning process.

RECOMMENDATIONS

The following recommendations are based on the findings of the Stage 3 LWMP:

- Submit the Stage 3 LWMP report to Village Council for review and adoption.
- Forward the Stage 3 LWMP report to BC ENV for review and final approval of the Village of Cumberland LWMP.

The following are recommendations for additional work or studies in the post-LWMP period that would complement the LWMP.

- Continue with combined sewer separation program with the objective being to achieve 100% separation by 2045, or earlier. Pursue all grant funding opportunities to assist with this.

- Complete the updates to the storm drainage and sewer master plans in 2025 and update storm drainage and sewer bylaws and enforcement policy, if necessary. Specific attention to be given to the storm bylaw for encouragement and enforcement for property owners in newly separated storm/sanitary areas to make connections to the new storm system.

- Develop and implement the Fats, Oils, and Grease (FOG) Bylaw to improve the wastewater source control and compatibility for treatment at the WWTF.

- Develop an educational program for the public and private sector with a focus on source control of contaminated dischargers to the sanitary sewer (and storm drain) systems.

- Identify other sources of I/I, develop a repair program, and update an asset management plan of the collection system.

- Implement the required parcel taxes to fund the LWMP program. Update the Wastewater DCC rate and bylaw to include future payment of the loans for the treatment upgrades.

- Establish a composite sampling program of the WWTF influent and lagoon wastewater to verify contaminant loading and removal rates. Formulate and define sampling protocols.

- Implement the enhanced Receiving Environment Monitoring Program (REMP) to assess the cumulative effects of the future effluent discharges into the receiving environment.

1. Introduction

The Village of Cumberland (Cumberland) is nearing completion of a process to upgrade its wastewater treatment system. Due to a 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, sensitive downstream river/estuary habitat with an aquaculture industry to protect. To address these challenges, the project has been structured in two phases.

The first phase requires necessary upgrades (nutrient removal and disinfection) to meet existing Permit requirements, as the existing lagoon treatment system is out of compliance.

The second phase includes development of a reed bed for effluent polishing prior to discharge to the receiving environment, as well as the relocation of the existing discharge, which is currently directly to Maple Lake Creek, to the adjacent wetland to allow for further polishing. Phase 2 also includes seismic improvements to the lagoon berms.

The result of the combined phases will be a High-Performance Lagoon (HPL) system followed by secondary clarification, tertiary filtration, effluent UV disinfection, and polishing via the reed bed / wetland, thus bringing the entire treatment process up to and beyond current day standards and regulations.

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 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.

The Stage 3 LWMP will be presented to Cumberland Council and BC ENV for review and adoption. If Cumberland wishes to re-visit the plan prior to adoption, the entire LWMP must be restarted at Stage 1 with the community goals clearly identified. Once the Stage 3 LWMP is adopted, it becomes the Cumberland's official plan for liquid waste, and it must be implemented.

After the LWMP adoption, "*The minister may, by order, amend or cancel a waste management plan and, if cancelled, the waste management plan ceases to have force or effect*" in accordance with Section 24(6) of the Environmental Management Act.

2. Summary of LWMP Stage 1 and 2

The Stages 1 and 2 of the LWMP planning process ran from May 2016 to October 2018. During this time there was extensive public consultation with a Wastewater Advisory Committee ("WAC") formed to guide the overall process and various engagement activities both online and in person, with numerous open houses and site tours (Appendix A).

These activities were documented in the Stage 1 & 2 report (July 2018). The major events are summarized in this section.

2.1. HISTORY

The evolution of Cumberland's wastewater system began in the early 1900's, as a combined storm sanitary collection system, discharging directly into Maple Lake Creek. This system grew with the village and in 1968 the existing lagoons were constructed to provide passive biological treatment prior to discharge to the creek. In 1971, the lagoons were upgraded with surface aeration to improve treatment capacity performance, but effluent was not disinfected. Construction of combined sewers ceased after 1968 but because most of the village core was on combined sewer, peak wet weather flows to the lagoons are very high.

In 1997, a major amendment was made to Cumberland's discharge Permit PE-0197 (See Appendix F), which set two major targets:

1. Add nutrient (phosphorus) removal and disinfection facilities by May 1999 to achieve specified effluent criteria; and

2. Reduce peak wet weather flows exceeding 7,600 m^3/day to 2,710 m^3/day by 2015.

Achieving Target (1) requires major treatment upgrades, and achieving Target (2) requires completing the separation of the combined storm sanitary sewers and other work on reducing infiltration and inflow.

The purpose of a Liquid Waste Management Plan (LWMP) is to carefully develop a long-term plan for wastewater management, that solves current and expected future issues. Cumberland chose to use the LWMP process to develop the solutions required by the amended permit.

The timeline of this process was:

- 1999-2001 Stage 1 LWMP – defining the scope and objectives for overall wastewater management and the treatment system. Long list of conceptual treatment and disposal options was developed. This included several alternative discharge locations to Maple Lake Creek.
- 2001-2003 Stage 2 LWMP – conceptual study of treatment options and selection of the preferred option - a large, constructed treatment wetland system and continuing discharge to Maple Lake Creek.

- 2003-2008 - further technical studies on the constructed wetland and construction of series of field test cells. Phosphorus removal and wet weather flow treatment/disinfection remained as concerns.
- 2008 -2011 - mechanical treatment options were revisited, which also considered the option of joining the South Sewer Project (regional wastewater collection and treatment system) proposed from the Comox Valley Regional District.
- 2011 Cumberland decision to join the South Sewer project, further LWMP work halted.
- 2011-2015 South Sewer project technical studies.
- 2015 - in consideration of dramatically escalated costs and a need to maintain lagoon operation to handle peak wet weather flows, Cumberland decided to withdraw from the South Sewer project and restart the LWMP process, to pursue a "made in Cumberland" solution.

Part of the rationale for restarting the LWMP process sixteen years after the first start was that there might be new improved options available that were not available, economic or not even considered in the original process. The new Stage 1 would take a "blank sheet" approach, going back to the first principles of the LWMP process to consider the current situation and cast the widest possible net for potential solutions.

At the time of the 2016 LWMP restart, no treatment upgrades had been implemented. There had been some works on storm-sanitary separation, but peak wet weather flows remained in the order of 20,000 m^3/day.

2.2. LWMP STAGE 1 SUMMARY

2.2.1. Stage 1 Scope of Work

The LWMP restarted in May of 2016, with the goal of combining Stage 1 and 2 into a single process and single report to expedite the process. A new consulting team was hired and a public Wastewater Advisory Committee (WAC) was struck, with the goal of completing the Stage 1 scope in 2016.

Through a series of WAC meetings, technical studies and open houses:

- the scope was set, goals and objectives were established, and a comprehensive evaluation system was developed that used a weighted scoring of goal achievement to evaluate competing options;
- various treatment and discharge options were identified; and
- options were evaluated and screened to a short list for further study

The public process was summarized in Table 1, with a lot of work achieved within a six-month period.

Table 1 Summary of Stage 1 LWMP Activities and Major Events

Stage	Year	Event	Date
Stage 1 LWMP	2016	WAC Meeting #1 & site tour	28 May
		WAC Mtg #2	June16
		WAC Mtg #3	June 30
		Open House #1	July 14
		WAC Mtg #4	July 28
		WAC Mtg #5	Aug 25
		WAC Mtg #6	Sep 8
		Open House #2	Sep 22
		WAC Mtg #7	Oct 6
		WAC Mtg #8	Oct 27
		Open House #3	Nov 1
		WAC Mtg #9	Nov 3
		WAC Mtg #10	Nov 17

2.2.2. Stage 1 Work Outcome

The Mission Statement developed by the WAC was:

> "*To develop an environmentally sustainable system to treat the liquid waste generated by the Village that is affordable and ideally economically productive, environmentally enhancing, and socially beneficial*".

In addition to meeting the current and future regulatory goals, some specific objectives were established to action the mission statement:

- Treatment to remove man-made contaminants, such as pharmaceuticals.
- Use of naturalised treatment systems (e.g. wetlands), if possible.
- Use of innovative treatment systems and climate resiliency planning to improve chances of receiving grant funding.
- Restoration and/or enhancement of natural environments (Maple Lake Creek and wetlands).
- Create public access to the treatment works and restoration areas, if possible and practical.

The long list of options came down to a short list of:

- One discharge location – Maple Lake Creek and the surrounding wetlands.
- Three treatment options for further study in Stage 2:
    - Option 1: A lagoon-based system with post-lagoon tertiary treatment.
    - Option 2: An all-mechanical treatment system with the lagoons being decommissioned. This required a specialized treatment system to handle the wet weather flows and tertiary treatment only on the baseflow portion.
    - Option 3: A hybrid system, with a high quality mechanical treatment plant to take baseflow and lagoons to handle wet weather flows.

Stage 1 concluded at the end of 2016, with a grant funding opportunity that favoured Option 2, and this was pursued, but not received, so Stage 2 resumed in 2017.

2.3. LWMP STAGE 2 SUMMARY

2.3.1. Stage 2 Scope of Work

Stage 2 consisted predominantly of technical studies on the three main treatment options, and various additional works to achieve some of the aspirational goals, such as pharmaceutical removal and wetland treatment. Once this work was concluded, it was brought back to the WAC and the public for consideration, as summarized in Table 2.

Table 2 Summary of Stage 2 LWMP Activities and Major Events

Stage	Year	Event	Date
Stage 2 LWMP	2017	WAC Mtg #11	Apr 25
		WAC Mtg #12	Sep 7
		WAC Mtg #13	Nov 2
		WAC Mtg #14	Nov 30
		Open House #3	Nov 1
	2018	WAC Mtg #15	Jan 25
		WAC Mtg #16	May 17
		Stage 1& 2 Report submitted	July 2018

2.3.2. Stage 2 Work Outcome

The major result of the Stage 2 work was the selection of the lagoon-based treatment system as the preferred option. It was determined that the inherent high flow handling ability of the lagoons was the best basis on which to proceed, with post-lagoon treatment on the baseflow portion.

An additional result was the preferred discharge location being to the wetlands adjacent to the lagoons. This could use the high-quality water, treated to reclaimed water standards, to restore summer wet conditions to the wetland area, and provide additional polishing treatment of the water itself. It would also be the basis of recreational trail access to the area, providing a social benefit.

A significant technical addition was the concept of the "Biochar Media Reed Bed" – a small, constructed wetland with charcoal in the soil matrix for enhanced biodegradation of pharmaceuticals and other contaminants that make it through the normal treatment process. This was identified as a component that could be added in the future to any option, and would only be implemented if funded through government grants.

The summary table of options from the Stage 2 report is reproduced below in Table 3.

Table 3 Stage 2 Options Summary

Attribute		Option 1 Upgraded Lagoon		Option 2	Option 3
	Category Score	Phase 1 + Phase 2A	Phase 1+ Phase 2B	Baseflow Mechanical	Full Flow Mechanical
Reclaimed Water Quality		MEP	GEP	GEP	GEP
Discharge Location		N. Wetland	MLC/N. Wetland	MLC	MLC
Capital Cost		$8.7M	$10.6M	$9.3M	$14.8M
Annual Operating Cost		$375k	$425k	$450k	$500k
Affordability	40	36.6	27.5	26.7	11.4
Economic Benefits	20	12.9	11.5	8.8	9.3
Environmental Benefits	20	16.5	14.1	12.9	14.5
Social Benefits	20	13.9	12.4	10.4	10.4
Total Score	**100**	**79.8**	**65.6**	**58.8**	**45.7**

It was decided that the upgraded lagoon option would be implemented, with Phase 1+2A (lagoon upgrades with nutrient removal and disinfection) being as soon as possible, to bring Cumberland into Compliance with the existing Permit, and Phase 2 (tertiary filtration and the reed bed) being implemented in the future when grant funding or LWMP borrowing allowed.

2.4. POST-STAGE 2 PROJECT IMPLEMENTATION (2019-2024 ACTIVITIES)

While Cumberland had successfully completed Stage 2, it was still out of compliance with the conditions of the existing Permit and had been since 1999. This resulted in enforcement action from the Ministry of Environment in 2018. The action was resolved in 2019 by mediation and a resulting Consent Order (See Appendix C) which set the condition that Cumberland was to complete both the upgrade works (nutrient removal and disinfection) and the Stage 3 LWMP, by Dec 2024. To achieve this timeline meant that funding, design and construction of the works would need to start immediately, prior to starting the Stage 3 LWMP.

Project funding was by combination of grant funding, borrowing and Cumberland reserves (further described in Section 7 on Project Funding) to allow commencement in 2021. The 2018 and 2019 grant funding applications included the reed bed with tertiary filtration held off for future addition.

During the design phase in 2021 there were two severe weather events that forced subsequent major design changes from the 2018 concept plan:

- The “heat dome” of June 2021 saw record high temperatures which turned the lagoons anoxic. This showed that the proposed expansion of the surface aeration system could not maintain oxygenation under warm water conditions. This forced a change to a diffused subsurface aeration system supplied by external blowers.
- The “atmospheric river” of November 2021 saw record rainfall and high water levels in Maple Lake Creek. This forced a relocation of the post-lagoon treatment works to higher ground, which also required the use of pumping compared to the gravity flow system.

Both these were major changes to the project which increased the scope, cost, and energy consumption substantially. They are further described in the paper “*Achieving Climate Resilience Takes some Energy*” in Appendix G.

A third major change in 2021 was the identification of a seismic stability issue with the lagoon berms adjacent to Maple Lake Creek, if a major seismic event occurs during or shortly after wet conditions. The only practical way to stabilize this berm is to fill in the adjacent creek channel, which requires first creating a new creek channel elsewhere through the wetland.

These design changes combined with general post-COVID inflation substantially increased the cost of the project. In early 2022, the project was split into two phases;

- Phase 1 – Permit compliance works of lagoon upgrades including aeration, phosphorus removal, and disinfection; and
- Phase 2- tertiary filtration , biochar reed bed, wetland augmentation, and seismic upgrade/channel relocation.

This split allowed Phase 1 to be implemented and Phase 2 to be paused while Cumberland pursued additional grant funding, which was secured in late 2022 to allow Phase 2 to proceed.

But, there is a permitting issue in that the discharge to the reed bed and wetlands is a Change of Discharge Location and must be authorized by the LWMP before it can be implemented. And the stream

relocation cannot occur until the new discharge location is in use, as the existing lagoon discharge is in the middle of the stream reach to be infilled. Thus, the Change in Discharge Location is part of the described works of this Stage 3 LWMP. The tertiary filtration component is integrated into the Phase 1 works and LWMP authorization is not needed for this component.

A final major design change in 2024 was the change from chemical disinfection to ultraviolet disinfection. The inclusion of tertiary filtration is what made this change feasible, as UV requires high clarity water to be effective.

With all these changes, the Phase 1 upgrade project has been significantly delayed and will not come online until the first quarter of 2026, over a year later than the December 2024 date required by the 2019 Consent Order.

Similarly, the completion of this LWMP has been delayed, in part because it could not be finalized until the design of the treatment works was finalized, and so it too does not meet the December 2024 date of the Consent Order. These delays do not change the content of this LWMP or the capital works program, but may trigger the enforcement provisions of the Consent Order.

This stage 3 LWMP is unusual as the major capital works are already underway, and there has been ongoing consultation between the end of Stage 2 and the commencement of Stage 3.

The major public consultation events during this time are shown below in Table 4, and there has been additional engagement online and via public reports to Council.

Table 4 Post Stage 2 Public Consultation

Stage	Year	Event	Date
Upgrade Project	2018	AAP to borrow $4.4M	Aug 24, rejected
		WAC Mtg #17	Sep 13
		Open House # 5, Site tour	Oct 2
		Referendum to borrow $4.4M	Oct 20, passed
		Open House # 6, site tour	Sep 29
	2021	Open House # 6, site tour	Sep 29
	2024	AAP to borrow $2.5m	17 June

There has also been ongoing consultation with the K'omoks First Nation during the post Stage 2 period, as part of the upgrade project. The significant events in this process are shown below in Table 5.

Table 5 Post Stage 2 Public Consultation with K'omoks First Nation

Year	Event	Date
2019	Project Presentation to Chief and Council	June
	Follow up Technical memo on proposed Peracetic acid disinfection	Nov
2022	Updated Project Presentation to Chief and Council	May
	Follow up Technical memo on proposed chlorine dioxide disinfection	July
2023	Third party reviews of chlorine disinfection	Feb
	Letter of Conditional support from KFN Chief and Council	April
2024	Updated project presentation to Chief and Council	Mar
	Site tour by K'omoks delegation	Nov
2025	Proposed workshop on operational procedures and environmental monitoring	TBD

Consultation, information sharing and environmental review with K'omoks First Nation will be ongoing after the LWMP is implemented.

3. LWMP Stage 3

3.1. STAGE 3 OBJECTIVES

Stage 3 LWMP provides a summary of the liquid waste management process to date and focuses on the detailed implementation study of the preferred Option from Stage 2. Additional requirements were provided by the Ministry of Environment and Climate Change Strategy as part of the feedback from the Stage 1&2 Report (Appendix B). In Cumberland's case, the expedited implementation of the wastewater upgrades was required by the 2019 Consent Order to bring Cumberland into compliance as quickly as possible (Appendix C). This has resulted in the unusual situation of the design, funding and construction of the upgrades being underway before Stage 3 was formally started in April of 2024.

The major components of Stage 3 are:

- Complete detailed design of treatment works.
  - Plan for new discharge location and effluent quality to meet MWR standards, with specific consideration for high wet weather flow handling.
  - Updated cost estimate.
  - Project Funding Plan.
  - Implementation Schedule.
  - Continued public and Frist Nation consultation.
  - Expand on source control, volume reduction, and infiltration and inflow reduction programs.
  - Identify control measures for combined sewer overflows and a strategy for separating (remaining) combined sewers.
- Update the Stormwater Management Plan.
  - Identify control measures for combined sewer overflows and a strategy for separating (remaining) combined sewers.
  - Updated cost estimates to Class B level.
  - Project Funding Plan.
  - Implementation Schedule.
- Commitment to a Plan Monitoring Committee.
- Adoption by Village of Cumberland Council.

4. Public Consultation

Cumberland residents are familiar with hearing about upgrades and planning for their wastewater system, as this has been a primary focus of infrastructure improvement in recent years. This familiarity includes Stage 1 and 2 liquid waste management planning from 2016 to 2018, borrowing-approval processes in 2018 and 2024, and ongoing communications (via newsletters, website, open houses) about the Wastewater Upgrades Project.

4.1. STAGE 3 ENGAGEMENT

Stage 3 built on established processes, including engagement with primary audiences – the public, wastewater lagoon neighbours, Village Council, staff, local media, and a re-established Wastewater Advisory Committee.

The process is based on the International Association of Public Participation (IAP2) spectrum of public participation at the INFORM to INVOLVE levels. The engagement plan also incorporated recommendations contained within the Ministry of Environment's Interim Guidelines for Preparing Liquid Waste Management Plans.

To engage with the community, Stage 3 engagement involved the following key tools:

- **Advisory Committee**: A Wastewater Advisory Committee was set up with members of the public and Council to provide overview, comment and direction on the LWMP process. Committee members included three returning members and two new members. The group met four times between August 2024 and March 2025, providing insightful recommendations which were presented to Council for their guidance and consideration.
- **Online Information Hub:** Engagecomoxvalley.ca/cumberland-lwmp was designated as the core consultation hub, with input encouraged to be submitted through the feedback functions. The hub was home to question and answers, advisory committee meeting minutes, online presentations and feedback questions.
- **In-Person Open House Events:** Four public open house events in September and February were supported with active promotion, using local media, online advertising, and e-newsletters to reach Cumberland residents in their home community.
- **Online Presentations** In total, 145 people either watched an online presentation or attended an in-person open house event. The recorded presentations were posted on YouTube and shared on the Engage Comox Valley website for those unable to attend an in-person event.

4.1.1. First Nations Engagement

A key piece of the engagement strategy was engagement with First Nations, with local and regional Nations invited to participate in the planning process and provide comments and feedback.

Representatives from the K'ómoks First Nation took part in a wastewater treatment facility tour, followed by an overview of the work underway on facility upgrades and long-term wastewater management planning. The critical engagement provided clear understanding of the Nation's interests and a path forward for further involvement, as traditional keepers of the land.

Cumberland also continues to be open to sharing information with regional Nations, as named by the Province, with expressed interest in Baynes Sound. During the Stage 3 process, nine Nations were contacted three times via letter and phone call to share information and invite questions, input and discussion.

Overall, the project team heard valuable discussions on the timing and costs of stormwater separation, ongoing costs, and the potential environmental impact on the surrounding waterways and Baynes Sound. These discussions should provide ongoing interest in wastewater operations and the Plan Monitoring Committee as the project moves forward.

For more information, please see the Engagement Summary at the end of this report (Appendix D).

5. Wastewater Management System

The Village of Cumberland, served by a partial combined sewer system, treats wastewater collected within the community in two wastewater treatment lagoons generating secondary effluent quality. The lagoons are located east of Cumberland and west of Highway 19 and Maple Lake Creek, as shown in Figure 1.

Figure 1 Village of Cumberland – Wastewater Lagoon Location and Configuration



The collected wastewater is treated in a two-cell lagoon system, originally constructed in 1968 as un-aerated facultative lagoons. Upgrades were made in 1971 to add aeration to the smaller lagoon and the larger one being a settling (quiescent) lagoon prior to discharge (undisinfected) into Maple Lake Creek. Maple Lake Creek is a tributary to the Trent River, which in turn flows into the estuary of Baynes Sound, a major shellfish aquaculture region (Figure 2). While these streams see very high winter flows, they are very dry in the 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 1930s, by excavating the ditch that is now Maple Lake Creek, to create farmland. Farming in the area was abandoned in the 1960s and since then forest regeneration has occurred in the upland areas, but invasive reed canary grass has established in the low-lying areas, 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 and allow for public access for wildlife viewing.

Figure 2 Village of Cumberland – Wastewater Lagoons Environmental Setting



5.1. WASTEWATER COLLECTION SYSTEM

The Cumberland sanitary sewer system dates back to the early 1900's. It was originally constructed as a combined storm-sanitary collection system. The total length of the collection system is approximately 30 km with pipe sizes ranging from 100 mm to 600 mm in diameter and pipe materials that include vitrified clay, steel, asbestos concrete (AC), concrete pipe, and polyvinyl chloride PVC.

Most of the old combined system has been separated and replaced with major works occurring in 2017 and thereafter. However, as of 2025, there remains approximately 18 ha of area within the village core that is on combined sewer. This area of combined sewer contributes to significant wet weather flow. Additionally, older parts of the dedicated sanitary sewer system, dating back to the 1960's, also contribute to high wet weather flows (refer to Table 6). There are no combined sewer overflows (CSOs) in the collection system.

While Cumberland is making continued progress on reducing peak wet weather flows, they are expected to remain high into the future. The highest flows typically occur only for one to three days at a time but can occur several times in any given year.

Table 6 Sanitary System Historical Flow Conditions

Year	Average Dry Weather Flow (m^3/day)	Maximum Day Flow (m^3/day)
2009	828	>15,000
2010	874	>15,000
2011	840	>15,000
2012	791	>15,000
2013	953	7250
2014	742	~20,000
2015	658	~20,000
2016	809	~20,000
2017	765	12,000
2018	730	~20,000
2019	900	6,900
2020	830	7,400
2021	830	10,250
2022	830	~20,000
2023	700	10,800
2024	760	7,430

The accuracy of flow measurement decreases as flows go above 15,000m^3/day. In cases where the overflow weir from the small lagoon is used, there is no flow measurement at this weir, and flow is assumed to be approximately 20,000m^3 on such days.

A unique factor of the Cumberland system is the large lagoon area of 36,000 m^2. This means that the effluent (discharge) volume is larger than the influent volume on rainy days. Recorded peak day rain events are in the order of 100 mm, which equates to approximately 3,600 m^3 falling onto the lagoon surface.

The current (2025) ADWF is deemed to be 900 m^3/day and the design future influent ADWF is set at 1,800 m^3/day and a nominal design wet weather multiplier of 2xADWF equates to 3,600 m^3/day.

Combined with the 3,600 m^3 from rain falling on the lagoon surface, the design wet weather effluent (discharge) flow is then 7,200 m^3/day. The tertiary treatment and disinfection capacity has been set at 7,200 m^3/day, with flow above this to be disinfected through an Excess Wet Weather Flow (EWWF) system.

5.1. CAPITAL PLAN – COLLECTION SYSTEM

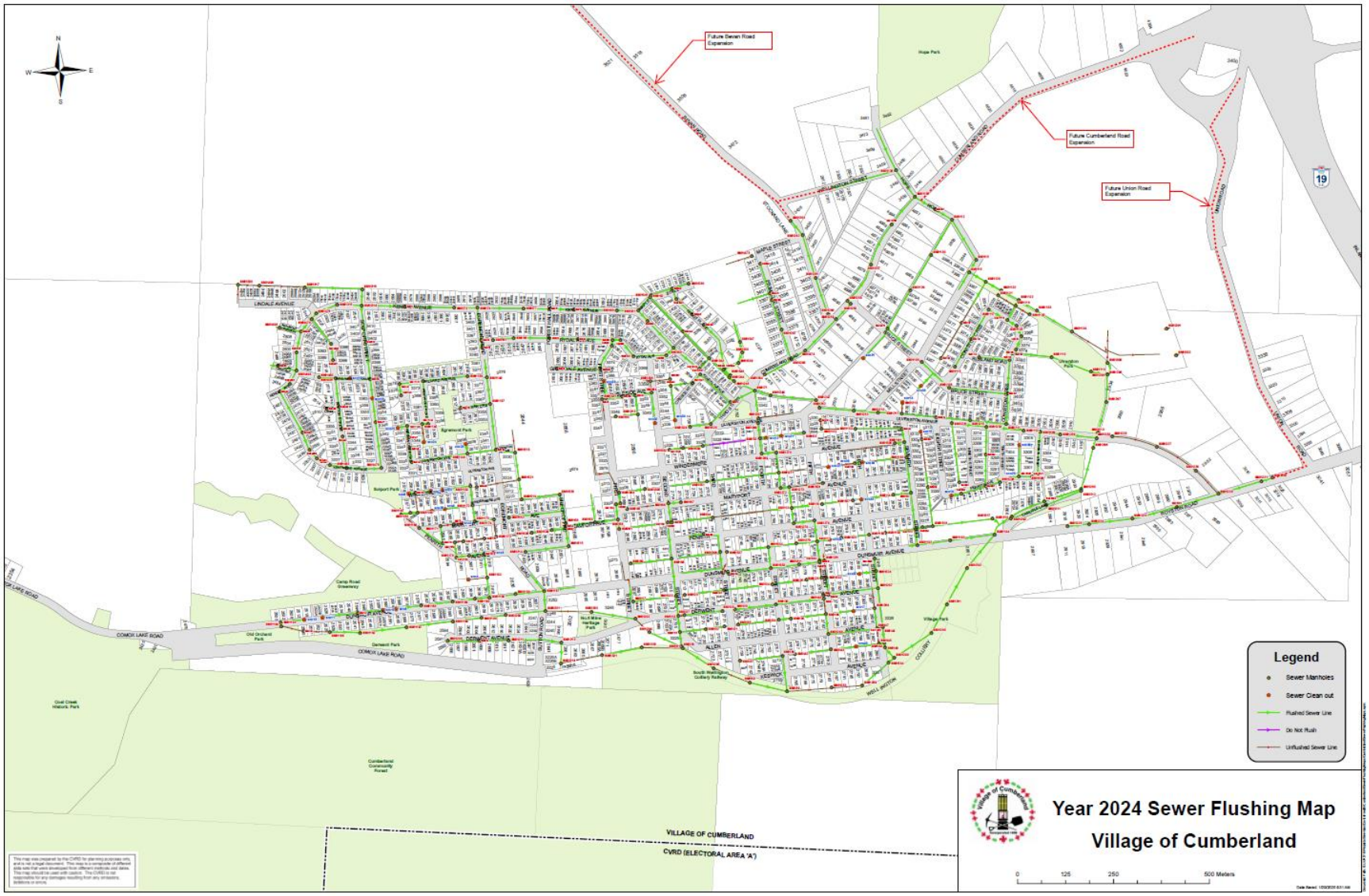
5.1.1. Collection System Upgrades/Expansion

Future expansion areas of the wastewater collection system include Union Road, Cumberland Road (between Hope Rd to Union Rd), and a connection of the Bevan Road industrial lands. These expansions are shown with red dotted lines in Figure 3.

Approximate timing for these expansions is:

- Union Road – 5 years.
- Cumberland Rd and Bevan Rd – 10 years.

Figure 3: Village of Cumberland Collection System



5.1.2. Collection System Expansion Costs

These planned expansions will add approximately 18% to 20% of new sewers (i.e., 5,400 m, refer to Table 7) to the existing collection system. The lengths, pipe diameters, and unit costs of PVC SDR 28 pipes, used to estimate construction costs, are indicated in Table 7. The Village of Cumberland's official Community Plan (OCP) identified Cumberland Rd as the one with higher residential density and commercial use areas in the community.

The unit pricing in Table 7 has been used by Public Works for planning capital works utilities projects as of 2024. The total costs of capital works over the next 5 and 10 years are estimated approximately at $600k and $2M, respectively, including added engineering and contingency amounts, estimated at 15% and 30% of the construction costs, respectively.

Table 7: Capital Costs for Collection System Expansions

Item	Length (m)	Pipe Diemater (mm)	Unit Cost ($/m)	Capital Cost Timing - (5 Years)	Capital Cost Timing - (10 Years)
Sanitary Sewer System					
Union Rd	1,200	200	$350	$420,000	-
Cumberland Rd (between Hope Rd and Union Rd)	900	250	$400	-	$360,000
Bevan Rd	3,300	150	$325	-	$1,072,500
Subtotal	5,400			**$420,000**	**$1,432,500**
15% Engineering				$63,000	$215,000
30% Contingencies				$126,000	$430,000
TOTAL CAPITAL COST				**$609,000**	**$2,077,500**

Part of this capital cost is expected to be covered by Development Cost Charges (DCCs).

The annual O&M operating budget allocated to the sewer collection system is approximately $80,000 for 2025 (*Village of Cumberland, 2025*).

5.1.3. Storm/Sanitary Sewer Separation

The presence of combined storm and sanitary sewers in the Village presents significant challenges related to capacity constraints, environmental impacts, and regulatory compliance. During wet weather events, stormwater runoff that enters the combined sewers significantly increases wastewater discharge into the Villages' treatment system.

A comprehensive sewer separation plan has been developed to fully separate combined sewers by adding new sanitary sewers and stormwater infrastructure (storm sewers services to home roof leaders and road drainage via catch basins). This consists of fourteen identifiable projects with an estimated capital cost of $12M (Class D estimate). The separation program will be completed within the twenty-year period of the LWMP. Implementation of projects will proceed as fast as practical, and some will be grouped together

where there are efficiencies to be gained in engineering, logistics or funding. The budget for this work with additional related details is estimated in Appendix E.

5.1.4. Inflow and Infiltration Reduction

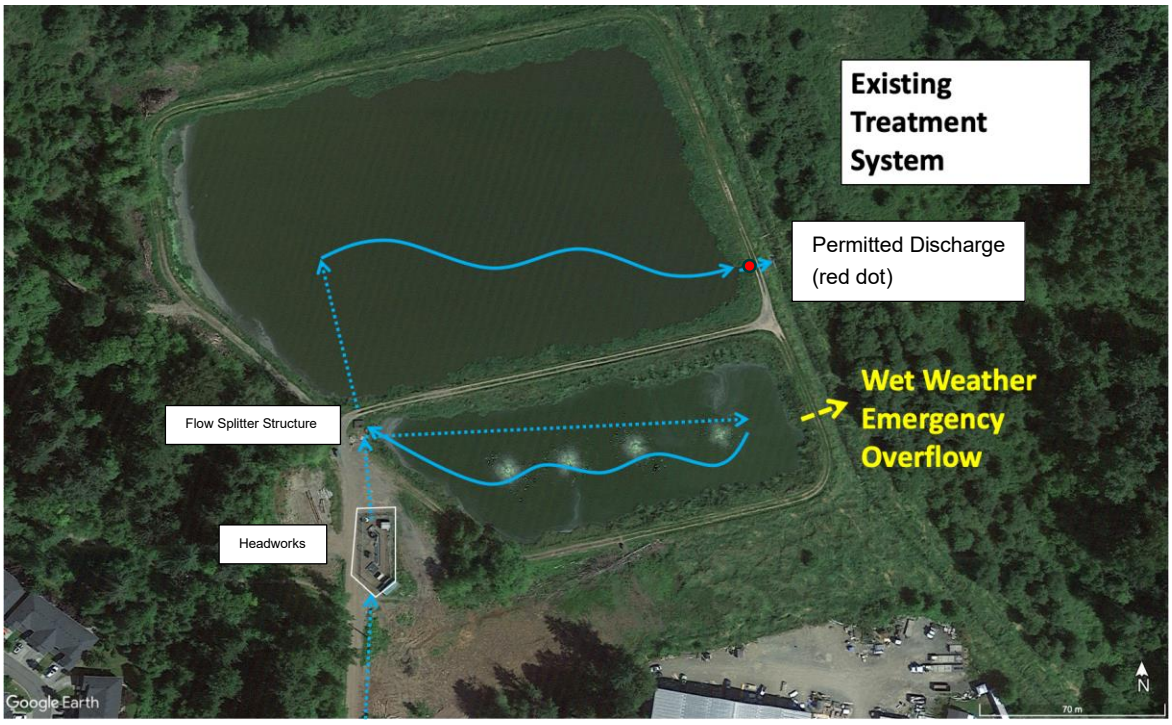
Cumberland has, and will continue, to make efforts to reduce general rainwater inflow and groundwater infiltration (I&I) into the wastewater collection system. Past projects have included the repair/replacement of numerous failed pipes and manholes, but there are more remaining. The Sanitary Sewer Master Plan update that is currently in progress in 2025 will include recommendations for a new program for active investigation and remediation of I&I sources.

5.2. EXISTING LAGOON TREATMENT

5.2.1. Existing Wastewater Lagoon Treatment Configuration

The existing wastewater treatment system consists of a single headworks screen followed by a flow splitting structure that directs the incoming wastewater to a small lagoon with four (4) 5 HP surface aerators. The flow is then directed from the smaller aerated lagoon into a larger facultative lagoon which, in turn, discharges treated effluent to Maple Lake Creek over a flow measuring weir (refer to Figure 4).

Figure 4 Village of Cumberland – Existing Wastewater Lagoon Treatment Configuration



5.2.2. Discharge Permit Status

The current discharge is authorized by the provincial government with a Discharge Permit PE-00197, initially issued in 1967, a major amendment in 1997, and last amended in 2019 (Appendix F). The

Discharge Permit authorizes a discharge of secondary effluent to Maple Lake Creek and stipulates the following effluent quality:

- an Average Dry Weather Flow (ADWF) up to 1,000 m^3/d;
- Maximum Daily Flow (MDF) of 2,710 m^3/d;
- maximum $cBOD_5$ and TSS of 30 mg/L;
- Fecal Coliforms (FC) of less than 200 MPN/100 mL; and
- total phosphorus concentration of less than 1 mg-P/L.

The existing WWTF does not have treatment processes in places that specifically target phosphorus removal and effluent disinfection, thus resulting in regulatory non-compliance with the discharge permit. The wet weather flows frequently exceed the 2,710 m^3/d threshold, making for another source on non-compliance.

5.3. CONCEPUTAL WWTF UPGRADE DESIGN

5.3.1. Design Flows and Loadings

The design flows and loadings for the upgrade of the wastewater treatment system are summarized in Table 8.

Table 8 Design Flows and Loadings

Parameter	Unit	Value
Design Population	people	8,500
Per Capita ADWF	L/c/d	210
Average Dry Weather Flow (ADWF)	m^3/day	1,800
Design Flow Rate (2 x ADWF)	m^3/day	3,600
Maximum Solids-Liquid Separation Capacity (2x3,600)	m^3/day	7,200
Maximum Tertiary Filtration Capacity (2x3,600)	m^3/day	7,200
Maximum UV Disinfection Capacity (2x3,600)	m^3/day	7,200
Minimum Design Flow Rate (with one unit/train out of service)	m^3/day	3,600
$cBOD_5$ Mass Loading (65 g/c/d x 8,500 people)	kg/day	550
TSS Mass Loading (75 g/c/d x 8,500 people)	kg/day	640
Nitrogen Mass Loading (12 g/c/d x 8,500 people)	kg/day	102
Phosphorus Mass Loading (1.5 g/c/d x 8,500 people)	kg/day	12.8
Lowest / Highest Influent Temperature	°C	8.5 / 21
Lowest / Highest Effluent Temperature	°C	3.5 / 33

Source: Village of Cumberland, High Performance Wastewater Lagoon Upgrade Project, Design Basis Memorandum, Integrated Sustainability, 2021.
ADWF – Average Dry Weather Flow; $cBOD_5$ – Carbonaceous Biochemical Oxygen Demand after 5 Days; TSS – Total Suspended Solids

5.3.2. Treatment Objectives, Design and Regulatory Criteria

The overall WWTF upgrade objective is to treat up to 7,200 m^3/d through the entire wastewater treatment process (i.e., headworks, aerated lagoons, solids-liquid separation, tertiary filtration, and UV disinfection) to meet the effluent water quality requirements outlined in Table 9.

Extreme wet-weather flows, exceeding the combined processing capacity of 7,200 m^3/day and lagoon storage capacity, will be screened, treated through the aerated lagoons to a secondary treatment level, disinfected using chlorine, then dechlorinated and discharged to Maple Lake Creek.

The design objectives for the upgraded wastewater treatment process are:

- In Phase 1 before adoption of the LWMP - to meet the current discharge Permit water quality requirements and federal Wastewater Systems Effluent Regulations (WSER) water quality requirements, and
- In Phase 2 after adoption of the LWMP – to meet the BC Provincial Municipal Wastewater Regulations (MWR) Greater Exposure Potential (GEP) reclaimed wastewater reuse water quality requirements.

Table 9 Treated Effluent Water Quality Objectives

Parameter	Unit	Value (Permit and WSER) Phase 1	Value (OC and MWR GEP) Phase 2
Discharge to		Maple Lake Creek	Western Channel/Wetland (≤ 7,200 m^3/day); and Maple Lake Creek (EWWF)
Average Dry Weather Flow (ADWF)	m^3/day	1,000	1,800
Nominal Design Flow (2 x ADWF)	m^3/day		3,600
Maximum WWTP Daily Flow Capacity	m^3/day	2,710	7,200
$cBOD_5$	mg/L	≤ 25 (avg) ≤ 30 (max)	≤ 10
TSS	mg/L	≤ 25 (avg) ≤ 30 (max)	≤ 10
Total Phosphorus	mg-P/L	≤ 1	≤ 1 (Note 1)
Orthophosphate	mg-P/L)	≤ 0.5	≤ 0.5 (Note 1)
Fecal Coliforms	CFU/100mL	≤ 200	≤ 1 (median); ≤ 14 (maximum)
Turbidity	NTU	n/a	≤ 2 (avg) ≤ 5 (max)
pH		6 to 9	6.5 to 9
Un-ionized Ammonia	mg/L-N/L at 15°C	≤ 1.25 (Note 2)	≤ 1.25 (Note 2)
Effluent Toxicity – 96-hr RBT(Note 4)		Pass	Pass
Chlorine Residual	mg/L	≤ 0.02 (Note 2)	min. 0.5 (MWR GEP) (Note 3) ≤ 0.02 (Note 2)
Trent River In-stream Total Phosphorus Objective (May 1-Sep 30)	mg-P/L	n/a	≤ 0.005 (avg) ≤ 0.01 (max)

Notes:
Note 1 – Phosphorus criteria required for discharge to streams, rivers, and estuaries with dilutions greater than 10:1, or lakes with surface area greater than 100 ha, and maximum daily flows grater than 50 m^3/d.
Note 2 – Federal Fisheries Act – Wastewater Systems Effluent Regulations requirement for discharges of 100 m^3/day or more to surface water bodies.
Note 3 – MWR requirement for disinfection of reclaimed water unless the addition of chlorine will detrimentally impact aquatic flora and fauna.
Note 4 – Rainbow trout single concentration acute toxicity test in a 100% effluent concentration.
WSER - Wastewater Systems Effluent Regulations; OC – Operational Certificate; MWR – Municipal Wastewater Regulation; GEP – Greater Exposure Potential; EWWF – Excess Wet Weather Flow; ADWF – Average Dry Weather Flow; MLC - Maple Lake Creek; $cBOD_5$ – Carbonaceous Biochemical Oxygen Demand after 5 Days; TSS – Total Suspended Solids; CFU – Colony Forming Units; NTU – Nephelometric Turbidity Units; RBT – Rainbow Trout Toxicity

5.3.1. WWTF Upgrade Phasing

The Wastewater Upgrades Project is about improving the wastewater treatment provided by the current lagoon system. This project includes two phases with the lagoon upgrades as the primary focus. Design work began in 2021, and construction is estimated to be completed in 2026.

The initial design work in 2021 was based on a one-phase project to implement the upgrades, including the reed bed and wetland augmentation.

During the design process in 2021, several major design changes were made, in response to geotechnical and weather conditions, specifically:

- A seismic stability issue with the eastern lagoon berms adjacent to Maple Lake Creek – the outside berm slope is much steeper than normal design requirements and slopes directly into the creek. This leads to a greater chance of failure in a seismic event during or shortly after weather. The design decision was that a new creek channel should be constructed to allow permanent infilling of the existing channel adjacent to the berms, which would resolve the seismic issue.

- The heat dome of June 2021 showed that a surface aspirating aeration system cannot maintain sufficient oxygenation under the warm water conditions created by heat waves. Summertime effluent quality had been degrading in previous years, but the heat dome was the worst ever recorded. Given that such events are expected to occur more frequently in the future, the design decision was made to change to a diffused sub-surface aeration system. This can maintain better mixing and oxygenation but was a substantial increase in project scope, cost and energy consumption.

- The atmospheric river event of November 2021 resulted in the highest water levels ever observed in Maple Lake Creek. The initial design for the treatment works was pursuing a gravity flow system from the lagoons to the creek, to avoid the use of pumping. The weather event flooded the proposed works area, and a design decision was made to not try to flood protect the works but instead move them to higher ground and avoid the flood risk. This requires the use of pumping and necessitated a complete hydraulic re-design of the treatment works.

These aspects were not contemplated in the Stage 2 conceptual design and represent a substantial increase the scope and cost of the project.

It was initially desired to design the project for minimum energy consumption to minimize climate change impacts. But the events of 2021 forced a design to maximize resilience to climate change induced events, which led to the counter-intuitive result of dramatically increased energy consumption. The weather circumstances and the thought process of the design changes are detailed in Appendix G .

In response to these changes, and the substantial cost increases, the project was split into two phases, with the second phase being contingent on receiving additional grant funding.

PHASE 1: Treatment Upgrades: These are the main treatment improvements, to meet provincial effluent and reliability standards, and WSER requirements. The works include:

1. Improvements to wastewater screening.
2. Changing the flow path in the lagoons and improving the existing aeration system.
3. Nutrients (i.e., phosphorus) removal.
4. Secondary clarification.
5. Additional environmentally friendly UV disinfection.
6. Ancillary works such as an operator's building, workshop, improved instrumentation, process controls, SCADA updates, site security, etc.

PHASE 2: Additional Improvements. These are the additional aspirational improvements identified through the planning process that will improve treatment but are not required by regulation. This includes:

1. Tertiary Filtration: To be completed in tandem with Phase 1.
2. Wetland Enhancement. 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.
3. Biochar Media Reed Bed: To be complete in tandem with wetland enhancement.
4. Maple Lake Creek Improvements: Re-routing and naturalization of the Maple Lake Creek channel by adding to east side of wetland area.
5. Seismic Upgrades: Improving east berm of the lagoons by infilling existing Maple Lake Creek channel and regrading berm walls.

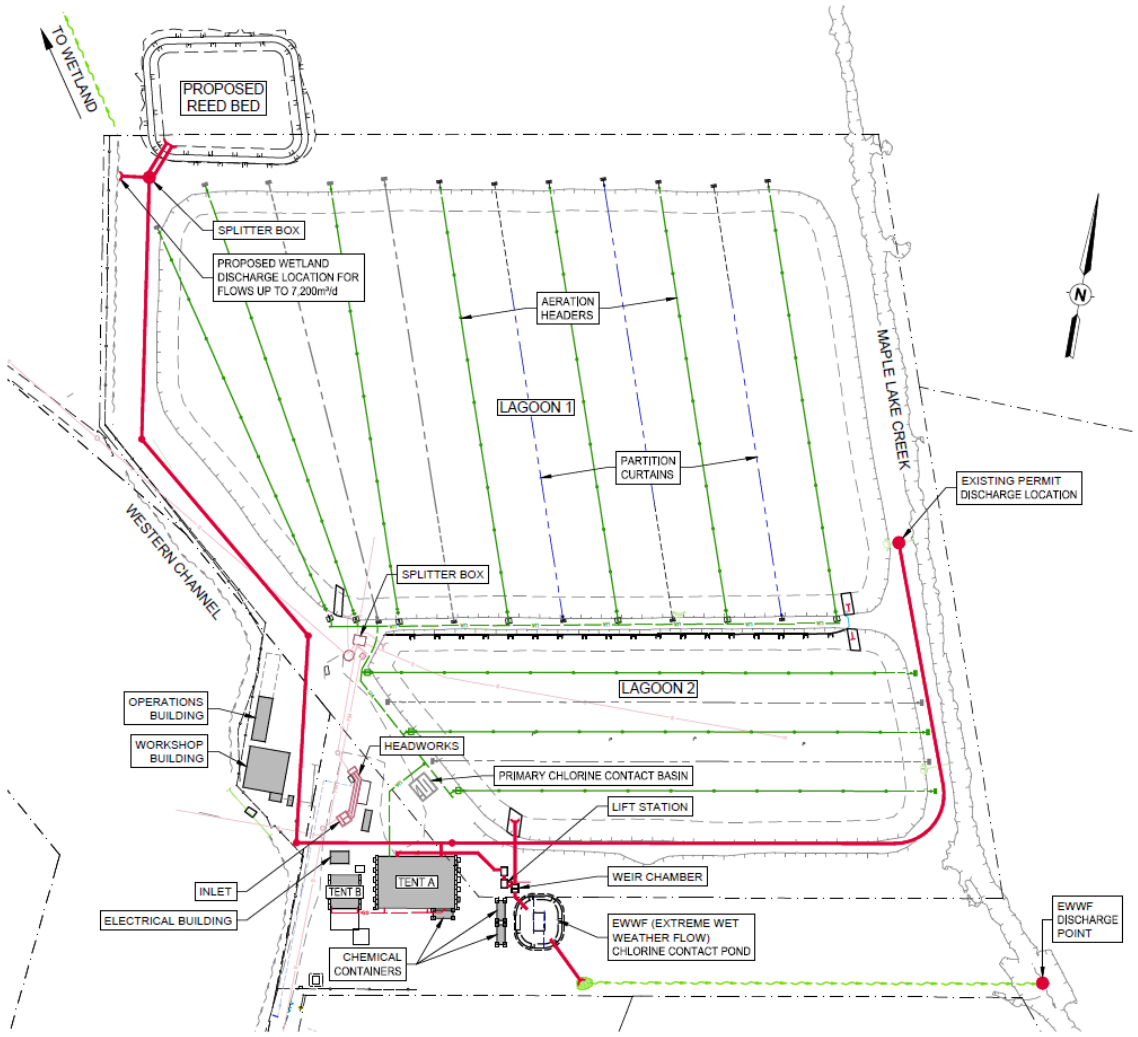
Additional grant funding for Phase 2 was secured in 2022 and the design of these components has been included in the overall project planning, and the tertiary filtration being integrated into the main treatment process design and construction works.

5.3.2. WWTF Upgrade Configuration

All wastewaters will flow through the screens and the two aerated lagoons. The design basis is for flows up to 7,200 m^3/d to be pumped from a diversion chamber, connected to an outlet of the second aerated lagoon, to the two (2) parallel SAF solids-liquid separation unit process systems, and then flow by gravity through the remainder of the treatment components (tertiary filters and UV disinfection) to effluent discharge. Each SAF, filter, and UV disinfection unit has the capacity to process up to 3,600 m^3/d (42 L/s). A discharge point for flows up to 7,200 m^3/day is a natural wetland located in the north-west corner of the larger lagoon (refer to Figure 5). Extreme wet weather flows through the lagoons, exceeding the

combined processing capacity of 7,200 m^3/day and lagoon storage capacity, will be discharged to Maple Lake Creek (refer to Figure 5).

Figure 5 Upgraded Treatment Facility Layout



The Cumberland WWTF is designed to meet or exceed the requirements of Reliability Category I as specified in Part 3, Division 1, Section 35 of the BC Municipal Wastewater Regulation (MWR).

5.3.3. WWTF Process Overview

Pre-screened wastewater from the headworks will flow into partial-mix, fine-bubble aerated lagoons that operate in series for biological treatment. Daily flow up to 7,200 m^3/d that has been treated through the lagoons will be processed in two 3,600 m^3/day parallel treatment trains and pumped to two parallel Suspended Air Flotation (SAF) units and tertiary disk filters for solids removal, and subsequently to UV

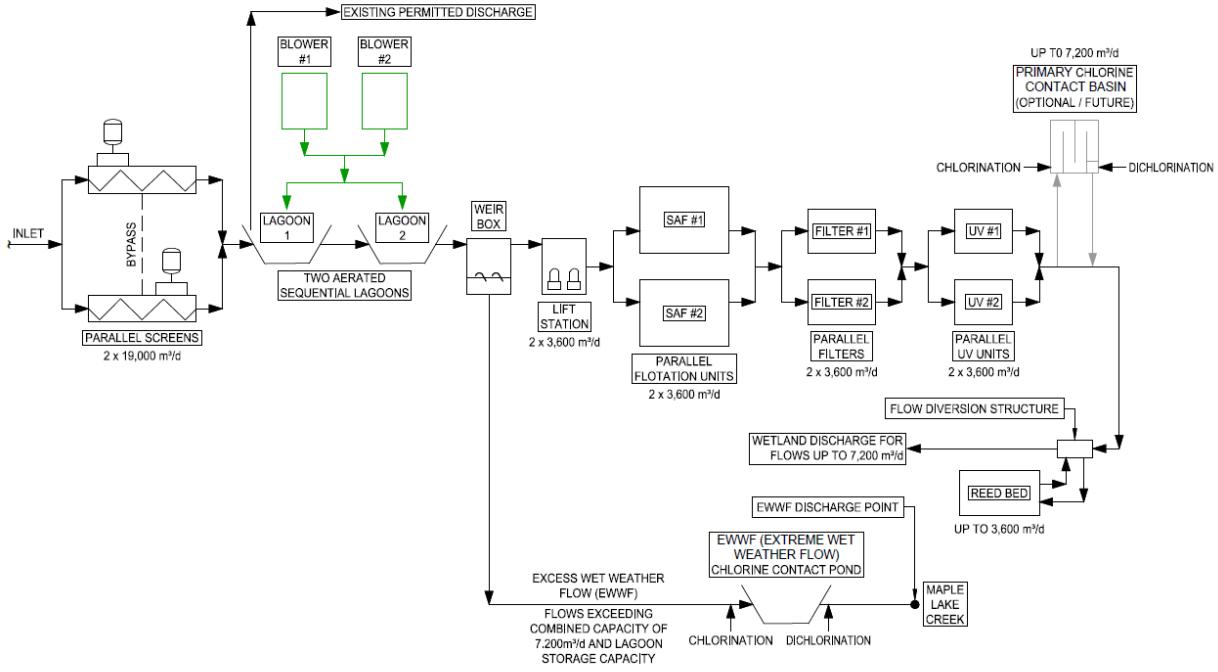
disinfection modules. Concurrently, a chemical coagulant will be injected ahead of the SAFs and disk filters to precipitate and remove phosphorus.

Water passing through the SAF units and disk filters will be disinfected with ultraviolet (UV) light and discharged to a natural channel located west of the WWTP site. This channel is hydraulically connected with, and discharges to, natural wetlands located on the north side of the lagoon system. Disinfected effluent flows up to 3,600 m^3/day will be passed through a reed bed during dry weather conditions prior to being used to augment flows within the surrounding wetlands.

In severe wet weather, flows exceeding the tertiary treatment capacity of 7,200 m^3/day and available wet weather lagoon storage capacity will be discharged to Maple Lake Creek via the Excess Wet Weather Flow (EWWF) basin.

The treatment process is schematically illustrated in Figure 6.

Figure 6 Process Schematics



A more detailed description of discrete process components is provided in Appendix H – Detailed Design Brief, Section 4.

5.4. EFFLUENT DISCHARGE

Upon adoption of the LWMP, the existing permitted discharge from the larger lagoon to Maple Lake Creek will be abandoned (refer to Figure 5).

Disinfected effluent flows up to 3,600 m^3/day will be passed through a reed bed during dry weather conditions prior to being used to augment flows within the surrounding wetlands.

A discharge point for flows up to 7,200 m^3/day is a natural wetland located in the north-west corner of the larger lagoon (refer to Figure 5). This total flow is a sum of the flow through the reed bed and the flow above 3,600 m^3/day that bypassed the reed bed.

Extreme wet weather flows through the lagoons, exceeding the combined processing capacity of 7,200 m^3/day and lagoon storage capacity, will be discharged to Maple Lake Creek via the Excess Wet Weather Flow (EWWF) basin (refer to Figure 5).

5.1. EOCP CLASSIFICATION

The MWR requires that wastewater treatment and collection systems be classified under the Environmental Operators Certification Program (EOCP). Classification is on a scale of 1 to 4 depending on the size and level of complexity of the WWTF.

The level of operator certification required to operate the proposed facility must equal the classification level of the facility, which is dependent on the operating complexity of the adopted treatment technology. The upgraded Cumberland WWTF is expected to be classified as either Class 3 or Class 4 facility.

Application for facility classification will be made at the time of commissioning of the treatment works as EOCP policy does not allow for applications prior to commissioning.

6. Cost Estimate

6.1. COSTING ASSUMPTIONS

The capital costs provided herein are estimated based on the following:

- approved work to date (March 2025) including environmental studies, engineering, and project management;
- actual construction costs to March 2025;
- cost estimates from 2025 received for approved work packages, such as civil, process, mechanical, structural, electrical, and HVAC till work completion;
- approved scope changes and budget adjustments to March 2025.

The costs estimated herein are expected to be within the margins of Class B cost estimate at the project completion – i.e., within ±15%-20% with a confidence interval of 90% in accordance with *Budget Guidelines for Consulting Engineering Services, Consulting Engineers of British Columbia, 2009*.

6.2. COST ESTIMATE

The table below summarizes the estimated costs for Phases 1 and 2 upgrades. Costing details are provided in Appendix I. The costs in Table 10 are broken down in the same format, as presented in the appendix, for consistency.

Table 10: Capital Cost Summary

Item	Phase 1 Budget ($)	Phase 2 Budget ($)
WWTF Ugrades		
Owner's Costs	1,519,192	
Consultant Fees		837,227
Design Fees	2,555,934	822,711
Construction Costs	13,542,212	2,700,060
TOTAL CAPITAL COST	**$17,617,338**	**$4,359,998**

The total capital costs of Phases 1 and 2 are estimated at $17.617 million and $4.36 million, respectively.

The capital program for upgrade works was first developed in the Stage 1&2 process in 2016-2018 (Table 11) and captured in the Stage 2 Report of July 2018. Since then, the design of the works started in 2021, and the scope and cost of the works have both increased. In 2022, the project was split into two phases to

reflect different funding sources and construction timelines. The last major LWMP capital work item – the storm-sanitary separation program has been scoped and added to the works program in 2025 to arrive at the completed LWMP works program.

Table 11: Capital Cost Updates from 2018 to 2025

Construction Phase	Capital Works	Cost Estimates by Year					
		2018	2021	2022	2023	2024	2025
Phase 1 (2021-2026)	Lagoon Upgrades	7.7	7.7	12.41	14.54	17.617	17.617
Phase 2 (2025-2027)	Reed Bed and Wetland Augmentation	2.0	2.0	2.0	2.0	2.0	2.0
	Tertiary Treatment			1.0	1.0	1.0	1.0
	Seismic Upgrade (MLC Channel relocation)			1.36	1.36	1.36	1.36
Long Term (2026-2046)	Storm-Sanitary Separation						12.0
	Total Estimated Cost	9.7	9.7	16.77	18.9	21.977	33.977
	VoC Approved Budget	-	9.7	16.77	18.9	21.977	21.977

The LWMP guidelines require that cost estimates for Stage 3 should be at a Class B level (nominal +20%). In Cumberland's case the treatment upgrade project is already underway, and many costs have already been committed and/or paid (e.g. design, process equipment purchases) making them effectively Class A (+-10%). Some construction costs such as the electrical contract have not been finalized at this stage (March 2025) and there always remains the possibility of other construction cost overruns. Overall, the approved project budget of $21.977M for Phase 1 and 2 can be regarded as being Class B for the purpose of this LWMP.

The cost estimate for the separation program is a Class D estimate. It cannot be refined further without doing preliminary engineering on all the fourteen components, and this is proposed to be done as they are implemented.

The operating costs for the treatment upgrades have been estimated based on the finalized design and updated for current (2025) rates for the major consumables of hydro and chemicals, and the biosolids composting agreement with the CVRD (Table 12).

Table 12: Operating Cost Estimate

Category	2018 Estimate	2025 Estimate
Labour (FTE's)	1.5	1.5
Labour	$135,000	$165,000
Hydro	$32,000	$101,000
Process Chemicals	$120,000	$95,000
Biosolids Disposal	$44,000	$70,000
External Laboratory	$10,000	$30,000
Misc. Supplies and Services	$13,000	$36,000
Maintenance	$13,000	$50,000
Contingency	$0	$53,000
Totals	**$367,000**	**$600,000**

The operating costs include the Phase 2 works, with tertiary filtration being part of the integrated treatment process. The reed bed and stream relocation works have no direct operating cost and minimal annual maintenance costs.

The operating costs have increased from the 2018 Stage 2 LWMP concept plan as the project scope and complexity has increased, and all cost items have had inflationary increases.

7. Project Funding

The wastewater upgrades are the largest capital project ever undertaken by the Village of Cumberland.

The treatment upgrade project (Phases 1 and 2) is already fully funded to the current project budget of $21.977M, with the last budget increase, (to $21.977M). being approved by Cumberland Council on October 28, 2024 (Table 13).

Table 13: WWTF Upgrade Budget

Funding Source	Approval Date	Amount ($M)
Federation of Canadian Municipalities "Green Municipal Fund" (GMF) Grant	2018	0.750
Borrowing, 20-year Term – Bylaw 1084	2018	4.400
Canada-BC Investing in Canada Infrastructure Program (ICIP) Grant	2019	7.113
BC Strategic Priorities Fund Grant	2022	2.500
Borrowing, 20-year Term– Bylaw 1207	2024	2.500
Cumberland Reserves (Incl DCC's)	2019-2024	4.714
Total Approved Upgrade Project Funding		**$21.977M**
Total Grants		$10.363
Grant %		47%

The total borrowing of $ 6.9M will be funded by a parcel tax from the two existing borrowing bylaws so there is no LWMP authorized borrowing needed to complete the Treatment Upgrades project (at the current budget).

The operating cost is, and will continue to be, funded by wastewater user fees.

This leaves the $12M storm-sanitary separation program as the major future capital work to be funded under the LWMP. Two options have been considered for funding this program:

1. Phased implementation over the twenty-year LWMP period, funded directly by a parcel tax for the entirety of the twenty-year period, with no borrowing.

2. LWMP authorized borrowing, to allow a five to ten year implementation of the program, repaid by a parcel tax over the twenty-year LWMP period.

The implementation timeframe and funding mechanism were the major questions for public input in the Stage 3 LWMP process.

During the public and Advisory Committee process it was recognized that:

- Cumberland ***must commit*** to completing the separation program within the (twenty year) duration of the LWMP so that there are no longer any old combined sewers remaining and the separated sanitary system meets modern design standards.

- There are other sources of wet weather flow (from the separated sanitary system and the 3.6 ha lagoon surface area itself), so completing the separation program will ***reduce but not eliminate*** the excess wet weather flows. The treatment works have been designed specifically to handle EWWF flows so there is little environmental benefit from an expedited elimination of flow from combined sewers.

- There may may be financial benefit to earlier implementation as construction costs are generally rising faster than inflation, so projects are more expensive in the future.

- A longer implementation (the full twenty years) gives more opportunity to access grant funding programs.

On the question of the future capital works of the storm-sanitary separation program, the Wastewater Advisory Committee recommended that:

- The separation program should be fully funded by the Village to allow its implementation over a maximum twenty-year period without reliance on grants.

- The decision on funding mechanism about whether to borrow or fund directly by parcel tax is to be made by the Council.

7.1. LWMP COSTS PER PARCEL

The LWMP costs have been calculated on the basis of property parcels, as that is how they will ultimately be paid for.

On a per parcel basis, the costs are as follows (based on 1818 parcels for 2026) (Table 14).

Table 14: Costs per Parcel

Item	Net Cost	Annual Cost per Parcel, Separation Funded by Tax	Annual Cost per Parcel, Separation Funded by Borrowing
Upgrade Borrowing (20-year Term)	$6.9M Loans $10.64M including interest	$312/yr	$312/yr
Operating Cost	$600k	$330/yr	$330/yr
Storm Sanitary Separation, all Tax	$12M	$330/yr	-
Storm Sanitary Separation, all Borrowing	$12M	-	$513/yr
Total LWMP Annual Cost Per Parcel		**$972/yr**	**$1,155/yr**

On May 26, 2025, the Village of Cumberland Council considered the question of the funding mechanism and resolved that it will be funded directly by the Village ***without need of LWMP authorized borrowing***. The nominal funding method is by parcel tax, but Cumberland may also use other taxation sources.

Thus, the final estimated cost per parcel for the LWMP program, at the commencement year of 2026, is $972/year per parcel.

All the parcel taxes, and the O&M costs, will be distributed over a greater population as future growth occurs. The rates per parcel calculated here represent the cost borne by the current population and rates would be expected to be reviewed and possibly reduced as part of the regular five-year reviews of the LWMP.

If grant funding is received for doing part of the separation program, then this would accelerate the implementation of the program, and lead to an earlier removal of the $330/year separation tax.

7.2. CONTRIBUTIONS FROM INFRASTRUCTURE GRANTS

Cumberland will make best efforts to secure senior government grants to assist with the separation program, but receipt of such grants is not guaranteed, and neither is the timing of them.

If grant funding is secured to assist with the separation program, then the execution of the program will be accelerated accordingly, leading to an earlier completion of the program and earlier removal of the parcel tax. It is not intended that grants would be used to reduce the annual amount of the parcel tax.

7.3. CONTRIBUTIONS FROM DCC'S

The use of DCC's (Development Cost Charges) is normally to fund projects that are yet to be done, rather than ones that have already been done. However, the provincial regulations allow DCC's to be used to pay off costs and loans for already completed projects in certain cases where infrastructure must be expanded before development can occur and this specifically includes wastewater treatment plants. In these cases, the DCC's can also cover the interest cost in addition to the project capital costs. Application must be made to the province for such a case.

The nominal DCC calculations are detailed in Appendix J. At the projected population growth rates, the sewer portion of the DCC would be $10,380 per parcel, and there are expected to be 778 new parcels over the twenty-year period. Collectively, this will realize $8.02M which will pay off 75% of the total loan cost (including interest) of $10.64M. Since DCC's are dependent on the rate of growth, the revenue stream fluctuates and is not guaranteed. So similarly to infrastructure grants, the DCC revenues in this case should be viewed as a bonus, rather than as a guaranteed stream that would allow an immediate reduction of the loan parcel taxes. With DCC's covering most of the loan cost, excess from user parcel taxes can go towards wastewater asset replacement reserves.

Overall, the treatment upgrades represent high quality treatment to produce a high-quality effluent. It was a foundational goal of the Cumberland, and captured in the Stage 1 &2 LWMP, to implement high quality treatment and it was recognized that this comes with a high cost. Cumberland's 2014 Official Community Plan had specific objectives regarding infrastructure funding:

> *5.5.3 (2) Support opportunities for Federal, Provincial, and First Nation partnerships for infrastructure to manage costs and risk to the Village and tax payers.*
>
> *5.5.3 (5) Seek maximum funding for infrastructure development from senior levels of government by taking advantage of special financing opportunities available for innovative efficient infrastructure development.*

In securing $10.36M of grant funding, for 47% of the total project cost, it is deemed that these policies have truly been actioned in the development and execution of this LWMP.

8. Implementation Timeline

The project implementation timeline to complete the WWTF upgrades is presented in Table 15. This timeline has been developed with input from the general contractor and is current as of March 2025.

Table 15: Implementation Timeline

Task		Duration	
		START	END
1	WWTF Detailed Design	2021	2025 Q2
2	Construction	December 2023	2026 Q1
3	Start-up and Commissioning of Treatment Upgrades	2026 Q1	2026 Q2
4	Commencement of Discharge to Wetlands	Upon Approval of LWMP (presumed 2026 Q2)	Ongoing
5	Construction of Reed Bed, Stream Relocation and Seismic Upgrade	2026 Q2	2026 Q4
5	Project Wrap-up	2026 Q4	2026 Q4

9. WWTF Operational Certificate

The Cumberland WWTF is currently authorized by the BC ENV Permit No. PE-00197 to discharge secondary treated effluent from the lagoon treatment process to Maple Lake Creek. Following ministerial approval of Stage 3 of the LWMP process, the existing Permit will be replaced by an Operational Certificate.

A Draft Operational Certificate will be coordinated with BC ENV, prepared, and proposed for ministerial review and approval after feedback on, and acceptance of, the proposed WWTF upgrade has been received from BC ENV.

10. Source Control and Wastewater Volume Reduction

10.1. SOURCE CONTROL

This section contains options for source control of contaminants entering the sewer system and opportunities for reduction of wastewater volume.

10.1.1. Review of Existing Sanitary Regulation Bylaw

Cumberland has two bylaws in place regulating sanitary and storm sewer connections, being:

- Municipal Sanitary System Regulation and Fees Bylaw No. 1025, 2015 - A Bylaw to regulate the connection, use, and extension to the municipal sanitary system and to impose fees for associated services (Appendix K); and
- Municipal Stormwater System Regulation and Fees Bylaw No. 1024, 2015 - A Bylaw to regulate the connection, use, and extension to the municipal stormwater system and to impose fees for associated services (Appendix L).

These bylaws are being reviewed in 2025 as part of the updates of the Sanitary and Stormwater Master Plans.

10.1.2. Fats, Oils and Grease (FOG) Bylaw

FOG discharge is generated in facilities such as individual homes and food service establishments where food preparation, food service, and kitchen clean-up occur. In addition, commercial establishments also generate FOG, including hotels, motels, restaurants, and pubs. Some examples of FOG are meats and other food scraps, gravies, salad dressing, bacon grease, cooking oil, yogurt, and body cream. When FOG is flushed down toilets and drains, including the kitchen sink, it causes problems for both the facility owner and the Village. FOG sticks and begins the build up inside the sewer pipes, and over time can block wastewater flow and clog sewer pipes. In extreme cases, sewers can overflow onto streets and into homes and businesses.

The Village could consider the development of a source control and wastewater volume reduction program for FOG. The bylaw would provide a means to limit FOG discharge into the sewer system by educating the users of the costly harms and installing FOG interceptors where necessary. A bylaw would provide regulatory framework for enforcement of small volume discharges identified within the community.

Currently, new commercial and industrial developments are required to install storm oil/grease separators for the removal of sediment and oils contained in stormwater discharged from parking areas, driveways for all multi-family, commercial, institutional, and industrial properties.

10.1.3. Public Education Program

One of the most effective source control tools is educating the public users about what they are discharging into the sewer system. An individual may not understand the harm certain substances can

cause and may be unknowingly shortening the life of the sewer infrastructure. There are a variety of avenues the Village may take to provide educational information to the public including:

- Mailing lists (email and paper)
- Virtual or paper-based information
- Virtual or in-person tours
- Displays at public functions
- Video infographics
- Surveys
- Local news media
- Grade school projects

10.2. WASTEWATER VOLUME REDUCTION

Cumberland has owned and operates its own water supply and distribution system since the early 1900's. Customers are unmetered and billed on a flat rate basis. In 2007, Cumberland moved to a proactive approach on water conservation, including a goal to implement universal water metering. Cumberland has a Water Conservation Bylaw No. 807 that requires that all residents and businesses be metered for water consumption - https://cumberland.ca/water-conservation-bylaw/ (Appendix M).

The metering retrofit program was completed in 2011 and the water rates were changed from flat rate to volumetric billing in 2014. Substantial reductions in water use have been achieved, and much of this has been by reducing leakage and wasteful outdoor water use.

In terms of wastewater generation, the average dry weather flow (ADWF) volumes have been relatively steady, but per capita volumes have been decreasing, and at 180 L/c/day are well below typical municipal standards of ~ 250 L/c/day and even the nominal value of 210 L/c/day used for the design of the WWTF upgrade (Table 16).

Table 16: Historical Trend of Cumberland Per Capita Wastewater Volumes

Year	Census Population	ADWF (m^3/day)	Per Capita ADWF (L/c/day)
2011	3,398	840	247
2016	3,753	809	216
2021	4,447	830	187
2024	4,800 (estimate)	760	158

The wet weather flows are dramatically influenced by four major factors, in decreasing order of control.

- The remaining combined sewer areas
- Rainwater inflow
- Groundwater infiltration
- Rainwater falling on the lagoon surface.

As part of this LWMP the Cumberland is committing to separating the remaining combined sewer areas, which will make a significant reduction in wet weather flows.

Cumberland has, and will continue, to make efforts to reduce general rainwater inflow and groundwater infiltration (I&I). Past projects have included the repair/replacement of numerous failed pipes and manholes, but there are more remaining. The Sanitary Sewer Master Plan update that is currently in progress will include recommendations for a new program for active investigation and remediation of I&I sources.

Cumberland has no control over the amount of rainfall on the 36,000 m^2 lagoon surface and the design maximum rain day of 100 mm will contribute 3,600 m^3 of flow – four times the current dry weather flow. While this is not a volume in the collection system, it is part of the discharge volume and will remain so as long as Cumberland continues to use the lagoons as the treatment system. While Cumberland will continue to make best efforts on volume reduction, it can never achieve the MWR target (section 44(1)) for a wet weather peaking factor of less than 2:1.

11. Stormwater Management

The 2.5 km² Village of Cumberland stormwater catchments are split over a watershed divide that traverses the center of the Village. In the north, runoff is directed through 7 catchments to outfalls that discharge into wetlands in the Maple Creek Watershed. In the south, 15 catchments drain to the South Cumberland Watershed. Eventually, all runoff from the Village discharges into the Trent River via tributary watersheds.

The existing drainage system is responsible for road drainage, conveyance of stormwater away from residences, and foundation drainage. Some areas within Cumberland currently lack stormwater infrastructure, leading to localized drainage issues. These are primarily areas with combined sewers, where road and foundation drainage is directed to the sanitary system.

Several developments in the last 10 years have added dedicated stormwater systems while the community also initiated work on separation of the combined sewers. As Cumberland continues to redevelop and expand, stormwater infrastructure investments should prioritize improving combined sewer separation, addressing service gaps, and integrating new development into the stormwater network.

Future developments in Cumberland will expand the stormwater system by continuing combined sewer separation and integrating new infrastructure. Infill developments within the Village Center will introduce localized stormwater collection systems to address areas lacking adequate drainage. Developments on the village's periphery will be designed to tie into existing catchments, ensuring proper drainage without overwhelming the system.

Cumberland is in the process of updating its Stormwater Management Plan in 2025 and additional details are provided in Appendix N.

11.1. OVERFLOW ELIMINATION PLAN

An Overflow is defined in Section 41 of the Municipal Wastewater Regulation as:

41 (1) In this Division:

- "**combined sewer overflow**" means a discharge from a combined sewer system to a location other than a wastewater facility; and

- "**municipal wastewater collection system overflow**" means a discharge from a municipal wastewater collection system to a location other than a wastewater facility, commonly referred to as a sanitary sewer overflow.

Even though Cumberland has a partial combined sewer collection system, there have not been any known overflows from any part of the collection system since at least 2010 (the longest serving current staff members). Accordingly, ***for the collection system***, overflows are deemed to have already been eliminated.

At the Treatment Facility (the lagoons) an overflow is deemed to occur when flow occurs over the outflow weir in the small (primary) lagoon. This weir is located near the exit point of the influent pipe, so any water flowing over this weir is effectively raw influent and an overflow is a reportable Spill Incident. Typically, such overflows only occur during extreme wet weather when the daily flow is greater than 15,000 m^3/day (i.e., 16 times current dry weather flow) or when there is a sudden inrush of influent from a heavy rain and/or snowmelt event (as occurred for two hours on December 26, 2022). There have been three such incidents in the period of 2018 to 2024.

With the planned treatment upgrades, the lagoon flow path is changed such that all flow passes through the aeration system in both lagoons before reaching the lagoon exit point, effectively receiving full secondary treatment. All flow up to 7,200 m^3/day goes to the tertiary treatment system for discharge to the wetlands and flow over 7,200 m^3/day will pass through the Excess Wet Weather Disinfection (EWWF) basin for discharge to Maple Lake Creek. In this way, the EWWF achieves the goals of section 44(2) of the MWR:

Use of storage or conveyance facilities

43 (1) A discharger may not use storage or conveyance facilities to reduce

(a)the amount of sewer separation required, or

(b)the amount of inflow and infiltration reduction required

unless the facilities immediately reduce and ultimately prevent the occurrence of combined sewer overflows.

(2) If facilities are used under subsection (1) and primary and secondary treatment is available, the discharger must do all of the following:

(a)provide at least primary treatment for flows greater than 2 times the ADWF;

(b)use the full secondary capacity of the treatment system;

(c)combine the primary and secondary municipal effluent prior to discharge;

(d)maintain a minimum receiving environment-to-discharge dilution ratio of 40:1;

(e)if disinfection is required, provide adequate excess disinfection capacity to ensure disinfection of the entire discharge flow

Inflow and infiltration

44 (1) A discharger must ensure that inflow and infiltration does not occur such that the maximum average daily flow exceeds 2 times the ADWF at the treatment plant during storm or snowmelt events with a less than 5-year return period, unless

(a)for municipal wastewater collection systems for which the contributory population to the treatment plant is 10 000 persons or more, the person responsible for the municipal

wastewater collection system addresses, as part of a liquid waste management plan, how inflow and infiltration can be reduced, or

(b)if paragraph (a) does not apply, the person responsible for the municipal wastewater collection system

(i) develops a liquid waste management plan or conducts a study, and

(ii) develops and implements measures to reduce inflow and infiltration.

(2) Despite subsection (1), if reductions below 2 times the ADWF are not possible or cost effective based on a cost-benefit analysis, the discharger must

(a)provide full secondary treatment for the entire flow at all times, or

(b)undertake to do all of the things listed in section 43 (2) (a) to (e) *[use of storage or conveyance facilities]*.

The lagoons will provide full secondary treatment at all times thus achieving 44 (2) (a) and the EWWF will provide disinfection for the non-tertiary treated flows thus achieving 43 (2) (a, b, c and e). The only condition that cannot always be satisfied is (d) to maintain the receiving environment dilution ratio of 40:1. With the lagoon discharge being near the top of the Maple Lake Creek catchment, the creek flow , even in extreme wet weather, is usually less than 10:1 dilution of effluent. The dilution ratio will increase in the future as Cumberland reduces wet weather flows and the use of the EWWF system becomes rarer and a smaller discharge when it is used. Even so, the dilution ratio cannot be controlled, and no specific targets can be met in wet weather conditions.

12.Integrated Resource Recovery/Management

The Cumberland WWTF in its current configuration produces effluent quality that is not suitable for reuse as the lagoon effluent does not meet MWR requirements for reclaimed water use. Principles of integrated resource management are typically implemented within the local context, where applicable, in the close proximity to the WWTF, and to the extent possible. As the volume of treated wastewater continues to increase in the future, due to new developments and connections of currently un-serviced or underserviced areas to the WWTF, the potential for use of reclaimed water produced by the upgraded WWTF, other than for wetland flow augmentation, may become more attractive.

The relatively small scale of the Cumberland wastewater treatment facility combined with the lagoon-based options under consideration does not provide significant opportunities for resource recovery, but consideration has been given to potential opportunities during all three stages of the LWMP.

12.1. RECLAIMED WATER REUSE

The BC MWR provides policies and specify requirements that govern all aspects of wastewater management including the reclaimed water use. In Stages 1 and 2 (2016-2018), consideration was given to the possibilities for reclaimed water use, with several possibilities identified, assuming high quality tertiary treatment, including:

1. On-site reuse for process water.
2. Irrigation water for municipal parks and playing fields.
3. Water for the Island Health hospital laundry facility (adjacent to the lagoons).
4. Wetland augmentation of the area next to the lagoons.
5. Stream augmentation in Maple Lake Creek.

Given that Maple Lake Creek naturally dries up in summer, the continuation of discharge of (high quality) treated water to the creek is essential for the downstream health of the creek. This ruled out any other permanent discharge locations (i.e. to a different watershed) and effectively means that stream augmentation will be happening by default.

Options 1 to 4 are discretionary uses and after studying the possibilities, and the relative complexity of implementing them, only Options 1 and 4 were carried forward for consideration in Stage 3.

Reclaimed water for process use was considered during the detailed design of the facility. There are two main uses of water – influent screen washing and chemical dilution/makeup water.

It was determined that potable water must be used for chemical makeup water to ensure high quality water and no possibility of a reaction of concentrated chemical with a potential contaminant in reclaimed water. This is consistent with design practice in other WWTF's that do not have membrane treatment.

For the influent screens, the daily water use is projected to be relatively low – 2 to 4 m^3/day. When the screens call for wash water, it is a relatively high flowrate for a short period of time. This means that there must be both a storage and pressure pump component to a reclaimed water system. The supply of water is a critical aspect of their function, so a potable backup is required. After a conceptual design was developed, it was determined that the operational complexity of providing the separate system and making it capable of winter operation was disproportionate to the small water savings achieved and overall benefit. So, further implementation was not pursued but capped connections have been made to allow for future installation, if desired.

Using the reclaimed water to augment the adjacent wetland areas, either summer only or year-round was identified as part of the preferred option from Stage 2. With the inclusion of tertiary treatment in the upgrade project, the effluent water will meet the Greater Exposure Potential (GEP) category and be suitable for use in the publicly accessible wetland area to the north of the lagoons. This will become the permanent discharge path for all effluent except Excess Wet Weather Flow.

12.2. BENEFICIAL USE OF BIOSOLIDS

As sludge in a lagoon treatment process accumulates over time, it requires periodic removal and disposal. Additional sludge will be generated by the addition of mechanical treatment components (sedimentation for secondary and filtration for polishing solids removal) that will require more frequent sludge removal. To be used beneficially, sludge must be processed (e.g., composted) according to Provincial standards.

In BC, any beneficial reuse of sludge would have to comply with the BC Organic Matter Recycling Regulation (OMRR) – BC Reg. 18/2002 (*BC MOE, 2002*), which is quite prescriptive and has extensive monitoring requirements.

The OMRR classifies compost under one of the two categories: Class A or Class B. Class A compost is unrestricted for use in horticultural applications and must meet significantly higher standards to minimize risk to people and the environment. Class B compost does not have as stringent standards, and thus use of Class B compost is limited. Class B compost can only be used in an urban environment if the ENV approves a management/application plan minimizing health and environmental risk, and public contact.

Meeting Class A compost standards requires testing of the compost, control of nutrient ratios, strict record keeping, drainage control around the composting pile, and overall strict control of the composting process. The control of nutrient ratios typically requires addition of other organic material such as wood chips or pellets. Operating and closure plans are also required.

12.2.1. Local Biosolids Management Options

Biosolids use options were studied as part of the Stage 3 detailed design. With the wastewater treatment process incorporating chemical phosphorus removal, the produced biosolids will have a high phosphorus content making them suitable for use as a soil amendment.

Biosolids production is estimated to be in the order of 0.3 to 0.5 dry tons per day. This is a very small amount when considering a purpose-built processing operation.

The limited land area at the lagoon site limits the on-site processing possibilities – it precludes the use of sludge drying beds or aerobic composting. Thus, the two possibilities considered were on-site processing by pyrolysis to biochar, and offsite processing – composting or land application.

Pyrolysis to biochar is a relatively recent processing development, with commercial operations at some European facilities since 2014 and in the USA since 2017. The Capital Regional District (CRD) is currently contemplating to test a pyrolysis process at the Residuals Treatment Facility (RTF) at Hartland Landfill in Victoria. The equipment is now "off the shelf" and there are numerous suppliers. However, the equipment is either very small scale – intended for work camps up to 100 to 200 people, or of large scale for WWTF's servicing 30,000 plus people. As of 2023, there were no standard equipment options available sized for handling Cumberland's current or projected future biosolids production.

The Comox Valley Regional District (CVRD) operates a composting facility to process biosolids from its Brent Road WWTF and produces a Class A biosolids compost which is marketed as "Skyrocket". This facility has process capacity ten times the biosolids volume that Cumberland will produce and has excess capacity to take Cumberland's production on a fee for service basis. It is also located just 3 km away from the (CVRD operated) Cumberland Landfill.

It represents the simplest processing option available, and the reuse is then part of the CVRD reuse strategy. Accordingly, this option has been adopted as the Cumberland biosolids strategy and a servicing agreement has been developed between Cumberland and the CVRD. Cumberland will provide transport to the CVRD facility.

12.2.2. Septage Management

The main village area of Cumberland is served by the sanitary collection system but there are some outlying areas of both residential and commercial properties that use on-site wastewater systems. Collectively, these represent less than 10% of the occupied property parcels in Cumberland and some of the areas, such as Bevan Road industrial area, will eventually be connected to the collection system. Permitting for the onsite systems is through Island health and management and pumping out is the responsibility of the property owners and is not actively managed by the Village of Cumberland.

Septage removal service to properties on septic is provided by local haulage contractors with septage disposal to the CVRD facility at Brent Road in Comox (25 km away), which has a dedicated septage receiving station and charges the haulage contractors on a fee for service basis.

In the past, the Cumberland wastewater facility occasionally accepted septage from the Comox Lake Campground (operated by the Village of Cumberland) but this caused grease and odour problems and was discontinued in 2018. Cumberland does not currently accept any septage and this is not part of the planned upgrades.

Cumberland operated an (unmanned) RV sani-dump facility from 2020 to 2024. It was found that this facility was used by more than just visiting RV's, being used for disposal of construction porta-potty waste and unauthorized septage disposal from "off-grid" houses. It was determined that this station and the

holding tank chemicals used in RV's and commercial portable toilets was causing Cumberland to fail effluent toxicity tests. The station was closed in spring of 2024 and Cumberland has not failed an effluent toxicity test since then. It is not planned to re-open the sani dump. However, Cumberland may choose to review the feasibility and possible re-opening of this station after the completion of the wastewater treatment upgrades.

12.3. ENERGY RECOVERY

In general, the treatment of wastewater and biosolids creates opportunities for energy recovery. These opportunities include heat recovery from the wastewater/effluent streams and combustion of gas produced by anaerobic digestion or a gasification plant for heating and/or generation of electrical power. The implementation of these options depends on factors including the size of the treatment facilities, treatment efficiency, and the location of potential heat/energy users in relation to the plant.

Energy recovery was conceptually considered during Stage 2. There is insufficient biosolids volume for any standard technology (e.g. anaerobic digestion) energy recovery. But there is potential for heat recovery from the effluent water. In winter, the lagoons lose heat through their large surface area and there is no recoverable resource. But in summer, the lagoons act as a large passive solar collector and gain heat, with effluent water being up to ten degrees Celsius warmer than influent.

There is no space heating demand in summer, but one potential customer is the adjacent Island Health hospital laundry facility, which is a large year-round heat consumer and is also the single largest water user in Cumberland. It is a state-of-the art facility in terms of water and heat efficiency. The concept was that warm effluent could be used to "pre-warm" the incoming potable water supply through a passive counterflow heat exchanger, without needing mechanical heat pumps to raise temperature differentials and thus reduce natural gas usage (in summer). But on studying the concept with Island Health, it was determined that the existing internal post-wash heat recovery is already doing this function, such that pre-warming would not achieve any energy saving. For the laundry to be able to use any heat, it would need to be as "hot" water and this would require commercial scale heat pumps to achieve these temperatures. There are no other nearby users of heat during summer so the heat recovery option for offsite users was abandoned.

During the design process, consideration was given to energy recovery from the mechanical blowers. The conversion of the aeration system from aspirating surface aerators to diffused subsurface aeration, powered by remote blowers, meant that there will be a 100 hp blower operating at any given time. The blowers were initially specified as stand-alone outside units in weatherproof enclosures. But they generate significant heat from both the electric motor and the heat of compression, and this represents a recoverable heat resource. On consideration that space heating is needed in the main process tent (for freeze protection) a design decision was made to relocate the blowers to inside the main process tent. In this way, the generated heat is passively released into the tent, offsetting cold weather heating loads and in mild conditions, eliminating them entirely. This represents a good example of incorporating resource recovery thinking into the design process.

The blower heat recovery is the only meaningful resource recovery project that could be incorporated into the upgrade project. However, possibilities for on and offsite use of reclaimed water and recovered heat should be revisited in the future as economic and environmental conditions might change and new opportunities might arise.

13. Plan Monitoring Committee

Following completion of the LWMP process, the Plan Monitoring Committee will be formed to monitor implementation of the LWMP. The committee will consist of the Manager of Public Works and a member or members of the Village Council and will serve after the plan has received approval from the Minister.

The Plan Monitoring Committee should set the scope of work which will be developed after the plan has been approved and will aid in plan implementation, monitoring, and provide on-going advice to Village council and staff. Monitoring is critical to the long-term success of the LWMP. Establishing timelines for deliverables and conducting assessment activities for determining the effectiveness of specific actions will ensure that Cumberland receives high value for their commitment to the LWMP planning process.

The Committee will also consider, based on the REMP results, if any of the Adaptive Management Strategies need to be implemented (Appendix P).

14.Recommendations

The following recommendations are based on the findings of the Stage 3 LWMP:

- Submit the Stage 3 LWMP report to Village Council for review and adoption. The council resolution is provided in Appendix P.
- Forward the Stage 3 LWMP report to BC ENV for review and final approval of the Village of Cumberland LWMP.

The following are recommendations for additional work or studies in the post-LWMP period that would complement the LWMP.

- Continue with combined sewer separation program with the objective being to achieve 100% separation by 2045, or earlier. Pursue all grant funding opportunities to assist with this.
- Complete the updates to the storm drainage and sewer master plans in 2025 and update storm drainage and sewer bylaws and enforcement policy, if necessary. Specific attention to be given to the storm bylaw for encouragement and enforcement for property owners in newly separated storm/sanitary areas to make connections to the new storm system.
- Develop and implement the Fats, Oils, and Grease (FOG) Bylaw to improve the wastewater source control and compatibility for treatment at the WWTF.
- Develop an educational program for the public and private sector with a focus on source control of contaminated dischargers to the sanitary sewer (and storm drain) systems.
- Identify other sources of I/I, develop a repair program, and update an asset management plan of the collection system.
- Implement the required parcel taxes to fund the LWMP program. Update the Wastewater DCC rate and bylaw to include future payment of the loans for the treatment upgrades.
- Establish a composite sampling program of the WWTF influent and lagoon wastewater to verify contaminant loading and removal rates. Formulate and define sampling protocols.
- Implement the enhanced Receiving Environment Monitoring Program (REMP) to assess the cumulative effects of the future effluent discharges into the receiving environment. Refer to Appendix O for REMP details.

The Council's resolution accepting LWMP recommendations is provided in Appendix P.

References

Village of Cumberland, Official Community Plan, 2014 (VoC, OCP 2014)

Village of Cumberland, Housing Needs Report, 2024 (VoC, HNR, 2024)

Village of Cumberland Stage 2 LWMP Report, July, 2018 (VoC Stage 2 2018)

BC MOE, Interim Guidelines for Developing Liquid Waste Management Plans ,2011 (BC MOE 2011)

BC MOE, Environmental Management Act, Municipal Wastewater Regulation, BC Reg. 129/99, 2012 (MWR, 2012).

Wastewater Systems Effluent Regulation, 2015 (WSER, 2015).AECOM (2015), Sewage Treatment Plant Odour Control Upgrade Drawings, for City of Revelstoke.

BC Organic Matter Recycling Regulation – BC Reg. 18/2002 (BC MOE, 2002).

Metcalf & Eddy. Wastewater Engineering: Treatment and Resource Recovery, (M&E, 2014).

EPA Design Manual EPA/625/1-86/021 – Municipal Wastewater Disinfection, United States Environmental Protection Agency (USEPA), 1986, (USEPA, 1986).

Metcalf & Eddy. Wastewater Engineering – Treatment, Disposal and Reuse, 3rd Edition, McGraw-Hill Publishing Company, 1991 (M&E, 1991).

Metcalf & Eddy. Wastewater Engineering – Treatment and Reuse, 4th Edition, McGraw-Hill Publishing Company, 2003 (M&E, 2003).

Design Guidelines for Wastewater Systems – British Columbia Region, Department of Indian Affairs and Northern Development Canada, Indian and Northern Affairs Canada, 2008 (INAC, 2008).

Handbook - Septage Treatment and Disposal, (EPA, 1984).

APPENDIX A
STAGE 3 WASTEWATER ADVISORY COMMITTEE MEETING MINUTES (MTGS 18-21)

Corporation of the
Village of Cumberland

2673 Dunsmuir Avenue
P.O. Box 340
Cumberland, BC V0R 1S0
Telephone: 250-336-2291
Fax: 250-336-2321
cumberland.ca

File No. 0540-20

Liquid Waste Management Plan
Wastewater Advisory Committee
Minutes of
Meeting #18
Wednesday, October 9, 2024, 2 pm to 4 pm
Council Chambers

Invitees

Name	**Representing**	**Present?**
Matt Ishoy	Chair, Public member at Large	Y
Ken Barth	Public member at large	Y
Mike Tymchuk	Public member at large, Alternate	Y
Chris Thomason	Public member at large (new)	Y
Brian Beaudry	Public member at large (new)	Y
Sean Sullivan	Alternate Council Representative	-
Neil Borecky	Alternate Council Representative	-
Troy Therrien	Alternate Council Representative	-
Rob Crisfield	Director of Operations	Y
Paul Nash	LWMP Project Coordinator	Y
Copied on correspondence		
K'omoks First Nation		
BC Ministry of Municipal Affairs		
BC Ministry of Environment and Climate Change		

Item, Time	**Description**	**Owner**
18.1	• Call to Order, Approval of Agenda Meeting called to order at 1pm Agenda approved	Chair
18.2	• Introductions of new members The two new members – Chris Thomason and Brian Beaudry introduced themselves, followed by a round table of introductions from the returning members	Chair

18.3	• Review of LWMP Process and Objectives Paul took the committee through items 18.3 to 18.6 with a powerpoint presentation	Paul
18.4	Review of progress, events since meeting #17 in Sep 2018	Paul
18.5	Review of current Wastewater Project • Technical Aspects • Progress • Setbacks	Paul
18.6	Objectives and process for Stage 3 LWMP • Major items • Items where WAC has input • Process from here	Paul

18.7	Wrap up • Round table /any other issues Discussion and Q&A from the members. Questions of note: Q. Is there any opportunity for the WAC to participate in the First Nations Consultation, given some members have experience in this? A. The FN consultation is primarily between the Village of Cumberland and the FN's, and happens at a staff-to staff level and sometimes Council to Council. The WAC is Cumberland's public process which is in parallel with the FN consultation, but not part of it. K'omoks First Nation always has a standing invitation to attend WAC meetings, but that is a case of them participating in the public process. Q. What has been the total cost of the LWMP process to date, and expected for completion– is this something that should be part of the final report? A. The cost to carry out the process is not a part of the final LWMP report. IF the WAC wants to see the final cost of the process, a request can be made to the Village to provide that information. An appropriate time for the information to be presented would be the last WAC meeting of this stage 3 process. Q. Has there been any investigation into the characteristics of the wastewater coming into the system from the hospital laundry? Studies elsewhere have shown they can contribute phosphorus and have unusual contaminants present. Are there any rules to regulate "trade waste" coming into the system A. There has not been a specific study of the water coming in from the laundry. It is known that they switched to phosphate free detergents over a decade ago. A monitoring program for the laundry and other commercial customers would be an option for the future LWMP Plan Monitoring Committee. There are some rules regulating incoming commercial wastewater – The provincial Municipal Wastewater Regulation has some rules regarding non-domestic wastewater Cumberland has a Source Control bylaw and this will be updated as part of the Stage 3 LWMP. A technical report on this topic – source control and the laundry - will be brought back to a future WAC meeting for discussion • Next Meeting Discussion that future meetings preferably for Thursdays, and a start time of 1pm. A meeting date was not set, to be advised by the • Adjournment Meeting adjourned at 4pm	Chair
	Public Q&A – there were no members of the public present for Q&A	Chair

Corporation of the
Village of Cumberland

2673 Dunsmuir Avenue
P.O. Box 340
Cumberland, BC V0R 1S0
Telephone: 250-336-2291
Fax: 250-336-2321
cumberland.ca

File No. 0540-20

Liquid Waste Management Plan
Wastewater Advisory Committee
Minutes, Meeting #19
Thursday, November 14, 2024, 1 pm to 3 pm
Council Chambers

Invitees

Name	**Representing**	**Present?**
Matt Ishoy	Chair, Public member at Large	Y
Ken Barth	Public member at large	Y
Mike Tymchuk	Public member at large, Alternate Chair	N
Chris Thomason	Public member at large (new)	N
Brian Beaudry	Public member at large (new)	Y
Sean Sullivan	Alternate Council Representative	N
Neil Borecky	Alternate Council Representative	N
Troy Therrien	Alternate Council Representative	Y
Rob Crisfield	Director of Operations	Y
Paul Nash	LWMP Project Coordinator	Y
Copied on correspondence		
K'omoks First Nation		
BC Ministry of Municipal Affairs		
Vancouver Island Health		
BC Ministry of Environment and Climate Change		

Item, Time	**Description**	**Owner**
19.1	Call to Order, Approval of Agenda, any items of new business to be added Meeting called to order at 1pm, Agenda approved (M:KB, S:BB)	Chair
19.2	Review of minutes of meeting #18, 9 October Minutes approved (M:TT, S:BB)	Chair

19.3	Update on Stage 3 process and timelines. ***Completion & Submission now planned for 31 March, 2025*** See attached Report to Council - LWMP Update 28 October, 2024	Paul
19.4	Content of Stage 3 Report • Review of MoE requirements from Stage 2 review (see attached letter). • Technical requirements for Operational Certificate submission. Noted in discussion that the technical requirements for the Operational Certificate are much more detailed than what is required for the Stage 3 LWMP report, so the OC submission is dependent upon a completed, detailed, engineering design.	Paul
19.5	Explanation of Enhanced EIS being conducted by EcoFish Paul showed the EIS presentation given by Ecofish to K'omoks First Nation on Nov 8. In discussion, it was noted that: • This EIS includes extensive study on the wetland area that will be receiving the treated water. • The Ministry has asked for study and nutrient budgets for both phosphorus and nitrogen, with a view to identifying whether a nitrogen criteria is required for the effluent. loading . There had not been any discussion in past years about a nitrogen criteria. • The EIS also includes study on some trace contaminants that are not currently regulated, and some of which originate from stormwater, not wastewater.	Paul

19.6	Considerations for future study • An updated Source Control Bylaw to include Hospital laundry and other commercial users. • Consideration of a tour of the laundry for the WAC (and to incorporate this with a future lagoon site tour) Others – Stormwater separation and servicing. In discussion, it was noted that: • While Cumberland has serviced numerous combined sewer areas with storm sewer, this does not mean that all properties now serviced have disconnected roof and/or perimeter drains from sanitary to storm sewer. • Having the properties complete the connection is an important part of the overall plan to reduce wet weather wastewater flows • There is a bylaw mechanism for enforcement of this, but there has been no administrative tracking of which properties have and have not connected. • Creating a system to manage and monitor this is an area of future work for Cumberland and the LWMP Plan Monitoring Committee.	Paul
19.7 **2:30 – 2:45**	Wrap up • New business – A site tour of the lagoon site for the WAC was suggested, as new members have never seen it for existing members the last tour was four years ago. Agreed that this will happen on the day of the next WAC meeting, with a start at site at midday, and then the WAC meeting at 1:30. Cumberland will contact the laundry to arrange a tour there, ideally for the same day. • Next Meeting – To be Thursday 30th January • Adjournment – meeting adjourned at 3pm.	Chair
2:45 – 3:00	Public Q&A - – there were no members of the public present for Q&A	Chair

Attachments:

- Report to Council – LWMP update 28 October 2024
- WAC meeting #19 Powerpoint presentation
- Ecofish EIS Presentation

Corporation of the
Village of Cumberland

2673 Dunsmuir Avenue
P.O. Box 340
Cumberland, BC V0R 1S0
Telephone: 250-336-2291
Fax: 250-336-2321
cumberland.ca

File No. 0540-20

Liquid Waste Management Plan
Wastewater Advisory Committee
Minutes,
Meeting #20
Thursday, 30 Jan, 2025, 1 pm to 3 pm
Council Chambers

Invitees

Name	**Representing**	**Present?**
Matt Ishoy	Chair, Public member at Large	Y
Ken Barth	Public member at large	Y
Mike Tymchuk	Public member at large, Alternate	Y
Chris Thomason	Public member at large (new)	Y
Brian Beaudry	Public member at large (new)	N
Sean Sullivan	Alternate Council Representative	N
Neil Borecky	Alternate Council Representative	N
Troy Therrien	Alternate Council Representative	Y
Rob Crisfield	Director of Operations	Y
Paul Nash	LWMP Project Coordinator	Y
Copied on correspondence		
K'omoks First Nation		
BC Ministry of Municipal Affairs		
Vancouver Island Health		
BC Ministry of Environment and Climate Change		

Site Tour. A site tour was held for the WAC members and Cumberland staff of the Island Health Hospital Laundry facility adjacent to the wastewater lagoons. This facility is the single largest wastewater contributor and so is of special interest to the committee. The facility has a state of the art laundry system that recycles water and heat to industry leading standards, and has used phosphate-free detergents for the last decade. As a result, it contributes wastewater that is warm and relatively "clean", adding only a small biological load to the system.

Item, Time	Description	Owner
20.1	Call to Order, Approval of Agenda, any items of new business to be added. Meeting called to order at 1:30pm, Agenda approved	Chair
20.2	Review of minutes of meeting #19, November 14, 2024 Noted that a review of LWMP costs to be included for a future meeting	Chair
20.3	Update on Stage 3 process and timelines. Remaining events Public Open House – Tues February 25th, 4:45 – 7pm Presentation of capital plan WAC meeting #21 Thursday, March 6, 1pm - Stage 3 Report Submission plan Draft submission to MoE for March 21 Cumberland Council review 5 May Final submission to MoE 16 May	Paul
20.4	Content of Stage 3 Report • Simplified Stage 3 report TOC was presented	Paul
20.5	Update on EIS –preliminary results An overview of the EIS results was presented. Main Question - "What is the impact of the ***proposed*** discharge on the receiving environment and downstream users?" The "proposed discharge" is the tertiary treated effluent from the upgraded works, and will be much higher quality than the current discharge: • Reduced phosphorus loadings and high-quality disinfection • Improved downstream fish habitat conditions compared to today • Improved water quality in the Trent River for potential further use by others • Potential for some metals (e.g. copper) to increase as Village grows • Post-upgrade monitoring to confirm if no further treatment is required.	Paul

20.6	Storm-Sanitary Sewer Separation Plan
	• Review of draft plan and capital cost
	• 14 different projects in downtown area
	• Estimated capital cost of $12M to complete
	• Adding in $3M of other infiltration reduction works leads to $15M total
	• Cr Therrien provided a quick estimate of $450 per house per year to pay for this over 20 years
	• Discussion about the environmental benefits – if any – of completing the separation program sooner (5yrs) rather than later (20yrs)
	  ○ The treatment project as being built provides environmental protection against peak wet weather flows with the Excess Wet Weather Flow Disinfection system
	  ○ Completing the separation will not reduce the peak wet weather flows to below 7200m/3day – the threshold to eliminate the EWWF system.
	  ○ There is a minor reduction in operating costs in the order of $10-20k per year from an earlier completion
	MOTION: "In consideration that Cumberland is already paying to implement treatment works to mitigate the environmental effects of high wet weather flows, the WAC proposes that:
	• The implementation of the storm-sanitary separation program be spread out of over the 20-year period of the LWMP,
	• The Village pursue both project implementation efficiencies (combining with other works as appropriate) and future grant funding opportunities to reduce the financial burden on the Village residents."
	Moved: Michael Tymchuk
	Seconded: Matt Ishoy
	CARRIED Unanimously
		Paul

20.7	Review of Storm and Sanitary Sewer connection bylaws. • Postponed until next meeting	Paul
20.8	Wrap up • ***Next Meeting – March 6*** Adjournment	Chair

Corporation of the
Village of Cumberland

2673 Dunsmuir Avenue
P.O. Box 340
Cumberland, BC V0R 1S0
Telephone: 250-336-2291
Fax: 250-336-2321
cumberland.ca

File No. 0540-20

Liquid Waste Management Plan
Wastewater Advisory Committee
Minutes,
Meeting #21
Thursday, March 6, 2025, 1 pm to 4 pm
Council Chambers

Invitees

Name	**Representing**
Matt Ishoy	Chair, Public member at Large
Ken Barth	Public member at large
Mike Tymchuk	Public member at large, Alternate Chair
Chris Thomason	Public member at large (new)
Brian Beaudry	Public member at large (new)
Sean Sullivan	Alternate Council Representative
Neil Borecky	Alternate Council Representative
Troy Therrien	Alternate Council Representative
Rob Crisfield	VC Director of Operations
Jason Wallace	VoC Manager of Projects
Paul Nash	LWMP Project Coordinator
Colleen Dane	Public engagement coordinator (Zinc Communications)
Copied on correspondence	
K'omoks First Nation	
BC Ministry of Municipal Affairs	
Vancouver Island Health	
BC Ministry of Environment and Climate Change	

Item	**Description**	**Owner**
21.1	**Call to Order, Approval of Agenda, any items of new business to be added** Call to order at 1pm, Agenda was adopted	Chair

<table>
<tr><td>21.2</td><td>Review of minutes of meeting #20, January 30,2025

Ken Barth noted that the LWMP cost history, as requested at Meeting #20, and presented at the Feb 25 open house, was not as detailed as he had intended it to be. In discussion it was noted by Cr Therrien that council would look for a full project cost reconciliation at the end of the LWMP process, expected be the end of 2025.</td><td>Chair</td></tr>
<tr><td>21.3</td><td>Update on Stage 3 process and timelines.

<table><tr><td>March 21</td><td>Submit draft Stage 3 report to MoE</td></tr><tr><td>Late April</td><td>Received feedback from MoE, finalize report</td></tr><tr><td>May 5</td><td>Cumberland Council approval</td></tr><tr><td>16 May</td><td>Submit final Stage LWMP report to MoE</td></tr><tr><td>End of 2025</td><td>Expected date for approval by Minister</td></tr></table>Cr Therrien asked if the Village should be meeting with the Minister of Environment at UBCM in September, about the LWMP? In discussion on this point it was noted that the LWMP would be in the hands of Ministry technical staff at that time, who have already said that the Cumberland LWMP will be the top processing priority once received. So there is likely little that the Minister could do to speed the process along. However, that does not mean there is no value in a meeting, so Cumberland Councillors should take a meeting with the Minister if they can get one.</td><td>Paul</td></tr>
<tr><td>21.4</td><td>Content of Stage 3 Report

• Updated community growth projections (from updated OCP)
• Wastewater Treatment Plan & Budget (current upgrade project)
• Environmental Impact Study of upgraded treatment on receiving water creek
• Updated Stormwater Master Plan
• Updated Source Control bylaw (trade waste policy)
• Inflow & Infiltration Reduction plan (including storm-sanitary separation plan)
• Financing plan for near future works – the storm sanitary separation program
  • Borrowing bylaw – might become a “parcel tax” bylaw
• Summary of public and First Nation consultation</td><td>Paul</td></tr>
</table>

21.5	**Review of public Open House Feb 25** • Overview of presentation Paul ran through the presentation from the Open House • Feedback on Storm- Sanitary separation program Colleen summarized the public feedback as; • Noting that collectively, it is a large tax increase • generally supportive of the least costly separation plan option – all tax and assuming 50% grants. • The representative from Fanny Bay Oysters expressed a desire for the project – especially the disinfection – to be brought online as soon as possible, and that the storm-sanitary separation program be implemented as fast as possible.	
21.6	**Storm-Sanitary Sewer Separation Plan** The overview of the financial plan was reviewed, noting some minor cost changes for loan repayment compared to the presentation at the Open House. In discussion about the timing of the implementation, it was noted that; • There is little environmental benefit from an expedited implementation, as the upgrade works will achieve environmental protection against high wet weather flows • Construction costs seem to rise faster than inflation, so doing the works earlier would be cheaper overall • A longer timeframe for implementation allows more cost to be spread onto future residents, and also to pursue more grant funding opportunities • A longer timeframe should not be taken to mean the program is of lesser importance, it is purely intended to be a means of reducing cost burden on existing taxpayers In discussion about funding the works, it was noted that: • While there is a reduced tax burden with the "all tax, no borrowing" option, a decision on how to fund the works is really for Council and Staff, not the WAC. The WAC's purview is that the program must funded, one way or another, but need not be accelerated • The issue of a large LWMP borrowing commitment reducing Cumberland's ability to borrow for other projects is also a question. For Council and staff, not the WAC. • While the prospect of 50% grant funding results in a reduced tax burden, there is no guarantee of securing any level of grant funding. It was generally agreed in discussion that it is better to start by taxing for the full amount, and if any grant funding is received it can either reduce future tax burdens or accelerate the completion of the program. • The current wastewater fee structure is largely a flat fee for all users, regardless of actual use (production) of wastewater. Some	Paul

municipalities use flat fee fees, others have fee structures based partially or fully on water usage. Where usage fees are involved, there can be accommodations for winter vs summer use (e.g wastewater usage fees are based on winter potable water use only) and special rate structures for unusual water users. It is rare to do explicit metering of wastewater except for large commercial users. In some cases there is "credit metering" of potable water use, such as metering of irrigation to allow deductions from overall potable water use to determine actual wastewater generation. Any usage-based fee system needs to consider these sorts of variables to avoid undesirable or inequitable results.

Recommendation #1

In consideration that Cumberland is already implementing advanced treatment works to mitigate the environmental effects of high wet weather flows, the WAC proposes;

On the ***timing*** of the program, that:

1. Cumberland commit to 100% completion of the Storm-Sanitary Separation Program within the 20 year period of the LWMP.
2. It be recognized that there is limited environmental value in an accelerated implementation of the separation plan
3. It also be recognized that the further the works are pushed into the future, the more likely it is that costs will increase.

On the ***funding*** of the program, that:

1. Council should decide the question of whether the program should be paid for directly by (parcel) tax, borrowing or a combination of both.
2. The financial plan should be based a full cost contribution – assuming no grant funding.
3. The Village pursue both project implementation efficiencies and future grant funding opportunities to reduce the financial burden on the Village residents.

Moved: Michael Tymchuk

Seconded: Brian Beaudry

CARRIED unanimously

Recommendation #2

In consideration of the large increase in wastewater costs (from the LWMP works program), the WAC recommends that the Village review the wastewater user fee and parcel tax structure with a view to a cost distribution based in part or whole on usage.

Moved: Matt Ishoy

Seconded: Chris Thomason

21.7	**Review of Storm and Sanitary Sewer connection bylaws.** • How do they work for when existing houses are newly serviced by separated sewers? • Are any updates suggested by the WAC? **Recommendation #3** In recognition that installing the separated sewers in and of itself does not achieve the full benefits until the newly separated users connect to the storm system, the committee recommends that: • The Village take a pro-active approach to ensuring that newly separated properties connect to the storm system, in accordance with the Stormwater system bylaw (1024) • There be ongoing efforts to ensure compliance with the Stormwater bylaw (1024) Moved: Michael Tymchuk Seconded: Chris Thomason CARRIED Unanimously	Paul
21.8	**Wrap up** There was a round of thanks and appreciation to all the members for their volunteer service. In particular to Matt Ishoy, Michael Tymchuk and Ken Barth, who are all original members from WAC meeting #1 in 2016. Even though this was the last official meeting of the WAC, the members requested to be kept informed of progress/developments, as appropriate. It was also requested that there be a site tour for the WAC in summer, when there has been substantial progress on construction Adjournment -4pm	Chair
	Public Q&A – there were no members of the public present.	Chair

APPENDIX B
MOE STAGE 2 LWMP APPROVAL LETTER

February 1, 2021 Authorization Number: 76780-30/VCUM

VIA EMAIL: rcrisfield@cumberland.ca; tvassos@aquadoc.ca

Village of Cumberland
2673 Dunsmir Avenue
PO Box 340
Cumberland, BC V0R 1S0

Dear Rob Crisfield, Manager of Operations for Village of Cumberland

Re: Review of Village of Cumberland Liquid Waste Management Plan – Stage 2 Report

Thank you for submitting "*Village of Cumberland Stage 2 Liquid Waste Management Plan*" report, dated July 19, 2018.

Staff reviewed the Stage 2 report and concluded that it satisfies the requirements for a Stage 2 Liquid Waste Management Plan (LWMP) report and is consistent with "*Interim Guidelines for the Preparation of Liquid Waste Management Plans*", July 2011. Therefore, I am pleased to advise you that the Village of Cumberland Stage 2 LWMP report is approved by the Director.

Please proceed with the Stage 3 LWMP report taking into consideration the following recommendations:

1. Update information to reflect current conditions at the wastewater treatment facility;
2. Continue public consultation and local First Nation engagement. Consolidate all efforts into final reports;
3. Be specific about the "Plan Area" and provide a site plan showing the current area affected by LWMP and areas of potential growth;
4. Discuss cumulative environmental impacts of all discharges in the area;
5. Expand on the Source Control Program and Inflow and Infiltration Reduction Program. Ensure all components of Section 5.5 and 5.8 of the LWMP interim guidelines are addressed.
6. Discuss existing water patterns characterized by sector and expand on options for volume reduction (i.e. reduction of sewage flows into the WWTP).
7. Identify control measures for combined sewer overflows system in addition to separating combined sewer systems to manage peak flows;

8. Expand on non-point source pollution to include if urban and agricultural runoff are concerns;
9. Submit an updated Stormwater Management Plan;
10. Commit to future action of expanding on how integrated resource recovery technologies and practices are being evaluated in relations to upgrading the treatment facility;
11. Update costs to reflect approved grant funding and Class B Estimates as defined in the LWMP interim guidance;
12. Commit to creating a Plan Monitoring Committee, and to monitor the implementation commitments of any Minister approved LWMP. A meeting schedule should be developed with a future target for a LWMP review within a 10 year horizon.

As you have progressed to Stage 3 of the LWMP process, you must submit an application for an Operational Certificate. This application will trigger a preliminary application meeting where requirements for a detailed environmental impact study will be discussed. The EIS must be completed prior to completing Stage 3. Operational Certificate application forms can be located at the following site:

Guidance, Forms & Fees for Waste Authorizations - Province of British Columbia (gov.bc.ca)

Please note that an operational certificate will be developed to align with MWR requirements.

If there are any questions, Kristina Moseley will be your contact going forward at 778.622.6887 or by email to kristina.moseley@gov.bc.ca.

Yours truly,

Liz Archibald
For Director, *Environmental Management Act*
Authorizations South – Municipal Liquid Waste

APPENDIX C
CONSENT ORDER

BRITISH COLUMBIA

Environmental Appeal Board

Fourth Floor, 747 Fort Street
Victoria BC V8W 3E9
Telephone: (250) 387-3464
Facsimile: (250) 356-9923

Mailing Address:
PO Box 9425 Stn Prov Govt
Victoria BC V8W 9V1

Website: www.eab.gov.bc.ca
Email: eabinfo@gov.bc.ca

Decision No. 2019-EMA-014(a)

ENVIRONMENTAL APPEAL BOARD
IN THE MATTER OF THE *ENVIRONMENTAL MANAGEMENT ACT*
S.B.C. 2003, C. 53

BETWEEN:

THE CORPORATION OF THE VILLAGE OF CUMBERLAND

APPELLANT

AND:

DELEGATE OF THE DIRECTOR,
ENVIRONMENTAL MANAGEMENT ACT

RESPONDENT

CONSENT ORDER

The Ministry of Environment and Climate Change Strategy (ENV) acknowledges that the Village of Cumberland in a show of willingness to comply with sections 1.1.2, 1.1.3, 1.1.4 of permit 197 commits to submitting a final application for registration under the Municipal Wastewater Regulation or a Stage 3 Liquid Waste Management Plan Report and construction of authorized works for their wastewater discharge by December 31, 2024.

As per Chapter 4, Section 4.0 of the ENV Compliance and Enforcement Policy and Procedure and including but not limited to Section 7 of the Administrative Penalties (*Environmental Management Act*) Regulation, ENV will use the above information as a factor taken into consideration of future compliance assessments and enforcement actions.

ON THE APPLICATION of the parties, without a hearing and by consent:

THE BOARD ORDERS under section 17(2) of the *Administrative Tribunals Act*, S.B.C. 2004, c. 45, that the Appellant's Appeal No. 2019-EMA-014 of the July 18, 2019 $85,800 administrative penalty (the "Penalty") for non-compliance with its permit to discharge treated effluent (the "Permit") is dismissed on the following terms, which represent an agreement between the parties under section 115(4) of the *Environmental Management Act*:

1. The Appellant shall within four (4) weeks of the entry of this order pay $15,000 to the Minister of Finance representing a portion of the Penalty;

2. The Appellant shall apply $40,000 representing the remaining portion of the Penalty to complete the Authorized Works as that term is defined in the Permit;

3. If the registration under the Municipal Wastewater Regulation or an Operational Certificate under an approved Liquid Waste Management Plan is not complete by December 31, 2025, unless any delay beyond that date is affected by a material change in circumstances not caused or contributed to by the appellant, $40,000 shall forthwith be paid to the Minister of Finance;

4. If the registration under the Municipal Wastewater Regulation or an Operational Certificate under an approved Liquid Waste management Plan is delayed beyond December 31, 2025 and that delay is affected by a material change in circumstances not caused or contributed to by the appellant, the appellant may seek to vary the completion date set out in paragraph (3) of this Order to a date no later than December 31, 2026 by application to the Director, *Environmental Management Act*, no later than November 1, 2025. The Director, *Environmental Management Act*, will vary the completion date set out in paragraph (3) of this Order as requested, provided the requirements of this paragraph have been met. The Director, *Environmental Management Act*, will provide a response before December 31, 2025. For certainty, the Parties expressly agree that the appellant's appeal is dismissed and that a new right of appeal will exist in respect of the decision from the Director, *Environmental Management Act*'s decision, if the director concludes that the appellant has not performed the terms and conditions of this agreement and that the $40,000 sum described in paragraph 3 is payable, or the completion date will not be varied, or both; and

5. Each party shall bear their own costs.

THE FOLLOWING PARTIES APPROVE THE FORM OF THIS ORDER AND CONSENT TO EACH OF THE ORDERS NOTED ABOVE ON THIS 18th DAY OF SEPTEMBER, 2020:

Signature of James Yardley
Lawyer for **The Corporation of the Village of Cumberland**

Signature of Stephen E. King Lawyer for the
DIRECTOR

Darrell LeHouillier, Chair
Environmental Appeal Board

APPENDIX D
ENGAGEMENT SUMMARY

Village of Cumberland
Liquid Waste Management Plan

Stage 3 Engagement Report



Prepared by
ZINC Communications Strategies
for the Village of Cumberland
March 11, 2025

Table of Contents

EXECUTIVE SUMMARY 2

1. INTRODUCTION 3

1.1 Project Background 3

2. ENGAGEMENT OVERVIEW 4

2.1 Overview 4

2.2 Objectives 4

2.3 Approach 5

2.4 Engagement Tools 6

2.5 By the Numbers 6

3. ENGAGEMENT RESULTS 7

3.1 Event Feedback 7

4. FIRST NATIONS ENGAGEMENT 10

4.1 K'ómoks First Nation 10

4.2 Regional First Nations 12

5. CONCLUSION 12

APPENDICES 13

EXECUTIVE SUMMARY

In July 2024, the Village of Cumberland activated Stage 3 of the Liquid Waste Management Plan, restarting engagement on the long-term planning project which began in 2016.

As public engagement is a requirement of the Liquid Waste Management Plan process, Stage 3 engagement followed up on processes established throughout the earlier stages. This included ongoing engagement with primary audiences – the public, wastewater lagoon neighbours, Village Council, staff, local media, and a re-established Wastewater Advisory Committee.

The engagement included critical First Nations engagement with outreach to K'ómoks First Nation as the traditional keepers of the land. Outreach also included regional First Nations, as identified by the Province, who have expressed interest in Baynes Sound.

The engagement process is based on the International Association of Public Participation (IAP2) spectrum of public participation at the INFORM to INVOLVE levels. The engagement plan also incorporated recommendations contained within the Ministry of Environment's Interim Guidelines for Preparing Liquid Waste Management Plans.

Stage 3 engagement involved the following key tools:

- **Advisory Committee**: A Wastewater Advisory Committee was set up with members of the public and Council to provide overview, comment and direction on the LWMP process. Meeting minutes and key presentations are available to the public after the meeting and shared on the Engage Comox Valley website.
- **Online Information Hub:** Engagecomoxvalley.ca/cumberland-lwmp was designated as the core consultation hub, with input encouraged to be submitted through the feedback functions.
- **Information Sessions:** Four public sessions were hosted in the Village Council chambers to allow for public information and input.
- **Online Presentation:** To meet the needs of those who wanted guided learning and additional information– but who were unable to attend an in-person event – a recording of the information sessions are posted on YouTube and shared on the Engage Comox Valley website.

1. INTRODUCTION

1.1 Project Background

Improving the Village of Cumberland's wastewater management has been a high priority for the community. There is a clear need for further treatment on a system that was first established in 1910 and expanded in 1968.

In 2016, the Village started a Liquid Waste Management Plan (LWMP). Over two years, it completed Stages 1 and 2, submitting them to the Province in 2018. Liquid Waste Management Plans are a requirement of the provincial government. They support local governments in B.C. in the development of sewer services. The plan involves gathering data, creating options for future services, identifying a preferred option, public engagement and conducting necessary studies, financial and implementation plans. Once submitted, the Province reviews the Plan and considers approval.

The Stage 1 and 2 processes included careful planning and community input to develop a sustainable treatment system in a region with unique challenges which include high winter wet weather flows, extremely dry summer conditions and a sensitive downstream habitat.

It identified a path forward for improvements to the Village's wastewater treatment lagoon system to meet provincial standards, fulfill environmental goals to remove human-caused toxins, restore degraded ecosystems and release safe water into Maple Lake Creek and the Trent River, which flows into Baynes Sound. The result of this – the Wastewater Upgrades Project – is now underway.

With the treatment improvements in progress, it became time for Stage 3 of the Cumberland LWMP to move forward. This stage focusses on 'wrapping up' the intensive planning work of earlier stages: reporting back to the community about the plan, completing the environmental impact study, and finalizing the operational certificate process for wastewater management into the future.

2. ENGAGEMENT OVERVIEW

2.1 Overview

The LWMP is critical to the long-term health of the sewer system and protection of the environment. The decisions made in the LWMP process will affect Cumberland residents through increases to sewer fees or tax rates and construction disruption. This impact requires authentic engagement to allow community input on liquid waste planning.

The LWMP strategy had three key steps for engaging the public. First, the launch re-started the work and raised community awareness. Second, an educational update informed the community further and invited input on priorities. Finally, the results of the upcoming work were shared, along with potential costs, for final feedback.

2.2 Objectives

The International Association of Public Participation (IAP2) spectrum of public participation was used to define the engagement goals for this project.



	INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
PUBLIC PARTICIPATION GOAL	To provide the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunities, and/or solutions.	To obtain public feedback on analysis, alternatives, and/or decisions.	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.	To partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution.	To place final decision-making in the hands of the public

Engagement for the LWMP is currently in Stage 3 and includes the following objectives:

- **INFORM** community members about the proposed approach, evaluation and how engagement in earlier stages influenced the outcomes.
- **INFORM** residents about the LWMP costs and implementation schedule.
- **CONSULT** residents about decisions to collect any comment regarding final components, for consideration if/where possible.
- **INVOLVE** K'ómoks First Nation in the Operational Plan and the design of wetland enhancement and stream relocation.
- **INFORM** First Nations about the LWMP process, status of work, implications for the receiving environment.
- Invite First Nations to **CONSULT**, creating opportunities to provide feedback if desired.

The following pages provide information on engagement objectives, tools and results.

2.3 Approach

The following engagement steps took place from July 2024 to March 2025:

- **Step 1 - Kick off and Advisory Committee Activation/Recruitment (Summer 2024):** In July, the Village relaunched the LWMP process, advising the community of upcoming work and updating them with information on the work completed to date.

  The kick off also included the activation/recruitment of the advisory committee members. The Village started by asking advisory committee members from Stages 1 and 2 to return and found three returning members who were willing to participate. A wider recruitment campaign (including press release, ads, e-newsletter) generated two new participants.

- **Step 2 - Update and Priorities (Fall 2024):** While the advisory committee gets underway, a media release, social media and community information were distributed in September 2024 announcing the creation of an information hub and inviting the public to the first of two open house events. The events focused on informing the public of the process to date, the work that is being done on the wastewater lagoons, and next steps. The presentation is recorded and posted to the hub for those that couldn't attend.

- **Step 3 - Outcomes and Cost (Winter 2025):** When more detail about stormwater separation costs are available, a second round of open houses are held in February 2025 to inform the public of the advisory committee's progress, the Environmental Impact Study, the stormwater separation timing and potential costs, as well as the plan's next steps.

  Two engagement questions on the stormwater separation as well as general feedback are posed and posted to the Engage Comox Valley site. The meeting is well advertised, and the presentation is recorded and posted to the hub for those unable to attend.

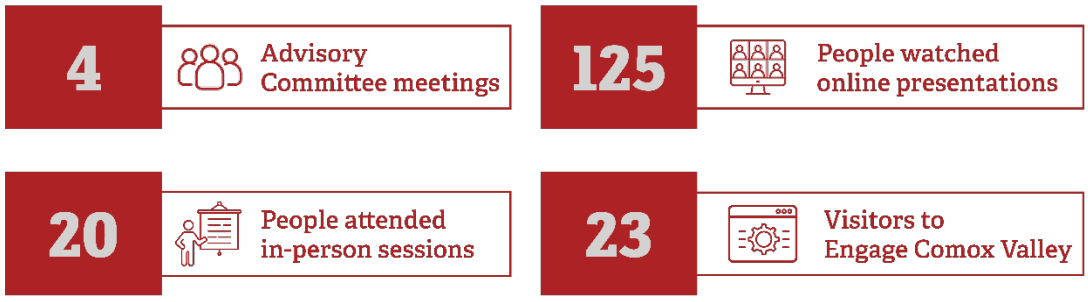
2.4 Engagement Tools

The overall success of the engagement was a result of the blend of tools used to promote engagement, inform and encourage participation.



2.5 By the Numbers

The numbers below highlight the resulting engagement that took place over the seven-month engagement timeframe:



3. ENGAGEMENT RESULTS

While several tools were used to invite participation and input, nearly all the feedback received on the Stage 3 Engagement was collected during four open house events (two back-to-back meetings in September 2024 and February 2025) and through the Wastewater Advisory Committee.

3.1 Event Feedback

September 2024 Engagement Events

The September open house events featured a presentation and an opportunity to learn about the status of the project, ask questions and provide input. Ten people attended the September events, in addition to the project team members.

The themes of the feedback focussed on three key issues:

- The status of the work yet to be done, rising costs and future asset management
- Questions about system impact and operations, including its effect on Maple Lake, nutrient load in waterways, reed bed function and maintenance, and past smell and noise disruptions in nearby communities

In addition, the there were two specific community questions, in the following areas:

- Sani-dump reopening
- Impact of Island Health laundry on the overall system

Table 1. September 2024 Open House Feedback Summary

FEEDBACK / QUESTIONS
• Impact of potential discharge on Baynes Sound shellfish farms
• Discussion on work needed to complete separation of storm and sewer
• Discussion on whether the system is connected to Maple Lake
• Discussion on costs rising and whether other communities are facing the same issues
• Interest in seeing stormwater repurposed
• Discussion on reed bed and how it is maintained
• Discussion on nutrient load in Maple Lake Creek
• Interest in having sani-dump reopened when project complete, with discussion about pros/cons, challenges to managing, overuse by people outside of community etc.
• Discussion on lifecycle of mechanical equipment
• Overview of asset management plan and planning for next replacement
• Discussion on Island health laundry facility and questions about issues it could be causing

February 2025 Engagement Events

In February 2025, 10 participants attended two open house events. The project team provided a project update and asked for feedback on the following two questions:

Q1 Stormwater Separation: As a part of the Liquid Waste Management Plan, the Village of Cumberland's Wastewater Treatment Plant is designed to manage large winter water flows.

We are also committed to meeting provincial storm water separation requirements, at an estimated total cost of $12 million. This commitment could cost Cumberland households $165 to $534 annually for 20 years, depending on available grant funding and payment options.

Borrowing to begin the work sooner will cost Cumberland taxpayers more ($267 to $534 a year) over the length of the plan. However, if the stormwater separation work takes place over 20 years, this work could then be paid through taxation (at an estimated cost of $165 to $330 a year) while allowing the Village more time to seek grants and additional funding.

Please share your feedback about stormwater separation timing and payment options.

Q2 Liquid Waste Management Plan: The Village is approaching completion of their long-term waste management plan as outlined in the presentation. Please share any final thoughts or comments about the plan.

The feedback themes focused on the two key issues, above as well as the impact of timing and potential discharge on the Baynes Sound shellfish farms.

In summary, the public feedback was:

- Generally in favour of implementing stormwater separation over time, lowering homeowner costs as the Village seeks additional grants and funding sources.
- Some pressure to speed the work along, in hopes of minimizing impact to downstream shellfish farmers.
- In addition, there was some conversation of how to incentivize water conservation and wastewater production – by setting future usage rates against water use, vs. a flat rate.

Table 2. February 2025 Open House Feedback Summary

FEEDBACK / QUESTIONS
• Impact of potential discharge on Baynes Sound shellfish farms, specifically: a. Concern for the impact of discharge on operation of Baynes Sound shellfish farms along with discussion around Cumberland being one of many treatment systems that release liquid waste into Baynes Sound. The LWMP work is being done to make sure Cumberland does not contribute to contamination. b. Understanding that many external factors complicate shellfish operations making it difficult to sustain operations, including shellfish testing rules and border regulations. c. Desire to move up start date of treatment operations. d. Discussion on how often the system might be overwhelmed, once operational. e. Request to expedite stormwater separation to minimize potential impact - the cost of borrowing is seen as negligible compared to economic costs of shut down. f. Request to time discharge when currents go North (out of Baynes Sound) vs. South
• Discussion on stormwater separation options and reasons for borrowing
• Conversation around the effect of borrowing on Cumberland's ability to pay for and manage large projects in the future.
• Discussion on how operational and maintenance costs are distributed once system is in place (per use vs. flat rate per parcel)
• Online question clarifying the buildings / streets requiring separation and a request to buy Canadian.

Wastewater Advisory Committee

Five community members signed up for the Wastewater Advisory Committee, with three returning from the Stage 1 and 2 committee, and two new participants joining for Stage 3. The advisory committee also had council representation and staff on hand to support discussion.

Between July 2024-March 2025, the group met four times to:

- Review LWMP progress
- Set objectives and process for the Stage 3 approach
- Review technical documentation including environmental impact studies
- Attend public open houses to hear feedback from the public
- Make recommendations to council re: sanitary/stormwater separation and fee structures
- Tour the wastewater treatment lagoons and Island Health laundry facility.

There was interest from the committee on a few specific topics:

- The LWMP process and the impact of inflation on the construction costs
- Commercial user impacts on the wastewater system (i.e.: Island Health Laundry facility)
- Encouraging Village homeowners in newly storm-separated areas to connect roof and perimeter drains to storm sewers from sanitary

Overall, the Wastewater Advisory Committee was an active and thoughtful group who took time to review and consider the detail presented to them. This insight and knowledge formed the basis for their recommendations presented to Council for their guidance and consideration moving forward.

4. FIRST NATIONS ENGAGEMENT

A critical component of the LWMP process is ensuring outreach and consultation with First Nations who have expressed interest in the wastewater system, its impacts and potential outcomes of the planning process. To achieve these goals, Cumberland created processes for the K'ómoks First Nation, and for regional Nations who have expressed interest in Baynes Sound.

4.1 K'ómoks First Nation

Engagement with K'ómoks First Nation on wastewater planning is part of ongoing dialogue with the Nation, primarily at the staff-to-staff level. A conditional letter of support is available in Appendix 8.

In November 2024, the Village project team hosted K'ómoks Nation representatives for a site tour at the wastewater treatment facility, followed by an overview of the work underway on facility upgrades and the ongoing planning for long-term wastewater management.

In addition, K'ómoks was copied on all advisory committee correspondence and invited to participate throughout the process. The major consultation events with K'ómoks First Nation for all three engagement stages are summarized below.

Table 3. K'ómoks First Nation Consultation Events (2016-2025)

DATE	EVENT
May 2016 - June 2018	• Stage 1 and 2 Liquid Waste Management Plan process. The Nation was an invited committee member and copied on all meeting agendas and minutes.
Aug 2016	• Cumberland Wastewater Advisory Committee Meeting. Address by Chief Robert Everson, highlighting concerns about protection of Baynes Sound
June 2019	• Cumberland presentation to Chief and Council. Nation re-iterated concern about disinfection and aquaculture protection, particularly from human pathogens
Nov 2019	• Follow up technical memo on peracetic acid disinfection
April 2022	• Preparation for presentation to Chief and Council in May. Technical memo on selected chlorine dioxide disinfection system
May 2022	• Project presentation to Chief and Council. Follow up request by KFN for a third-party review of chlorine dioxide

Nov & Dec 2022	• Third party reviews completed and submitted to K'ómoks
April 2023	• Letter from (new) Chief and Council giving conditional support for the project and the use of chlorine dioxide, provided the Nation is involved in the development of operational procedures
April 2023	• Acknowledgment letter from Cumberland and agreement to involve the Nation in development of operational programs
Feb 2024	• Sharing Project Memo #37 summarizing the project and its construction status
Feb 2024	• Sharing background reading list of project description documents for new Council
Mar 2024	• In-person presentation to Chief and Council about the project, specifically the change to UV disinfection
Nov 2024	• Site tour for Nation Councillors and presentation on project progress and EIS work

Consultation with K'ómoks is ongoing, with further meetings planned in April or May 2025 to discuss the operating plan for the facility, per the April 2023 letter.

Key feedback from K'ómoks included:

- Downstream water quality in the Trent River should not be degraded as the Nation may wish to extract water in the future.
- The Trent River is important to the critical habitat of the K'ómoks estuary
- Ongoing participation by the Nation is preferred as systems move into operations
- Future monitoring on the efficacy of the treatment system will be necessary

To continue the collaborative work with K'ómoks First Nation, the Village will continue to engage with K'ómoks representatives after completion of the facility, including:

- Involve K'ómoks in the Operational Plan development
- Involve Stream Guardians in the wetland enhancement design and stream relocation works
- Provide quarterly environmental monitoring reports
- Invite K'ómoks to be part of the upcoming Plan Monitoring Committee

4.2 Regional First Nations

The Province of BC provided a list of First Nations who should be invited to consult on Stage 3 of the LWMP. That list included:

- Wei Wai Kum Nation
- We Wai Kai Nation
- Homalco First Nation
- Qualicum First Nation
- Tla'amin Nation
- NanwakolasCouncil
- Mamalilikulla First Nation
- Tlowitsis Nation

The Village reached out to each of the Nations three times during the process:

- In July 2024, a letter was sent (email/hard copy) to each, inviting participation and offering a meeting to provide overview and collect input on the LWMP process. A backgrounder was included with those letters.
- In late August/early September 2024, phone calls were made to each Nation, following up on the letter and offering to share further information or allocate time to support them in engagement. Following this outreach, two Nations confirmed they did not need to receive further information on the Cumberland LWMP.
- In October, a letter was sent (email/hard copy) to the remaining Nations on the list, again inviting participation, questions and feedback

The Village remains open and responsive to First Nations and will share information as requested on the wastewater planning process and treatment improvements underway.

5. CONCLUSION

Wastewater planning has been a continuing conversation in Cumberland since first stages of the LWMP were initiated in 2016, with various levels of activity. The ongoing process can make it challenging to sustain public participation in a formal planning or engagement process – particularly around wastewater which can face limited public interest.

However, the return of three Wastewater Advisory Committee members, and two new members, has provided thoughtful insight and engagement on the process as a whole.

Four public open house events were supported with active promotion, using local media, online advertising, and e-newsletters to reach Cumberland residents in their home community. In addition, 145 people either watched an online presentation or attended an in-person open house event.

Specific engagement with the K'ómoks First Nation provided clear understanding of the Nation's interests and a path forward for further involvement. Cumberland continues to be open to sharing information with regional Nations about the planning process and treatment improvements.

The resulting comments about the timing and costs of stormwater separation, ongoing costs and impact on the surrounding waterways should see interest in ongoing operations, and participation in the Plan Monitoring Committee as the project moves forward.

APPENDICES

Appendix 1 – Engagement Brief

Appendix 2: Event Display Boards

Appendix 3 – News Release sample

Appendix 4 – Advertisement Samples

Appendix 5 – E- Bulletin Sample

Appendix 6 – Wastewater Upgrades Project Newsletters (2)

Appendix 7 – Engage Comox Valley Page

Appendix 8 – Letter of Conditional Support from the K'ómoks First Nation

Appendix 9 – Letters to the K'ómoks First Nation (2)

Appendix 10 – Regional First Nation Letter Samples (2)

Appendix 11 – Wastewater Backgrounder

DISCUSSION DRAFT

VILLAGE OF CUMBERLAND: STAGE 3 LIQUID WASTE MANAGEMENT PLAN
COMMUNICATIONS/ENGAGEMENT PLAN – JUNE 2024

1. OVERVIEW

The Village of Cumberland is seeking to complete Stage 3 of their Liquid Waste Management Plan, with completion required before the end of 2024.

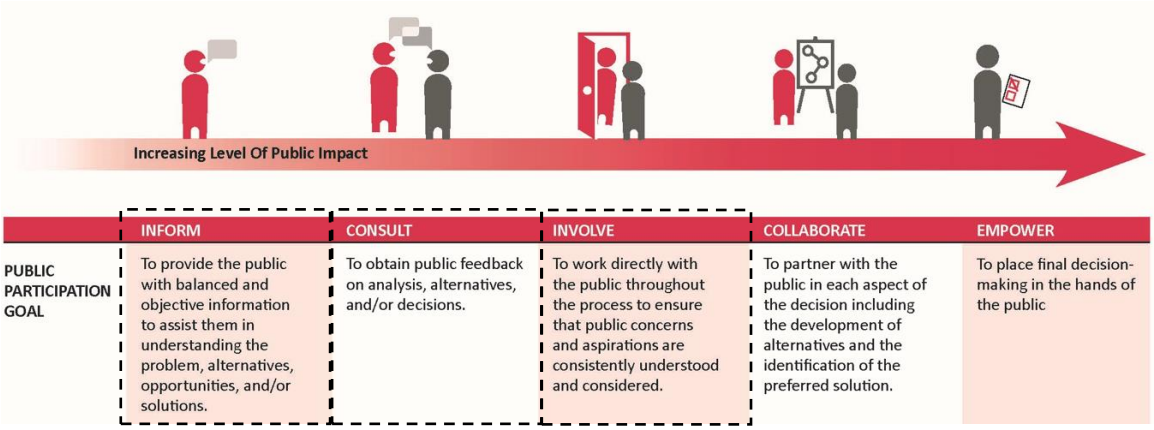
The LWMP process restarted in 2016, and a combined Stage 1 and 2 report was submitted to the Province in July 2018. Since then, the Village has focused on delivering required upgrades to the village's Wastewater Treatment Lagoons. This included the completion of a referendum in October 2018 to approve borrowing for the project, and subsequent grant funding awards have allowed the project scope to encompass not just the minimum upgrades needed for Permit compliance, but also to meet the expected requirements of the future LWMP Operational Certificate

Construction of the Wastewater Upgrades Project is now underway, and the Province is seeking the completion of the Liquid Waste Management Plan.

With the treatment project already underway, the primary focus of Stage 3 is on evaluation of options/measures for stormwater management and the storm/sanitary sewer separation program, development of operational and environmental monitoring plans, as well as summarizing the LWMP process, financing and implementation schedule.

2. LEVEL OF PUBLIC ENGAGEMENT

The public engagement plan is based on the International Association of Public Participation (IAP2)'s spectrum. It is proposed that the goals of this engagement are to INFORM and CONSULT (highlighted in circled boxes below).



	INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
PUBLIC PARTICIPATION GOAL	To provide the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunities, and/or solutions.	To obtain public feedback on analysis, alternatives, and/or decisions.	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.	To partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution.	To place final decision-making in the hands of the public

This level reflects that the bulk of the planning and analysis has now been complete and there are limited opportunities for public input to change outcome here. There has been extensive public engagement and consultation about wastewater management and future plans for the Village though earlier stages of the LWMP, and as a result of the progress of the Wastewater Upgrades Project (including ongoing community updates and extensive outreach supporting a referendum in 2022).

Focus at this stage will be on the best practice of 'closing the loop' on engagement, and collecting final comments for consideration.

3. GOALS

- **INFORM** community members about the proposed approach, evaluation and how engagement in earlier stages influenced the outcomes.
- **INFORM** residents about the cost and implementation schedule of the measures included in the LWMP
- **CONSULT** residents about decisions to collect any comment regarding final components, for consideration if/where possible.
- **INVOLVE** K'ómoks First Nation in the Operational Plan and the design of wetland enhancement and stream relocation.
- **INFORM** First Nations about the LWMP process, current status of work, implications for the receiving environment.
- Invite First Nations to **CONSULT**, creating opportunities to provide feedback if desired.

4. APPROACH

Residents in the Village of Cumberland are familiar with hearing about upgrades and planning for their wastewater system, as this has been a primary focus of infrastructure improvement in recent years. This familiarity includes borrowing-approval processes in 2018 and 2024, and ongoing communications (via newsletters, website, open houses) about the Wastewater Upgrades Project.

To engage the public on Stage 3 of the LWMP process, the Village will:

- Ensure that timely, accurate information is available for consideration.
- Summarize and publish the engagement activities done since Stage 2
- Look to well-established communications tools used by the Village, with particular focus on those that have been successful on other wastewater engagement efforts
- Plan for active outreach events to occur in September – not during the summer – to encourage participation.
- Re-engage the Technical/Public Advisory Committee on the Stage 3 components to share outcomes and ask for comment.
- Use a variety of tools to share information and collect feedback to ensure accessibility to the process from the community.
- Develop a specific outreach approach for First Nations that informs of process, reasons for interest and invites direction on preferred method/level of consultation.

5. KEY AUDIENCES

INTERESTED/ IMPACTED PARTIES	• Cumberland ratepayers/community members • Wastewater Lagoon Neighbours • Technical/Public Advisory Committee members • Village Council • Local Media

FIRST NATIONS	• K'omoks First Nation • Wei Wai Kum Nation • We Wai Kai Nation • Homalco First Nation • Qualicum First Nation • Tla'amin Nation • Nanwakolas Council • Mamalilikulla First Nation • Tlowitsis Nation

6. FIRST NATIONS ENGAGEMENT

Engaging with the region's First Nations will be an important part of this stage of engagement, and requires a separate, and distinct, process from the engagement of the general community's update. Because Cumberland's wastewater treatment process ultimately releases into Baynes Sound, there are a number of First Nations who have interest both historical and current in the area.

K'ómoks First Nation

The Village of Cumberland is in ongoing communication with the K'ómoks First Nation, and has provided updates and opportunities for input prior to and during the Wastewater Upgrades Project, including commitments to involve them in the development of operational procedures and downstream environmental monitoring. To engage with K'ómoks for Stage 3 of the LWMP, the Village will:

- Continue to provide quarterly project construction progress updates (started in Q1, 2024)
- Provide a written update about the process and current stage of LWMP development
- Bring forward the Stage 3 updates to the agenda of upcoming government-to-government meetings already established
- Offer resources to support consultation should K'ómoks want to participate
- Host a tour of the works in summer 2024
- Involve with the development of the Operational Plan
- Consult on review of the Environmental Impact Study (EIS) and development of the downstream monitoring program
- Involve Stream Guardians with design of wetland enhancement and stream relocation works
- Invite to be part of future Plan Monitoring Committee

Regional First Nations

The province has provided a list of First Nations who should also be invited to consultation on Stage 3 of the LWMP. To inform these Nations of the work and current opportunity for input, the Village will:

- Provide a written update about the process, current stage of development and consultation opportunity, including a review of the EIS
- Offer to host a meeting or visit to make a presentation, and provide other opportunities to provide additional input.
- Follow up on initial outreach with a second invitation, should no response be received initially.

The Village will remain open and responsive to First Nations, providing information as and how requested by Nations who want to participate in the consultation process. The outreach will be led by the Village's lead contact for First Nations relations.

7. COMMUNICATION TOOLS

Community Engagement

- Webpage
- Press Release (key milestones)
- Email Notices
- Backgrounder/FAQs
- Open House Events with feedback opportunity
- PAC/TAC Meeting
- Promotional advertising for events
- E-newsletters
- Feedback Forms: Online + Hard Copy

K'omoks First Nation Engagement

- Letter 1: Update on LWMP process, current stage, consultation opportunity
- Site tour
- EIS review
- Involvement in working group on Operational Plan, Environmental monitoring and wetlands/stream relocation
- Government to government meetings if/as requested

Regional First Nations Engagement

- Letter 1: Update on LWMP process, current stage, consultation opportunity
- Backgrounder
- Meetings/Workshop Sessions if requested
- Letter 2: Follow up if no response received
- Other materials as requested, needed

8. ENGAGEMENT OBJECTIVES + TOOLS – BY PHASE

The focus of engagement during Stage 3 of the LWMP will be in September in order to receive feedback in time to collate/submit with the draft report to the province. In the summer period, the Village will focus on re-establishing information sources, reconnecting with those previously involved and preparing for the fall outreach schedule. See the below timeline with objectives and communications and engagement tools.

ENGAGEMENT ACTIVATION (MAY/JUNE)	
OBJECTIVES	Confirm engagement approach and timeline
	Review/update current LWMP materials
	'Launch' Stage 3 of engagement
COMMUNICATIONS + OUTREACH	Engagement Plan
	Work Plan
	Key Messages
	Web Content
	Email Notices

	Press Release
	Letter 1 and Backgrounder for First Nations Engagement
GROUNDWORK FOR ENGAGEMENT (JULY/AUG)	
OBJECTIVES	Begin outreach with First Nations
	Plan/create materials for engagement events
	Reconnect Public/technical Advisory Committee.
COMMUNICATIONS + OUTREACH	Event Planning and Promotion
	Informational Materials for events
	Email Notices
	PAC/TAC Outreach
	K'ómoks Site Tour and invite for participation in EIS review, operational plan and environmental monitoring.
	Meeting/Workshop with First Nations if requested
PUBLIC ENGAGEMENT EVENTS (SEPT)	
OBJECTIVES	Provide update to the community about the LWMP process and Stage 3
	Invite comment on the proposed measures and approach outlined in the draft LWMP
	Continue First Nations Engagement + Consultation
COMMUNICATIONS + OUTREACH	Event Delivery
	Feedback Form
	Event Promotion (continue)
	E-Newsletter
	PAC/TAC Outreach
	Continued K'ómoks consultation/involvement
	Meeting/Workshop with First Nations if requested
	Letter 2: First Nations if no response received
SUMMARIZE/REPORT BACK (OCT/NOV)	
OBJECTIVES	Collect/collate comment from the community
	Summarize input in engagement summary, to be attached to LWMP draft
	Continue/complete First Nations Engagement + Consultation
COMMUNICATIONS + OUTREACH	Meeting/Workshop with First Nations if requested
	What We Heard Report
	Press Release (Report/Wrap up)
	Wrap up Engagement Tools
	E-newsletter

9. TIMELINE

The below graphic maps out the high level of engagement steps over the timeline, with a start marking the most significant engagement windows.

	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Engagement Activation							
Groundwork for Engagement							
Community Engagement				★			
First Nations Engagement							
Summary Report							

The summary report will be included with the draft Stage 3 LWMP to be submitted to the Province on Nov. 1, 2024.

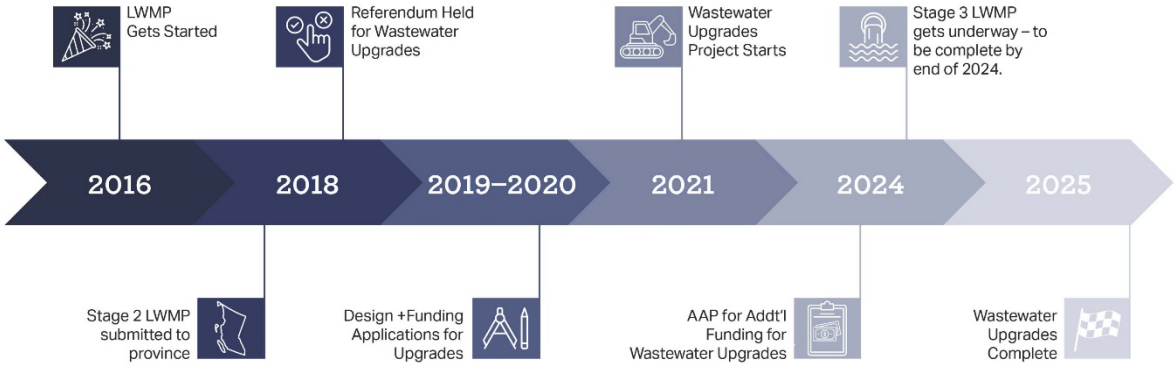
10. SUMMARY

The Village of Cumberland is committed to completing Stage 3 of their Liquid Waste Management Plan in 2024. To do so, a plan for engaging with the community – both the wider audience of the village residents as well as more specific interested/affected parties – is presented to give opportunity for input about the proposed plan, the process ahead and how feedback from earlier stages has been considered. Separate and specific approaches and tools are proposed for engaging with First Nations.

The engagement effort will be focused in the early fall, to give time for input and allow the project team to consider and summarize results to be submitted along with the LWMP draft.

Wastewater Timeline

The Village of Cumberland is preparing to complete the final piece of their Liquid Waste Management Plan (LWMP) – a plan that will guide wastewater management and required improvements for decades to come. It's been in the making for some time – see the below progress on wastewater planning in the Village.



THE VILLAGE OF CUMBERLAND

About Wastewater Planning

A Liquid Waste Management Plan is a major planning exercise for a local government. To learn more about the LWMP and next steps for the Village, here are some Frequently Asked Questions.

What is a LWMP and why is it needed?

Liquid Waste Management Plans allow municipalities to develop community-specific solutions for wastewater management that meet or exceed existing regulations. They are one of two regulatory pathways to authorize wastewater treatment systems and allow some flexibility in matching regulatory requirements to each municipality's situation.

What happens in Stage 3 of the LWMP?

Stage 3, the final stage of the LWMP, largely focuses on 'wrapping up' the intensive planning work of earlier stages: reporting back to the community about the plan ahead, completing the environmental impact study, and completing the operational certificate process for wastewater management into the future.

The work will also involve evaluating options/ measures for stormwater management and the storm/sanitary sewer separation program, developing operational and environmental monitoring plans, and summarizing the LWMP process, financing and implementation schedule.

What is the Wastewater Upgrades Project?

The Wastewater Upgrades Project will improve treatment provided by the current wastewater lagoon system. It is required to meet provincial treatment requirements and fulfill environmental goals to release safe water into Maple Lake Creek and Trent River. It will improve screening, add extra aeration and disinfection, among other improvements.

The project is a result of the Stage 1 and 2 Liquid Waste Management Plan process, and reflects community input to develop a sustainable treatment system in a region with unique challenges which include high winter wet weather flows, extremely dry summer conditions and a sensitive downstream habitat.

Work began in 2022 and is estimated to be complete in 2025.

For more information: **Cumberland.ca/wastewaterupgrades**

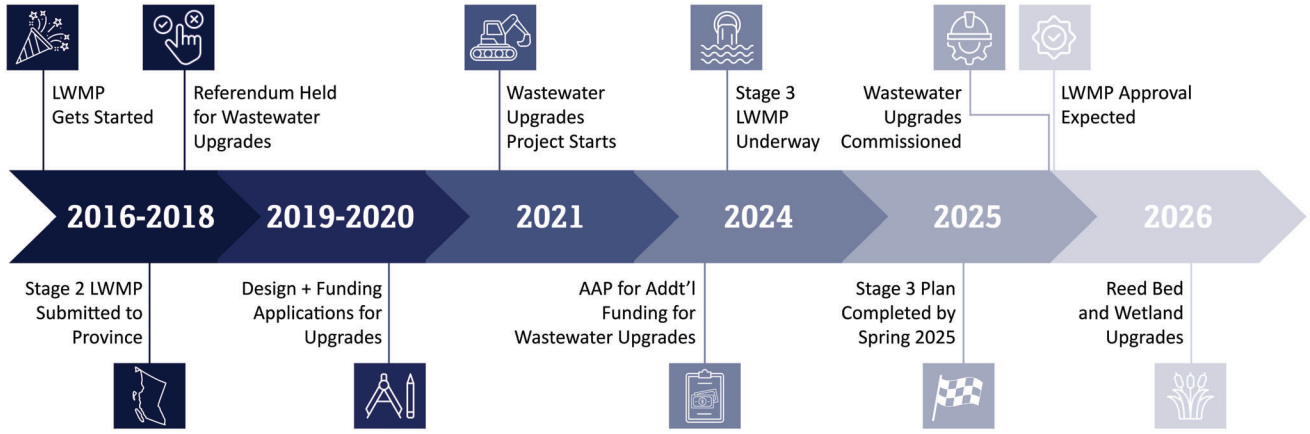
How do I get involved?

Share your Input Online: An online engagement page has been created for this stage of the LWMP. Residents can find the latest information and share comments/questions:
engagecomoxvalley.ca/cumberland-lwmp

THE VILLAGE OF CUMBERLAND

Wastewater Timeline

The Village of Cumberland is preparing to complete the final piece of their Liquid Waste Management Plan (LWMP) – a plan that will guide wastewater management and required improvements for decades to come. It's been in the making for some time – see the below progress on wastewater planning in the Village.



THE VILLAGE OF CUMBERLAND

About Wastewater Planning

A Liquid Waste Management Plan is a major planning exercise for a local government. To learn more about the LWMP and next steps for the Village, here are some Frequently Asked Questions.

What is a LWMP and why is it needed?

Liquid Waste Management Plans allow municipalities to develop community-specific solutions for wastewater management that meet or exceed existing regulations. They are one of two regulatory pathways to authorize wastewater treatment systems and allow some flexibility in matching regulatory requirements to each municipality's situation.

What happens in Stage 3 of the LWMP?

Stage 3, the final stage of the LWMP, largely focuses on 'wrapping up' the intensive planning work of earlier stages: reporting back to the community about the plan ahead, completing the environmental impact study, and completing the operational certificate process for wastewater management into the future.

The work will also involve evaluating options/measures for stormwater management and the storm/sanitary sewer separation program, developing operational and environmental monitoring plans, and summarizing the LWMP process, financing and implementation schedule.

What is the Wastewater Upgrades Project?

The Wastewater Upgrades Project will improve treatment provided by the current wastewater lagoon system. It is required to meet provincial treatment requirements and fulfill environmental goals to release safe water into Maple Lake Creek and Trent River. It will improve screening, add extra aeration and disinfection, among other improvements.

The project is a result of the Stage 1 and 2 Liquid Waste Management Plan process, and reflects community input to develop a sustainable treatment system in a region with unique challenges which include high winter wet weather flows, extremely dry summer conditions and a sensitive downstream habitat.

Work began in 2022 and is estimated to be complete in 2025. Reed bed and wetland upgrades will take place in 2026.

For more information: **Cumberland.ca/wastewaterupgrades**

How do I get involved?

Share your Input Online: An online engagement page has been created for this stage of the LWMP. Residents can find the latest information and share comments/questions: **engagecomoxvalley.ca/cumberland-lwmp**

THE VILLAGE OF CUMBERLAND

APPENDIX 3. NEWS RELEASE SAMPLE

Corporation of the Village of Cumberland

2673 Dunsmuir Avenue
P.O. Box 340
Cumberland, B.C V0R 1S0
Telephone: 250-336-2291
Fax: 250-336-2321
cumberland.ca

News Release
For immediate release
September 13, 2024

Village Kicks off Final Stage of Liquid Waste Management Plan

Cumberland, BC – The long-term plan for wastewater management in the Village is moving into its final stage this fall.

The Liquid Waste Management Plan (LWMP) – a long-term plan required by the Province of BC – was started originally in 2016 with Stages 1 and 2 completed and submitted in 2018. That plan mapped out critical next steps for the Wastewater Upgrade Project, and the Village turned its focus to the urgent and necessary improvements for the wastewater treatment lagoons.

With the Wastewater Upgrades project now well in hand, the Village is looping back to the final step in the LWMP process – Stage 3, to be completed by the end of 2024. Stage 3 is largely focused on 'wrapping up' the intensive planning work of earlier stages: reporting back to the community about the plan ahead, completing the environmental impact study, and completing the operational certificate process for wastewater management into the future.

"Wastewater treatment upgrades are a critical strategic goal for Council and we are so excited to invite the public back to provide their feedback on the latest design as we complete stage 3 of the LWMP process. Residents have been so supportive of our work on this and we are very much looking forward to seeing this project move toward our operational certificate from the Province," said Mayor Vickey Brown.

Cumberland residents are invited to learn more and offer their input by attending one of two information sessions being held on September 26, 2024. Both sessions will be held in Council Chambers and will cover the same material, including a presentation and Q&A session:

- Session #1: Sept. 26, 4:45pm – 5:45pm
- Session #2: Sept. 26, 6:00pm – 7:00pm

An online engagement page has also been created for this stage of the LWMP. Residents can find the latest information and share comments and questions at engagecomoxvalley.ca/cumberland-lwmp

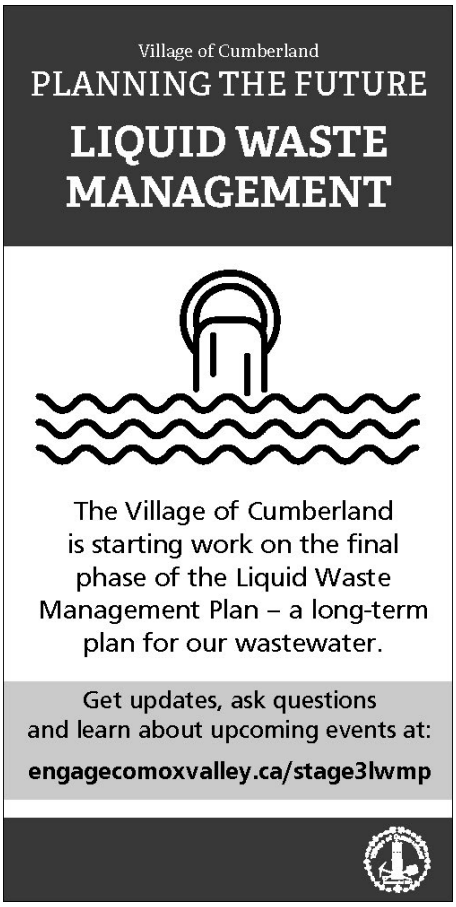
For more information about the ongoing wastewater upgrades project, please visit cumberland.ca/wastewaterupgrades

Media Contacts:
Mayor, Vickey Brown
250-218-0321
mayor.brown@cumberland.ca



The Liquid Waste Management Plan will map out how the Village of Cumberland will manage wastewater – including the completion of improvements at the Wastewater Treatment Facility shown here.

APPENDIX 4 - ADVERTISEMENT SAMPLES



Currently Cumberland, Aug. 2024

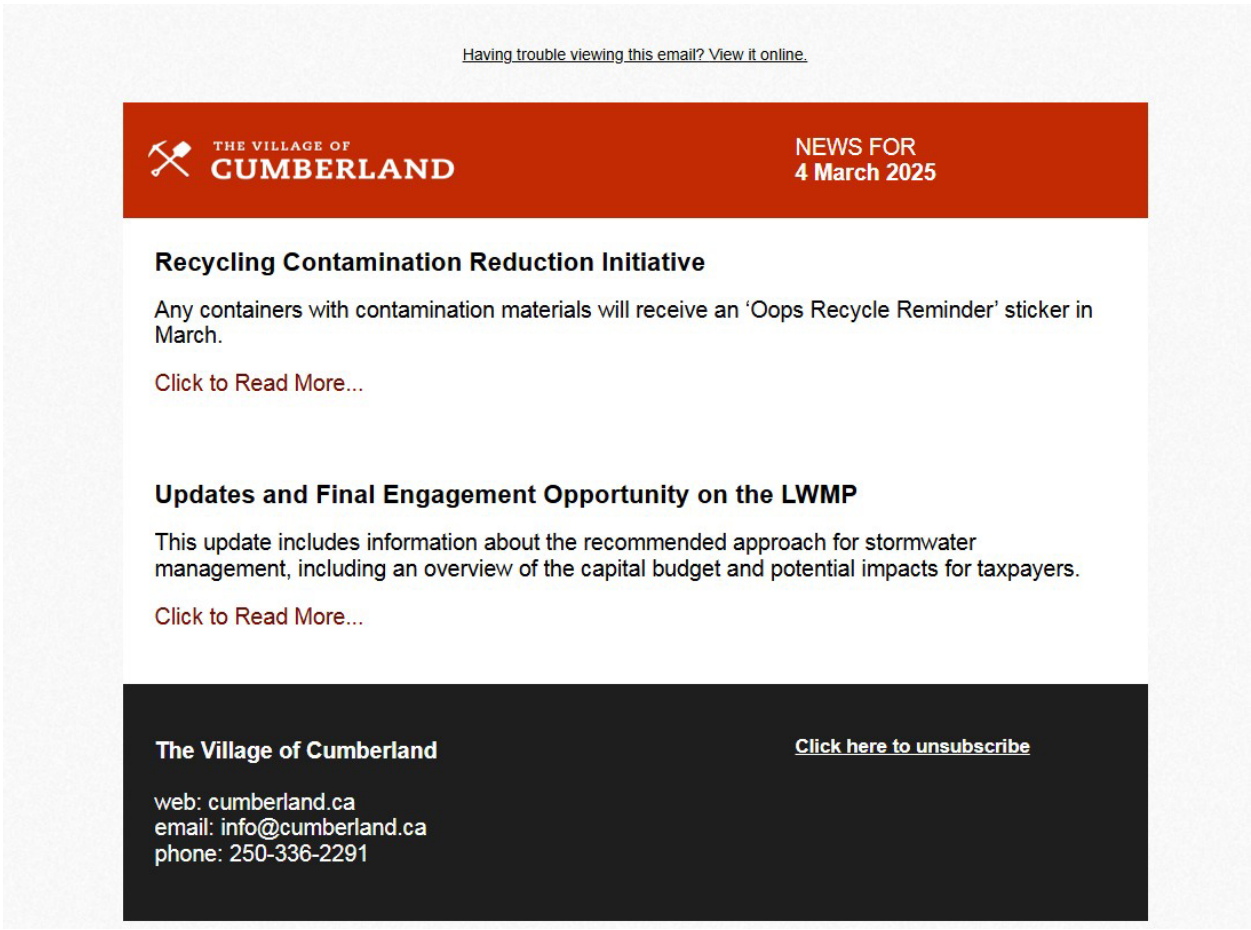


Currently Cumberland, November 2025



Currently Cumberland, January 2025

APPENDIX 5 – E- Bulletin Sample



Having trouble viewing this email? View it online.

THE VILLAGE OF CUMBERLAND

NEWS FOR
4 March 2025

Recycling Contamination Reduction Initiative

Any containers with contamination materials will receive an 'Oops Recycle Reminder' sticker in March.

Click to Read More...

Updates and Final Engagement Opportunity on the LWMP

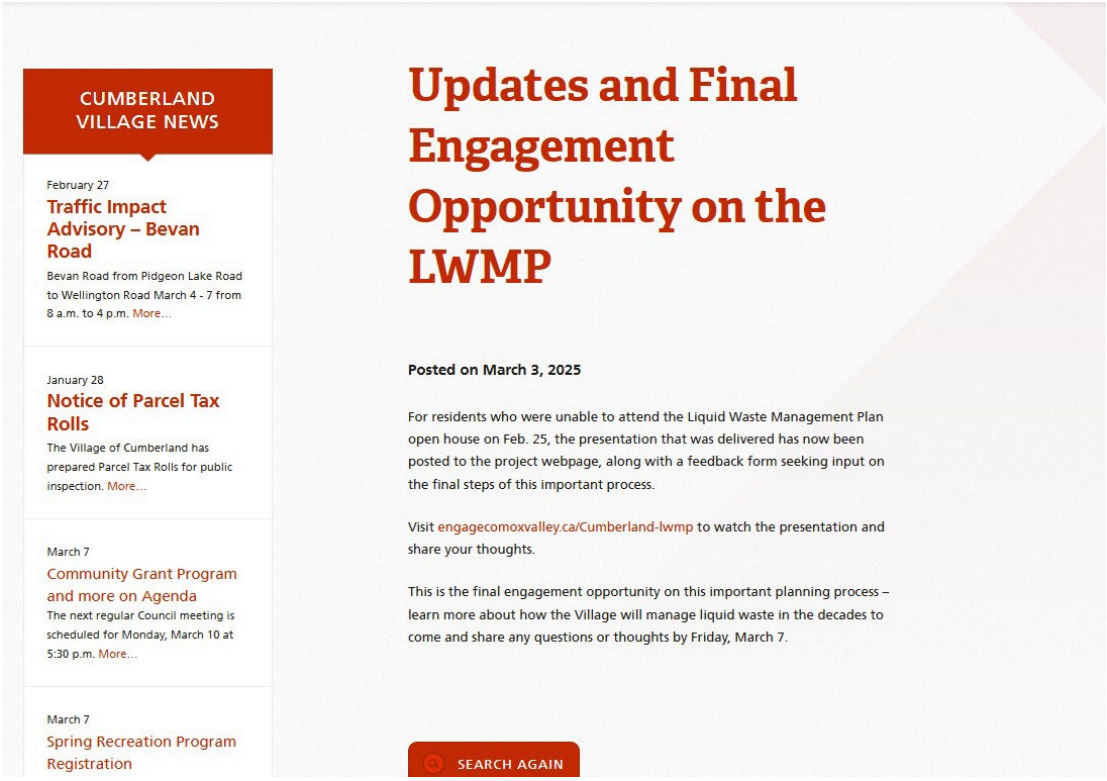
This update includes information about the recommended approach for stormwater management, including an overview of the capital budget and potential impacts for taxpayers.

Click to Read More...

The Village of Cumberland

web: cumberland.ca
email: info@cumberland.ca
phone: 250-336-2291

Click here to unsubscribe



CUMBERLAND VILLAGE NEWS

February 27
Traffic Impact Advisory – Bevan Road
Bevan Road from Pidgeon Lake Road to Wellington Road March 4 - 7 from 8 a.m. to 4 p.m. More...

January 28
Notice of Parcel Tax Rolls
The Village of Cumberland has prepared Parcel Tax Rolls for public inspection. More...

March 7
Community Grant Program and more on Agenda
The next regular Council meeting is scheduled for Monday, March 10 at 5:30 p.m. More...

March 7
Spring Recreation Program Registration

Updates and Final Engagement Opportunity on the LWMP

Posted on March 3, 2025

For residents who were unable to attend the Liquid Waste Management Plan open house on Feb. 25, the presentation that was delivered has now been posted to the project webpage, along with a feedback form seeking input on the final steps of this important process.

Visit engagecomoxvalley.ca/Cumberland-lwmp to watch the presentation and share your thoughts.

This is the final engagement opportunity on this important planning process – learn more about how the Village will manage liquid waste in the decades to come and share any questions or thoughts by Friday, March 7.

SEARCH AGAIN



CUMBERLAND
Wastewater Upgrades Newsletter

A quarterly update on Cumberland's high performance lagoon upgrade

ISSUE 7
AUGUST 2024

Hello from the Village of Cumberland's Wastewater Upgrades Project team. This is our sixth issue of our project update newsletter which will keep you informed on progress on this important infrastructure upgrade. For more information and ongoing updates, check out the website at cumberland.ca/wastewaterupgrades





The new operations/workshop building was built and installed by Cumberland-based Muchalat Construction.

BUILDING INSTALLATION MARKS KEY IMPROVEMENT FOR PROJECT

Work on Cumberland's Wastewater Upgrades Project is picking up speed as the project team prepares for the significant lagoon changes, after completing other key site improvements.

A key part of the improvements was recently completed with the installation of the new operations building at the site. The facility is a modular construction completed by Muchalat Construction, whose headquarters are just down the road from the treatment facility.

The building marks an important improvement for the facility, which has previously operated with no on-site operations centre and very limited storage. This will make it more feasible for the facility to be properly managed, given the additional treatment stages that will be added to the wastewater treatment system.

Following the approval of a revised budget and borrowing (see "Successful AAP" sidebar on Pg. 2), the project team is now ready to roll forward with the change to the lagoons and treatment systems. Work will continue to summer 2025.

The Wastewater Upgrades Project is required to meet provincial treatment requirements and fulfill goals to release safe water into Maple Lake Creek and Trent River. It will improve screening, add extra aeration and disinfection, among other improvements.

For more information about the Wastewater Upgrades Project, and the latest updates, visit Cumberland.ca/wastewaterupgrades

ESTIMATED SCHEDULE

Here's the most current milestone schedule for the coming year.

Winter 2023/2024

Building Construction

Late Summer 2024

Groundwork/Lagoon Work Reactivates

Summer 2025

Construction Completion

Fall 2025

Commissioning

Q4 2025

Project Completion

CUMBERLAND
Wastewater Upgrades Newsletter

ISSUE 7
AUGUST 2024





SUCCESSFUL AAP

In May/June 2024, the Village of Cumberland held an Alternate Approval Process to seek approval for additional borrowing to fund the increased project budget on the Wastewater Upgrades Project.

The AAP was successful, allowing the Village to proceed with borrowing an additional $2.5 million to cover the additional costs that have accumulated due to increased materials costs, unexpected site conditions, delays in detailed design and a partial re-design to build in climate resiliency.

Thank you to everyone who reviewed the information and considered their AAP response. A summary of the AAP process and information is available on the project website for review.

FINAL STAGE OF LWMP KICKING OFF

The long-term plan for wastewater management in the Village is moving into its final stage this fall.

The Liquid Waste Management Plan – a long-term plan required by the Province – was started originally in 2016 with Stages 1 and 2 completed and submitted in 2018. That plan maps out critical next steps for the Wastewater Upgrade Project, and the Village turned its focus to the urgent and necessary improvements for the wastewater treatment lagoons.

With that process now well in hand, the Village is looping back to the final step in the LWMP process – Stage 3, to be completed by the end of 2024. Stage 3 is largely focused on 'wrapping up' the intensive planning work of earlier stages: reporting back to the community about the plan ahead, completing environmental impact study, and completing the operational certificate process for wastewater management into the future.

We want you to participate too! Here's how you can get involved:

Join the Committee: The Advisory Committee created for Stage 1 & 2 will be re-established, but new members are welcome to join. We expect two meetings to be held in the fall to review the plan and provide feedback.

Attend an Infosession: Presentations will be given the evening of Sept. 26, 2024, in Council Chambers. Join us for an overview of the work completed and provide your feedback. Presentations at 4:45 p.m. and 6 p.m. in Council Chambers.

Share your Input Online: An online engagement page has been created for the project – join us there for the latest info and share comments/questions: engagecomoxvalley.ca/cumberland-lwmp

STAY IN TOUCH

This update is issued by the Village of Cumberland to keep the community informed about the Cumberland Wastewater Upgrade project.

To stay updated about the project's progress:

Cumberland.ca/wastewaterupgrades

wwt-upgrades@cumberland.ca



CUMBERLAND

Wastewater Upgrades Newsletter

An update on Cumberland's high performance lagoon upgrade

ISSUE 8
FEBRUARY 2025

Hello from the Village of Cumberland's Wastewater Upgrades Project team – we hope 2025 has kicked off well for you all. This is our eighth issue of our project update newsletter which will keep you informed on progress on this important infrastructure upgrade. The year ahead will be a busy one on site, so stay tuned for updates ahead and thanks for following along! **Cumberland.ca/wastewaterupgrades**



Headworks subgrade: Machines prepare the ground at the new site of the headworks. The new operational building, completed in late 2024, can be seen in background.

Site Reactivated for Busy Construction Year

CONSTRUCTION RESTART

Work is getting underway in earnest on the Wastewater Upgrades Project, with more contractors led by Maple Reinders setting up on site and starting on the critical tasks ahead. The month of January has been focused on ground preparation - getting the subgrades ready for construction, and completing the closure of an old exploratory mine borehole that was discovered last year.

In the coming months, the focus of work will be on the extensive grading required for updates, along with installation of underground electrical and air piping. Two tented areas that will house equipment and the electrical room will also be prepared before moving onto the lagoon works.

WHAT IT MEANS FOR YOU

Construction work will continue all of 2025 and will be entirely on the site of the wastewater treatment facility off of Ulverston Road. However, people in the area should expect increased traffic and noise and ensure they stay off of the access road to the site. There are good trails nearby that keep you safely out of the construction zone.



Join Us - Learn More

Wastewater Plan Infosession
Come by our upcoming infosession to hear a presentation and ask questions about wastewater planning for the Village.

Tuesday, Feb. 25, 2025
Council Chambers, 2673 Dunsmuir Ave.
4:45 p.m. – 5:45 p.m.
OR 6:00 p.m. – 7:00 p.m.
See full story on page 2.

LONG-TERM WASTEWATER PLAN WRAPPING UP

The Village is completing the final stage of its Liquid Waste Management Plan (LWMP) – marking the end of an important long-term planning process that maps out wastewater direction for the decade to come.

The LWMP process actually began in 2016, and earlier stages identified the plan for the Wastewater Upgrades Project that is now under construction. The focus on upgrading the treatment facility to meet regulatory requirements was prioritized as the most urgent task – and with it underway, it was time to circle back to complete the wider plan which includes stormwater management.

The Wastewater Advisory Committee – made up of Village residents, property owners and Councillors – have been meeting to review and consider the results of technical assessments and proposed plans forward. A public infosession has been scheduled for February (see details on Pg. 1) – this will be the last public engagement window before the plan is drafted and submitted.

Learn more and follow the progress of this plan at **engagecomoxvalley.ca/cumberland-lwmp**





Mineshaft concealed
An old exploratory mine borehole that was found during early site investigations as been cleared and covered, removing a safety risk in the area.

DID YOU KNOW?

Because of incidents of vandalism, the site is under 24-hour video security. If you see any unusual activity in the area, please report it.

About the Wastewater Upgrades Project

The Village of Cumberland is upgrading its wastewater treatment system to meet provincial standards, as well as fulfill environmental goals to remove man-made toxins, restore degraded ecosystems and release safe water into Maple Lake Creek and the Trent River, which flows into Baynes Sound.

For mor information about the project, visit **cumberland.ca/wastewaterupgrades**

STAY IN TOUCH

This update is issued by the Village of Cumberland to keep the community informed about the Cumberland Wastewater Upgrade Project.

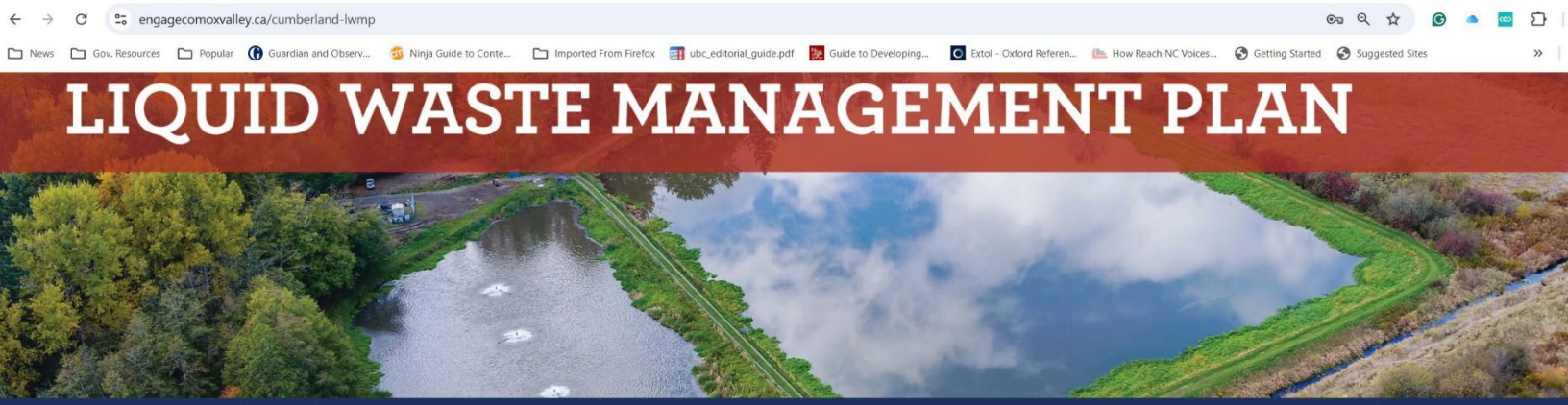
To stay updated about the project's progress:

Cumberland.ca/wastewaterupgrades

wwt-upgrades@cumberland.ca

APPENDIX 7. ENGAGE COMOX VALLEY PAGE

https://engagecomoxvalley.ca/cumberland-lwmp



Village of Cumberland LWMP

Join the conversation on the Village of Cumberland's liquid waste management planning process.

+ Follow

Home / Village of Cumberland LWMP

Completing Cumberland's long-term Wastewater Plan

The Village of Cumberland is preparing to complete the final piece of their Liquid Waste Management Plan – a plan that will guide wastewater management and required improvements for decades to come.

> Welcome to our online engagement hub, where you can follow along for additional information, get updates, and share questions/comments.

Timeline of Cumberland's LWMP



Open

Stage 3 LWMP - Feedback Form

Complete this feedback form to provide important feedback on the final pieces of the Stage 3 LWMP by 12 p.m (noon) on Friday, March 7.

Stormwater Separation

As a part of the Liquid Waste Management Plan, the Village of Cumberland's Wastewater Treatment Plant is designed to handle large winter water flows.

We are also committed to meeting provincial storm water separation requirements, at an estimated total cost of $12 million. This commitment could cost Cumberland households $165 to $534 annually for 20 years, depending on available grant funding and payment options.

Borrowing to begin the work sooner will cost Cumberland taxpayers more ($267 to $534 a year) over the length of the plan. However, if the stormwater separation work takes place over 20 years, this work could then be paid through taxation (at an estimated cost of $165 to $330 a year) while allowing the Village more time to seek grants and additional funding.

Please share your feedback about stormwater separation timing and payment options:

Feb. 25 Open House Presentation: Stage 3 LWMP Plans + Direction



Presentation: Overview of Stage 3 LWMP



FAQ

- What is an LWMP?
- What happens in Stage 3 of the LWMP?
- When was Stage 1 and 2 completed?

See more

Advisory Committee Meetings: Minutes and Presentations

The Wastewater Advisory Committee is made up of members of the public and council. The committee provides overview, comment and direction on the Liquid Waste Management Plan process. Follow their progress in between wider community engagement periods here.

+ Oct. 9, 2024 Meeting

+ Nov. 14, 2024 Meeting

Links

Cumberland's Liquid Waste Management Plan

APPENDIX 8 - K'OMOKS FIRST NATION CONDITIONAL LETTER OF SUPPORT

K'ómoks First Nation

3330 Comox Rd., Courtenay BC, V9N 3P8 | Ph: 250.339.4545 | F: 250.339.7053 | E: reception@komoks.ca

To Village of Cumberland.

April 6th, 2023

Re: Cumberland Wastewater Treatment Project

This letter is written to express the conditional support of the Chief and Council of the K'ómoks First Nation for the Cumberland Wastewater Treatment Project on the condition of further and maintained consultation to the satisfaction of K'ómoks leadership.

Based on the information provided, it is our understanding that this project as it has been put forward, will improve the conditions of the Trent River water way by reducing the contaminants in treated water that is released from the wastewater treatment plant. However, K'ómoks has concerns with the treatment of water with chlorine dioxide at the levels indicated. K'ómoks is in ongoing communication with BC regarding potential future residential use of Trent River Water and have an interest in maintaining the integrity of this water supply which is consistent with future residential use.

K'ómoks support for this work is contingent on the Village of Cumberland making a commitment to ongoing communication and active consultation with K'ómoks regarding the Operations and Maintenance Manual for the Cumberland Wastewater Treatment plant, to ensure the plan is aligned with K'ómoks First Nation's objectives regarding water treatment and environmental sustainability.

It is our expectation that continuous monitoring of the Trent River will be communicated regularly with K'ómoks and include monitoring for compliance with the Canadian drinking water guidelines, along with regular evaluation of the impact of this operation will have on the use of water from the Trent River for human consumption.

We look forward to continuing to build open and transparent communication with the Village of Cumberland and we navigate managing the variety of interests impacting our territory.

Respectfully,

Kenneth Price
Chief Councillor
K'ómoks First Nation

Corporation of the
Village of Cumberland

2673 Dunsmuir Avenue
P.O. Box 340
Cumberland, BC V0R 1S0
Telephone: 250-336-2291
Fax: 250-336-2321
cumberland.ca

July 25, 2024

VIA EMAIL TO: reception@komoks.ca
AND REGULAR MAIL

K'omoks First Nation
3330 Comox Road
Courtenay, BC V9N 3P8

Liquid Waste Management Plan – Stage 3

On behalf of the Village of Cumberland, we are sending this letter to update the K'omoks First Nation on planning and improvements underway for Cumberland's wastewater system. The Village is currently working on Stage 3 of our Liquid Wate Management Plan, while simultaneously completing critical improvements to our wastewater lagoon system to meet provincial treatment standards.

As a First Nation with historical interest in the region, we invite you to learn more, ask questions and provide your feedback.

About Cumberland's Wastewater Treatment System

The Village's wastewater is currently collected and treated through a two-cell lagoon system that includes aeration and a settling pond before water is released into Maple Lake Creek, a tributary of the Trent River, which flows into Baynes Sound. These streams see high wet weather flows, but almost entirely dry up in summer, leaving the released wastewater as essentially the only flow in Maple Lake Creek. The current system does not meet provincial or federal treatment standards.

From 2016-2018, the Village developed Stage 1 and Stage 2 of a Liquid Waste Management Plan which looked at all the options for improving wastewater treatment. Any system must be able to handle both the winter and summer conditions and provide capacity for future growth of the Village. It was determined that an upgraded lagoon system was the best option to achieve this. In 2018, a referendum was undertaken to borrow funds for a Wastewater Lagoon Upgrade and provincial and federal grant funding was secured in 2019 to allow the upgrade project to proceed. After several years of design and re-design for improved climate change resiliency, that construction project is now underway, to be completed in summer 2025.

Simultaneously, the Village is looking to complete Stage 3 of the LWMP process and obtain a provincial Operational Certificate as the regulatory authorization. Consultation with regional First Nations is a required part of this process.

Engagement with First Nations

We understand that Baynes Sound has significant historical and current importance to First Nations in the region and the work Cumberland is undertaking is important to protecting the marine environment's long-term health. The K'ómoks First Nation has been engaged in the process since 2016 and have always highlighted the importance of protecting the water quality and aquaculture of Baynes Sound, and the project has been designed to maximize this. They have had active review of plans for the wastewater upgrades that are currently underway, regular updates about the progress and will also be involved in the development of the receiving environment monitoring program.

As part of the Stage 3 LWMP plan, we invite other regional Nations to learn more about the treatment system in Cumberland, our proposed plans ahead, and provide input. This feedback from the traditional keepers of the land and water around us is important to the success of the long-term plan.

Steps Ahead

The Village is required to complete the LWMP by the end of 2024. Over the next four months, the project team will complete an Environmental Impact Study, develop the receiving environment monitoring plan and a public engagement process, along with First Nations engagement and consultation.

We are enclosing a project description, offering more details about the objectives of the plan, and what will be undertaken in this upcoming Stage to ensure Cumberland has a robust plan for managing wastewater and protecting the environment into the future.

If you would like to know more, or be given an overview via a presentation, meeting or a site tour, please contact us. We'd be happy to meet and hear from you about the proposed plan.

Kind regards,



Rob Crisfield
Director of Engineering and Public Works
Village of Cumberland
rcrisfield@cumberland.ca
Encl.

cc: We Wai Kai Nation
Wei Wai Kum Nation
Homalco First Nation
Qualicum First Nation
Tla'amin Nation
Nanwakolas Council
Mamalilikulla First Nation
Tlowitsis Nation
Da'naxda'xw First Nation

Corporation of the
Village of Cumberland

2673 Dunsmuir Avenue
P.O. Box 340
Cumberland, BC V0R 1S0
Telephone: 250-336-2291
Fax: 250-336-2321
cumberland.ca

October 11, 2024

VIA EMAIL TO: reception@komoks.ca
AND REGULAR MAIL

K'omoks First Nation
3330 Comox Road
Courtenay, BC V9N 3P8

Liquid Waste Management Plan – Stage 3

On behalf of the Village of Cumberland, we are sending this letter to follow up on our introduction, sent July 25, 2024, regarding planning work underway for the Village's wastewater management.

The Village is currently working on Stage 3 of our Liquid Wate Management Plan, while simultaneously completing critical improvements to the existing wastewater lagoon system to meet current and future provincial treatment standards.

Cumberland's wastewater system is connected to Baynes Sound – an area of important historical and current importance to First Nations in the region. As a First Nation with historical interest in the region, we invite you to learn more, ask questions and provide your feedback.

The K'ómoks First Nation has been engaged in the process over the past eight years, with active review of plans for the wastewater upgrades that are currently underway and regular updates about the progress.

Share your Feedback/Questions

We welcome your input and would be happy to coordinate a meeting or call to share more information or answer questions.

We are enclosing a project description, shared with our last letter, offering more details about the work completed to date, the objectives of the plan, and what will be undertaken in this upcoming Stage to ensure Cumberland has a robust plan for managing wastewater and protecting the environment in the future.

The Village is planning to complete the LWMP by the end of 2024. Should you wish to engage, we hope to hear back by **November 15, 2024**. Feedback from the traditional keepers of the land around us is important to the success of the long-term plan.

Kind regards,



Rob Crisfield
Director of Engineering and Public Works
Village of Cumberland
rcrisfield@cumberland.ca
Encl.

cc: We Wai Kai Nation
Wei Wai Kum Nation
Homalco First Nation
Qualicum First Nation
Tla'amin Nation
Tlowitsis Nation
Da'naxda'xw First Nation

Corporation of the
Village of Cumberland

2673 Dunsmuir Avenue
P.O. Box 340
Cumberland, BC V0R 1S0
Telephone: 250-336-2291
Fax: 250-336-2321
cumberland.ca

July 25, 2024

VIA EMAIL TO: communications@wewaikai.com
AND REGULAR MAIL

We Wai Kai Nation
690 Headstart Crescent
Campbell River, BC V9H 1P9

Liquid Waste Management Plan – Stage 3

On behalf of the Village of Cumberland, we are sending this letter to update the We Wai Kai Nation on planning and improvements underway for Cumberland's wastewater system. The Village is currently working on Stage 3 of our Liquid Wate Management Plan, while simultaneously completing critical improvements to our wastewater lagoon system to meet provincial treatment standards.

As a First Nation with historical interest in the region, we invite you to learn more, ask questions and provide your feedback.

About Cumberland's Wastewater Treatment System

The Village's wastewater is currently collected and treated through a two-cell lagoon system that includes aeration and a settling pond before water is released into Maple Lake Creek, a tributary of the Trent River, which flows into Baynes Sound. These streams see high wet weather flows, but almost entirely dry up in summer, leaving the released wastewater as essentially the only flow in Maple Lake Creek. The current system does not meet provincial or federal treatment standards.

From 2016-2018, the Village developed Stage 1 and Stage 2 of a Liquid Waste Management Plan which looked at all the options for improving wastewater treatment. Any system must be able to handle both the winter and summer conditions and provide capacity for future growth of the Village. It was determined that an upgraded lagoon system was the best option to achieve this. In 2018, a referendum was undertaken to borrow funds for a Wastewater Lagoon Upgrade and provincial and federal grant funding was secured in 2019 to allow the upgrade project to proceed. After several years of design and re-design for improved climate change resiliency, that construction project is now underway, to be completed in summer 2025.

Simultaneously, the Village is looking to complete Stage 3 of the LWMP process and obtain a provincial Operational Certificate as the regulatory authorization. Consultation with regional First Nations is a required part of this process.

Engagement with First Nations

We understand that Baynes Sound has significant historical and current importance to First Nations in the region and the work Cumberland is undertaking is important to protecting the marine environment's long-term health. The K'ómoks First Nation has been engaged in the process since 2016 and have always highlighted the importance of protecting the water quality and aquaculture of Baynes Sound, and the project has been designed to maximize this. They have had active review of plans for the wastewater upgrades that are currently underway, regular updates about the progress and will also be involved in the development of the receiving environment monitoring program.

As part of the Stage 3 LWMP plan, we invite other regional Nations to learn more about the treatment system in Cumberland, our proposed plans ahead, and provide input. This feedback from the traditional keepers of the land and water around us is important to the success of the long-term plan.

Steps Ahead

The Village is required to complete the LWMP by the end of 2024. Over the next four months, the project team will complete an Environmental Impact Study, develop the receiving environment monitoring plan and a public engagement process, along with First Nations engagement and consultation.

We are enclosing a project description, offering more details about the objectives of the plan, and what will be undertaken in this upcoming Stage to ensure Cumberland has a robust plan for managing wastewater and protecting the environment into the future.

If you would like to know more, or be given an overview via a presentation, meeting or a site tour, please contact us. We'd be happy to meet and hear from you about the proposed plan.

Kind regards,



Rob Crisfield
Director of Engineering and Public Works
Village of Cumberland
rcrisfield@cumberland.ca
Encl.

cc: K'omoks First Nation
Wei Wai Kum Nation
Homalco First Nation
Qualicum First Nation
Tla'amin Nation
Nanwakolas Council
Mamalilikulla First Nation
Tlowitsis Nation
Da'naxda'xw First Nation

Corporation of the
Village of Cumberland

2673 Dunsmuir Avenue
P.O. Box 340
Cumberland, BC V0R 1S0
Telephone: 250-336-2291
Fax: 250-336-2321
cumberland.ca

October 11, 2024

VIA EMAIL TO: communications@wewaikai.com
AND REGULAR MAIL

We Wai Kai Nation
690 Headstart Crescent
Campbell River, BC V9H 1P9

Liquid Waste Management Plan – Stage 3

On behalf of the Village of Cumberland, we are sending this letter to follow up on our introduction, sent July 25, 2024, regarding planning work underway for the Village's wastewater management.

The Village is currently working on Stage 3 of our Liquid Wate Management Plan, while simultaneously completing critical improvements to the existing wastewater lagoon system to meet current and future provincial treatment standards.

Cumberland's wastewater system is connected to Baynes Sound – an area of important historical and current importance to First Nations in the region. As a First Nation with historical interest in the region, we invite you to learn more, ask questions and provide your feedback.

The K'ómoks First Nation has been engaged in the process over the past eight years, with active review of plans for the wastewater upgrades that are currently underway and regular updates about the progress.

<u>Share your Feedback/Questions</u>

We welcome your input and would be happy to coordinate a meeting or call to share more information or answer questions.

We are enclosing a project description, shared with our last letter, offering more details about the work completed to date, the objectives of the plan, and what will be undertaken in this upcoming Stage to ensure Cumberland has a robust plan for managing wastewater and protecting the environment in the future.

The Village is planning to complete the LWMP by the end of 2024. Should you wish to engage, we hope to hear back by **November 15, 2024**. Feedback from the traditional keepers of the land around us is important to the success of the long-term plan.

Kind regards,



Rob Crisfield
Director of Engineering and Public Works
Village of Cumberland
rcrisfield@cumberland.ca
Encl.

cc: K'omoks First Nation
Wei Wai Kum Nation
Homalco First Nation
Qualicum First Nation
Tla'amin Nation
Tlowitsis Nation
Da'naxda'xw First Nation



VILLAGE OF CUMBERLAND

High Performance Wastewater Lagoon Upgrade Project

Project Description, July 2024

PURPOSE

The Village of Cumberland has developed an innovative project for upgrading its lagoon-based wastewater treatment. Due to a 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, sensitive downstream river/estuary habitat and aquaculture industry to protect.

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:

- Provide treatment to meet all the regulatory needs,
- Provide capacity for population double the current size of Cumberland
- Incorporate enhanced treatment of emerging contaminants such as pharmaceuticals,
- Use the treated water to provide flow to stagnant wetland ponds
- Improve aquatic habitat
- Provide recreational trails, and
- Deliver the service in a sustainable and climate change resilient manner.

HISTORY

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 1920s and includes some areas that have 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 12 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 collected 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 the estuary of Baynes Sound, a major shellfish aquaculture region. While these streams see very high winter flows, they are very dry in the 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 1930s, by excavating the ditch that is now Maple Lake Creek, to create farmland. Farming in the area was abandoned in the 1960s 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, and allow for public access for wildlife viewing.

PROJECT OBJECTIVES

The major technical objectives are to:

a. Improve the wastewater treatment to meet all current and near future regulatory standards

b. Provide high performance disinfection – with particular emphasis on destruction of human viruses - for the protection of public health and aquaculture in the downstream waters of the Trent River and Baynes Sound
c. Ensure the treatment process, and the treatment works themselves, are resilient to future climate change impacts of winter flooding and summer heat.

The major works required to achieve this are:

- Optimize the lagoon biological treatment to ensure performance under summer and winter conditions
- Chemical phosphorus removal to prevent algae blooms in the downstream creek and river
- Tertiary filtration to achieve reclaimed water standards
- High intensity ultra-violet (UV) disinfection of tertiary treated flow (up to 7200m3/day). Provision has been included to add additional chlorine disinfection if needed to achieve virus reduction targets)
- Chlorine disinfection of excess wet weather flow (over 7200m3/day), with dichlorination followed by flow through a grassed detention basin.
- Design for reliability and redundancy to ensure treatment performance in all conditions
- Provide for Cumberland growth from the current population of 4500 people to 8000.

These works will provide a tertiary high standard of treatment for flow from the current dry weather flow of 900m3/day up to 7200m3/day and still provide secondary treatment and disinfection to excess wet weather flows from 7,200 to 14,400 m3/day. As Cumberland continues to separate the old combined storm-sanitary sewers – and complete other infiltration control work – the wet weather flows will decrease to below 7200m3/day, the excess wet weather flow system can be decommissioned. This will end the use of chlorine for disinfection. The timeframe for this sewer rehabilitation and flow reduction is by 2035.

ASPIRATIONAL GOALS

Cumberland has always desired to go above and beyond the regulatory requirements. The wastewater project incorporates some additional goals for treatment performance and environmental enhancement:

- 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.
- Using the reed bed treated water to irrigate an area of the existing wetlands to bring water to stagnant ponds and for further natural polishing of the water before reaching the creek
- Providing wetland treatment of stormwater flows entering the wetlands area from the Village
- Upgrading the lagoon berms to meet current seismic protection standards by infilling the ditch section of Maple Lake Creek adjacent to the eastern berm
- Creating a new, naturalized streamform channel for Maple Lake Creek on the east side of the wetland area, to replace the infilled section.
- Aquatic habitat enhancement in Maple Lake Creek by adding natural form weirs and fishways to maintain summer water levels deep enough to prevent elevated water temperatures and create viable fish habitat.
- Creating a recreational amenity by providing access trails through the wetland area

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

FIGURE 1. Site Location



FIGURE 2. Initial Treatment Operation



FIGURE 3. Future Treatment Operation

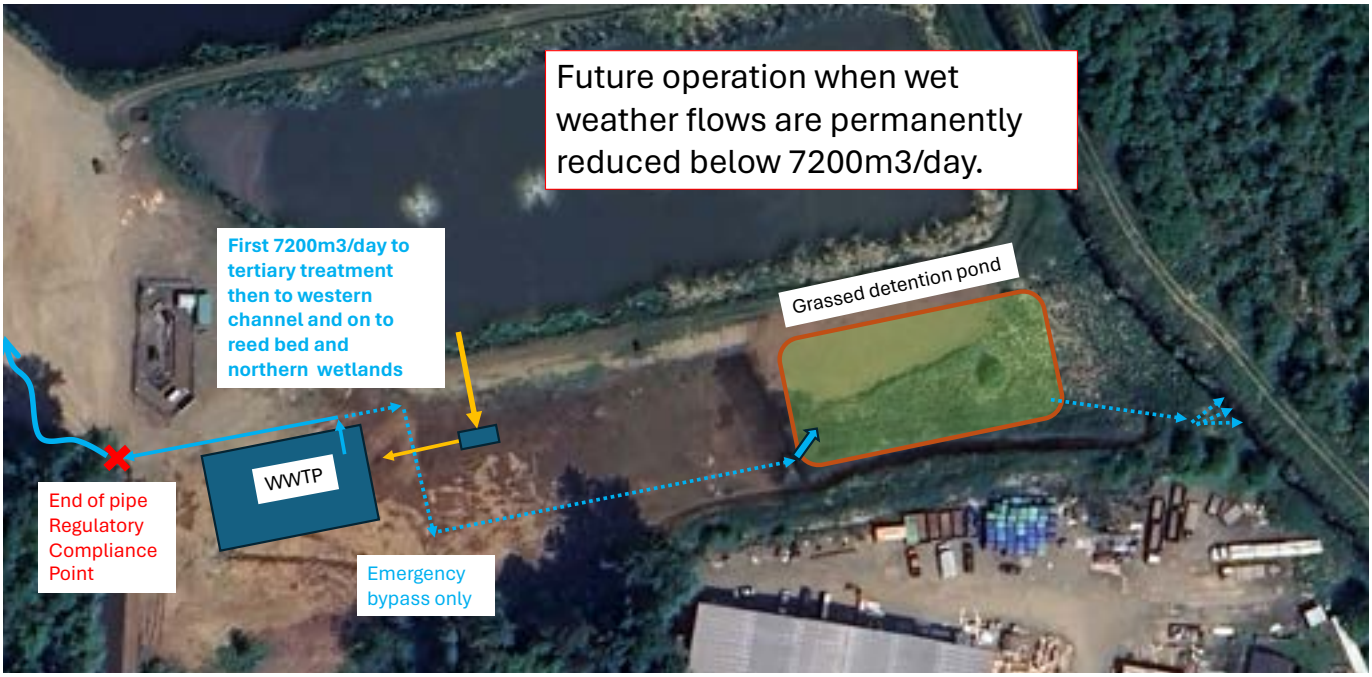


FIGURE 4. Reed Bed and Wetland Enhancement Areas



PROJECT COSTS & FUNDING

As a result of incorporating design changes for climate resiliency and environmental enhancement, and post-COVID inflation, the project costs have doubled since the definition of the project in 2019 from $9.7 million to $20.4 million in 2024.

Various federal, provincial and municipal grant funding has been secured for the project, totalling $10.4m

TIMELINE

The project began in 2021 but has experienced numerous delays in the design and construction process. The current schedule of the project is as follows:

Schedule	Activity	2023		2024				2025			
				Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
	Prelim. design			Completed							
	Detail design										
	Site Clearing										
	Construction										
	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 to 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.

APPENDIX E
COMBINED SEWER SEPARATION STRATEGY

Memorandum

4015 7 Street SE, Calgary AB T2G 2Y9, T: 403.254.0544 F: 403.254.9186

To:	**Village of Cumberland**	Date:	**March 20, 2025**
Attention:	**Jason Wallace**	Project No.:	**34053**
Cc:	**Paul Nash, Rob Crisfield, and Joel Clarkston**		
Reference:	**Combined Sewer Separation Strategy - DRAFT**		
From:	**Joel Grieco, EIT, Sarah Barbosa, P.Eng., ENV SP**		

The presence of combined storm and sanitary sewers in the Village presents significant challenges related to capacity constraints, environmental impacts, and regulatory compliance. During wet weather events, stormwater runoff that enters the combined sewers significantly increases wastewater discharge into the Villages' treatment system.

1.0 Identification of Combined Sewer Locations

To identify the locations of combined sewers, previous mapping from the 2011 Sanitary Sewer Master Plan was reviewed, and updates to the combined sewer mapping provided by the Village were incorporated. The GIS data did not include sanitary service connections, so a conservative approach was taken to identify specific sewer lengths connected to parcels identified by the Village was carried out by looking at existing topography and using a preliminary sanitary model. **Figure 1.1** shows combined sewers and identifies properties that are connected to them. In total, there are 4.2 km of combined sewers in Cumberland, representing 16% of the entire sewer system by length.

2.0 Combined Sewer Separation Strategy

A comprehensive sewer separation plan has been developed to fully remove combined sewers and remediate the alignment by adding new sanitary sewers and stormwater infrastructure (storm sewers and catch road drainage via catch basins). The implementation of the separation projects is intended to be phased over multiple years, prioritizing projects based on:

- Coordination with other planned infrastructure upgrades
- Areas with the highest risk of sewer capacity issues or environmental impacts
- Availability of funding from municipal, provincial, and federal sources

The phased implementation approach ensures that the improvements are cost-effective and can align with available funding opportunities. As part of implementing the strategy, it is recommended that the hydraulics of the proposed projects be modelled and confirmed as part of upcoming updates to Cumberland's Sanitary Master Plan.

2.1 Project Based Approach

The separation plan began with a detailed assessment of the Village's sewer network to identify areas with combined sewers. The analysis considered existing system layouts, flow patterns, and points of connection to downstream infrastructure. Given the dendritic nature of the sewer network, combined sewers in the Village were divided into 14 distinct projects, each representing a manageable segment for remediation as a capital project.

Figure 2.1 illustrates the 14 sewer separation projects and **Figures 2.2.1 to 2.2.4** outline the separation strategy. The delineation of project areas was guided by the following principles:

- **Hydraulic Connectivity**: Ensuring that connected areas are remediated in distinct projects to prevent a piecemeal execution of combined sewer remediation.
- **Constructability and Logistics:** Grouping areas into reasonable lengths to allow for efficient construction, minimal disruption, and cost-effectiveness.
- **Cost and Budgetary Considerations**: Balancing project size with available funding to ensure a feasible implementation timeline.

2.2 Cost Estimate

A preliminary cost estimate was developed for each project based on industry-standard unit costs for excavation, pipe installation, road restoration, and associated works. The cost estimates are Class D, representing an uncertainty of ±50% and based on limited site information. The costs in the estimate are defined as an approximate magnitude of cost of the proposed project, based on broad requirements, and to be used for developing long-term capital plans and for preliminary discussion of proposed capital projects. Key factors and assumptions considered in the cost estimate include:

- It is assumed that combined sewer pipes will be fully removed and replaced due to their age, and the need to fully remove storm service connections. The estimate assumes new sanitary and storm pipes with no combined sewers being repurposed into sanitary mains. It is assumed that refurbished sewers will generally follow the existing combined sewer alignment.
- A conservative pipe size has been assumed, one size larger than the existing sewers. This will be refined through upcoming sanitary modelling in updates to Cumberland's Sanitary Master Plan.
- The proposed storm system is assumed to follow the sanitary alignment where possible, and tie into existing downstream storm sewers. In the absence of storm modelling, a 450 mm pipe size has been used to represent an average size of storm sewer replacement, to be refined through future modelling in updates to Cumberland's Stormwater Master Plan.
- Unit costs are based on tendered projects from Vancouver Island and recent tender costs in Cumberland.

The estimated costs for the 14 projects are summarized in **Table 2.1**. A detailed cost estimate is attached.

Table 2.1 Combined Sewer Separation Project Cost Estimates

Project Number	Location	Estimated Cost
1	Between Kendal Avenue and Ulverston from 1st Street to 3rd Street	$ 1,940,000
2	1st Street from Ulverston Avenue to Maryport Avenue	$ 1,050,000
3	Maryport Avenue Laneway form 2nd Stret to 5th Street	$ 1,070,000
4	Windermere Avenue Laneway from 3rd Street to 4th Street	$ 420,000
5	Windermere Avenue and Maryport Avenue Laneway from 5th Street to 7th Street	$ 1,570,000
6	Penrith Avenue Laneway from 2nd Street to 5th Street	$ 1,250,000
7	Penrith Avenue Laneway from 5th Street to 7th Street	$ 780,000
8	Dewert Avenue and Laneway from 5th Street to 7th Street	$ 1,030,000
9	Dunsmuir Avenue Laneway from 1st Street to 3rd Street	$ 870,000
10	2nd Street and Royston Road	$ 810,000
11	Penrith Avenue east of Egremont Road	$ 610,000
12	Maryport Avenue, Penrith Avenue and Neighbourhood West of Egremont Road	$ 3,010,000
13	Egremont Road West of Cumberland Community School	$ 570,000
14	Windermere Avenue and Laneway West of Egremont Road	$ 860,000
	Total:	**$ 15,840,000**



LEGEND

- Cadastre
- Combined Sewer Areas
- Combined Sewers
- Storm Outlet
- Storm Catchbasin
- Storm Manhole
- Storm Main
- Storm Culvert
- Open Drainage Channel
- Sanitary Manhole
- Sanitary Forcemain
- Sanitary Main

TITLE

COMBINED SEWER LOCATIONS

PROJECT

LWMP PLANNING

CLIENT

VILLAGE OF CUMBERLAND

DATA SOURCES

- Topographic Map: Hybrid Reference Layer: Esri Community Maps Contributors, Esri Canada, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, US Census Bureau, USDA, NRCan, Parks Canada

PROJECTION

NAD 1983 UTM Zone 10N

0 0.05 0.1 0.2

1:10,000 KM

FIGURE	1.1
DATE	2025-03-20
PROJECT NO.	34053
AUTHOR	

Document Path: Q:\Projects\34053_VCU_LWMP_Planning\34053_VCU_LWMP_Planning_ProProject\34053_VCU_LWMP_Planning_ProProject.aprx



LEGEND

- Cadastre
- Combined Sewer Areas
- Flow Directions
- Sanitary Manhole
- Storm Manhole
- Sanitary Main
- Storm Main
- Storm Culvert
- Open Drainange Channel

Combined Sewer Remediation Projects

- Project 1
- Project 2
- Project 3
- Project 4
- Project 5
- Project 6
- Project 7
- Project 8
- Project 9
- Project 10
- Project 11
- Project 12
- Project 13
- Project 14

TITLE

COMBINED SEWER REMEDIATION PROJECTS

PROJECT
LWMP PLANNING

CLIENT
VILLAGE OF CUMBERLAND

DATA SOURCES

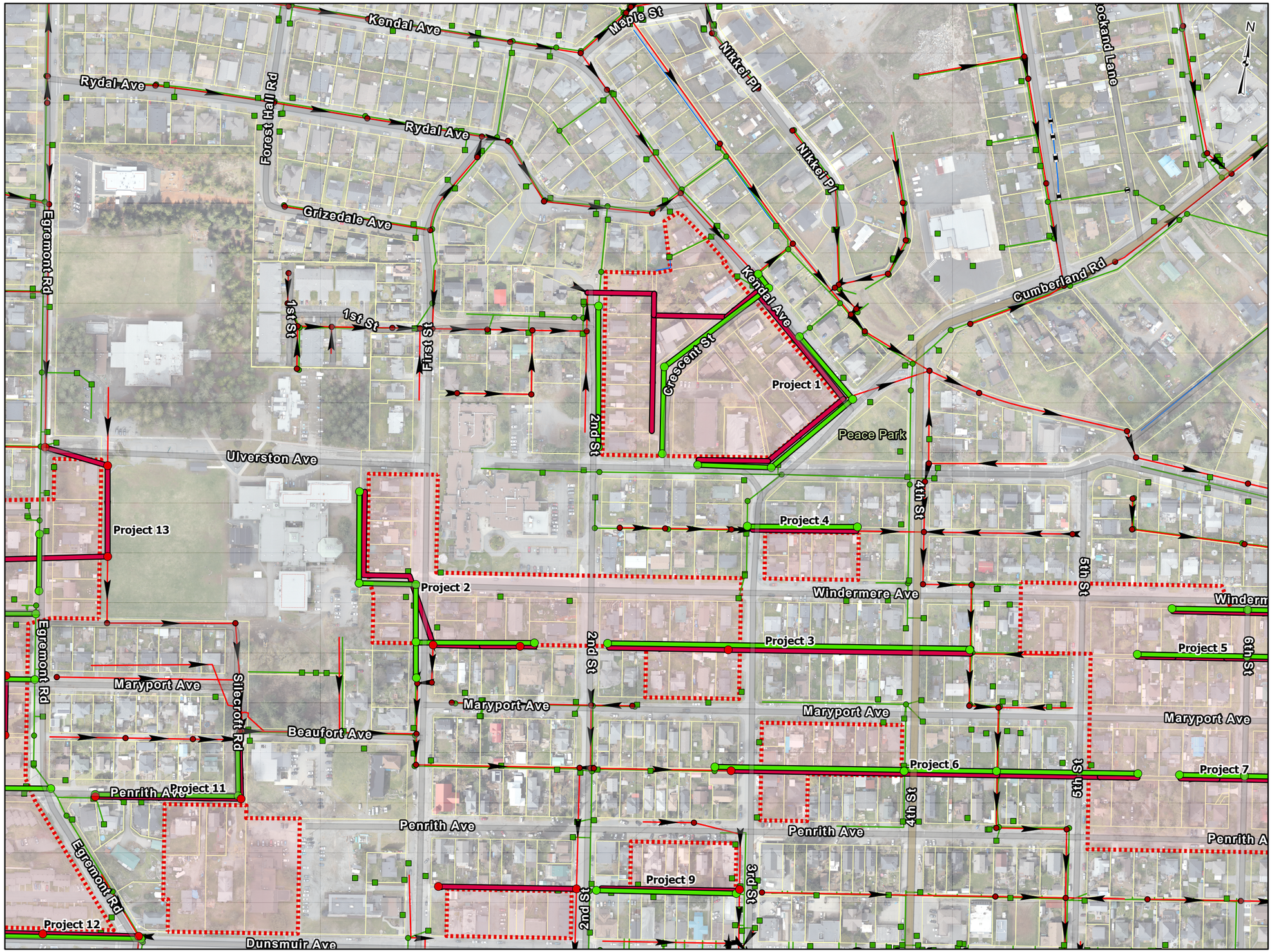
- Topographic Map: Hybrid Reference Layer: Esri Community Maps Contributors, Esri Canada, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, US Census Bureau, USDA, NRCan, Parks Canada

PROJECTION
NAD 1983 UTM Zone 10N

0 0.04 0.07 0.14
1:5,000 KM

FIGURE	2.1
DATE	2025-03-20
PROJECT NO.	34053
AUTHOR	

Document Path: Q:\Projects\34053_VCU_LWMP_Planning\34053_VCU_LWMP_Planning_ProProject\34053_VCU_LWMP_Planning_ProProject.aprx

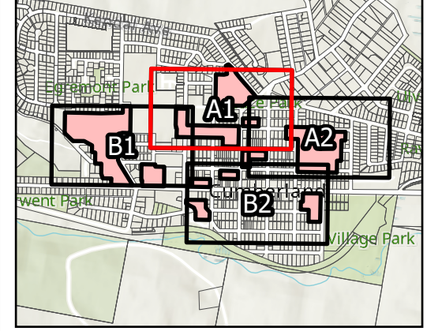


LEGEND

- Cadastre
- Combined Sewer Areas
- Existing Storm Culvert
- Existing Sanitary Manhole
- Existing Storm Manhole
- Existing Storm Catchbasin
- Existing Sanitary Main
- Existing Storm Main
- Open Drainange Channel
- Sanitary Flow Directions
- Proposed Sanitary Sewer Remediation
- Proposed Sanitary Manhole Replacement
- Proposed Storm Mains
- Proposed Storm Manhole

Note: Proposed storm mains are offset from proper alignments for visibility and may be drawn outside of road ROW. Alignments are conceptual.

KEYPLAN



TITLE

COMBINED SEWER REMEDIATION PROJECTS

PROJECT
LWMP PLANNING

CLIENT
VILLAGE OF CUMBERLAND

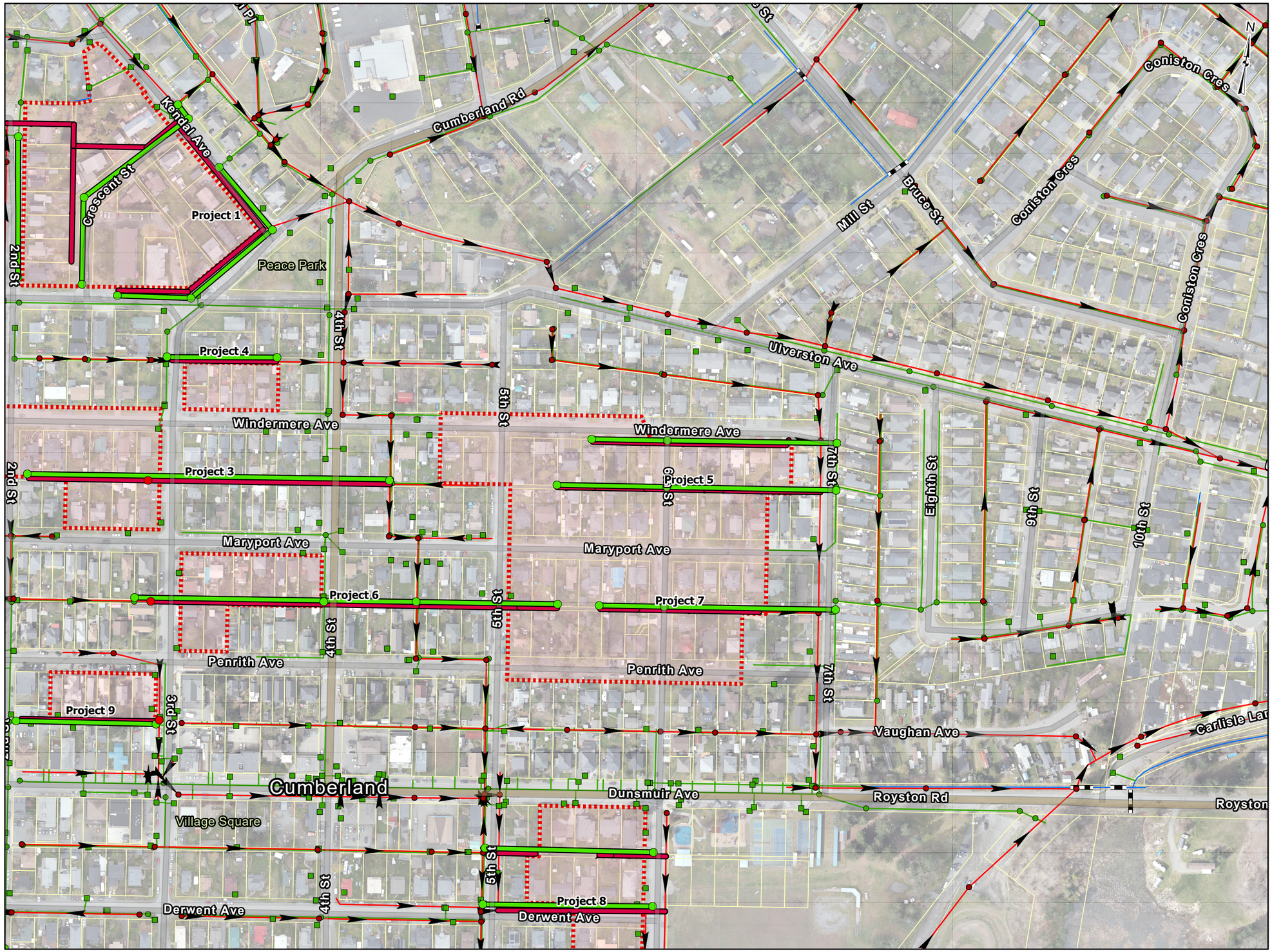
DATA SOURCES
- Topographic Map: World Topographic Map: Esri Canada, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, US Census Bureau, USDA, NRCan, Parks Canada

PROJECTION
NAD 1983 UTM Zone 10N

0 0.02 0.04 0.08
1:3,000 KM

FIGURE	2.2.1
DATE	2025-03-20
PROJECT NO.	34053
AUTHOR	

Document Path: Q:\Projects\34053_VCU_LWMP_Planning\34053_VCU_LWMP_Planning_ProProject\34053_VCU_LWMP_Planning_ProProject.aprx

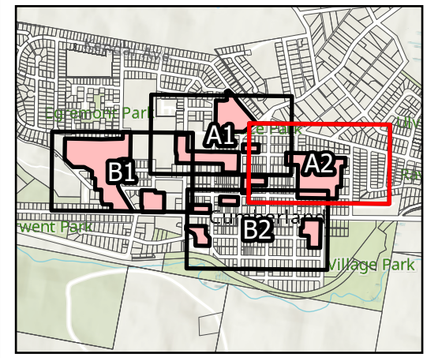


LEGEND

- Cadastre
- Combined Sewer Areas
- Existing Storm Culvert
- Existing Sanitary Manhole
- Existing Storm Manhole
- Existing Storm Catchbasin
- Existing Sanitary Main
- Existing Storm Main
- Open Drainange Channel
- Sanitary Flow Directions
- Proposed Sanitary Sewer Remediation
- Proposed Sanitary Manhole Replacement
- Proposed Storm Mains
- Proposed Storm Manhole

Note: Proposed storm mains are offset from proper alignments for visibility and may be drawn outside of road ROW. Alignments are conceptual.

KEYPLAN



TITLE

COMBINED SEWER REMEDIATION PROJECTS

PROJECT
LWMP PLANNING

CLIENT
VILLAGE OF CUMBERLAND

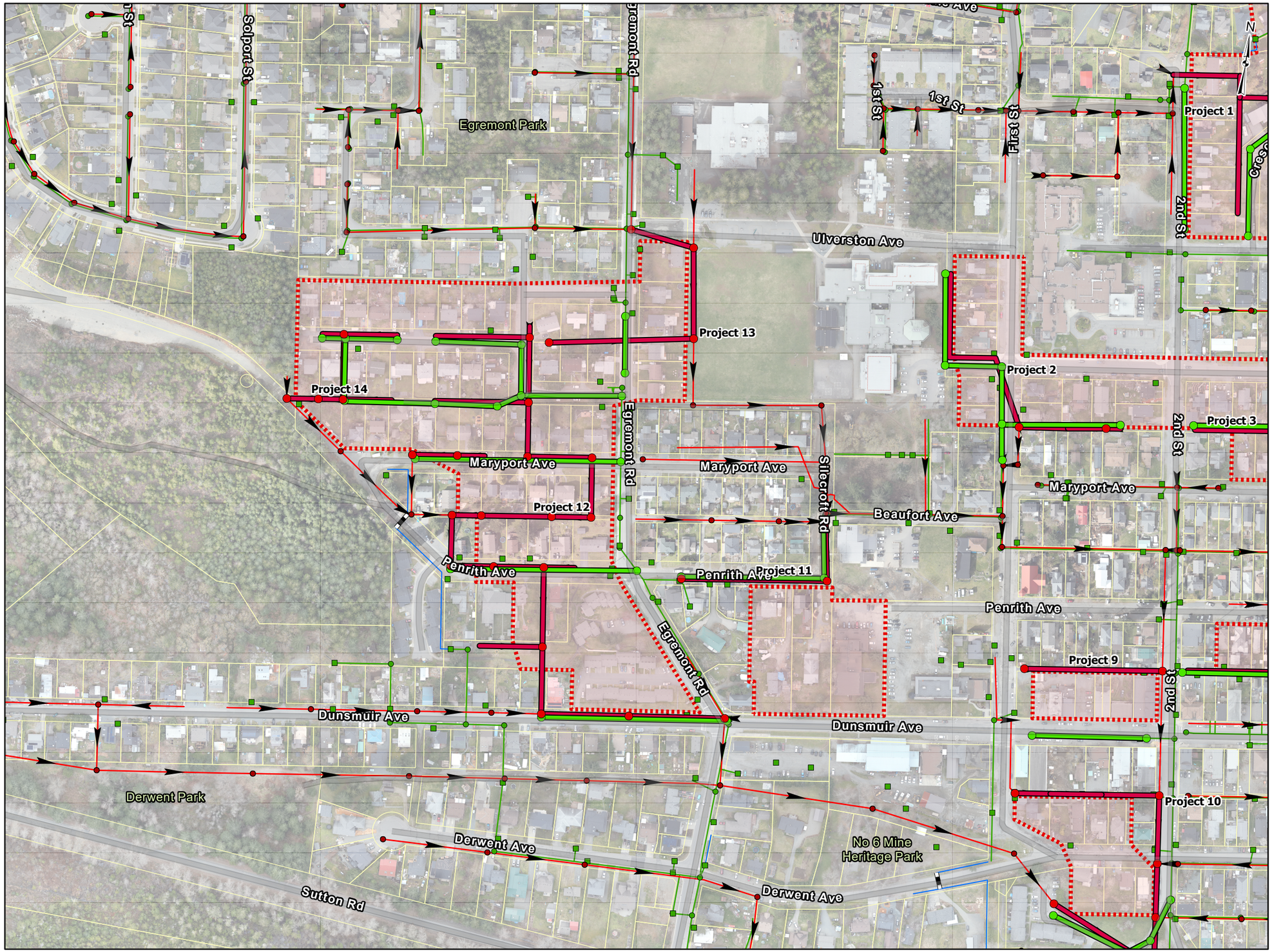
DATA SOURCES
- Topographic Map: World Topographic Map: Esri Canada, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, US Census Bureau, USDA, NRCan, Parks Canada

PROJECTION
NAD 1983 UTM Zone 10N

0 0.02 0.04 0.08
1:3,000 KM

FIGURE	2.2.2
DATE	2025-03-20
PROJECT NO.	34053
AUTHOR	

Document Path: Q:\Projects\34053_VCU_LWMP_Planning\34053_VCU_LWMP_Planning_ProProject\34053_VCU_LWMP_Planning_ProProject.aprx

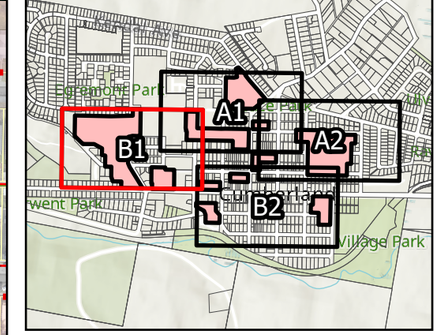


LEGEND

- Cadastre
- Combined Sewer Areas
- Existing Storm Culvert
- Existing Sanitary Manhole
- Existing Storm Manhole
- Existing Storm Catchbasin
- Existing Sanitary Main
- Existing Storm Main
- Open Drainange Channel
- Sanitary Flow Directions
- Proposed Sanitary Sewer Remediation
- Proposed Sanitary Manhole Replacement
- Proposed Storm Mains
- Proposed Storm Manhole

Note: Proposed storm mains are offset from proper alignments for visibility and may be drawn outside of road ROW. Alignments are conceptual.

KEYPLAN



TITLE

COMBINED SEWER REMEDIATION PROJECTS

PROJECT
LWMP PLANNING

CLIENT
VILLAGE OF CUMBERLAND

DATA SOURCES
- Topographic Map: World Topographic Map: Esri Canada, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, US Census Bureau, USDA, NRCan, Parks Canada

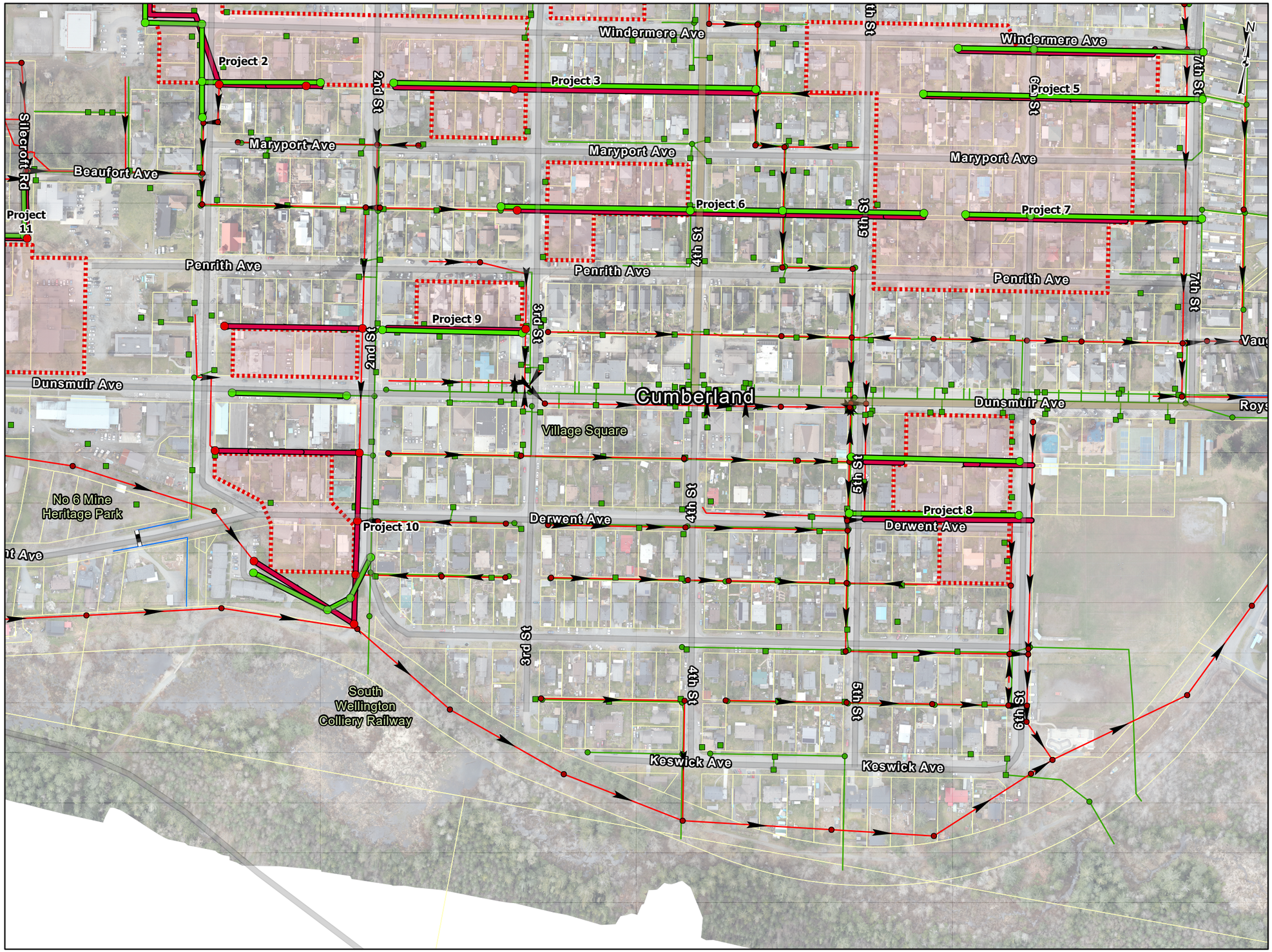
PROJECTION
NAD 1983 UTM Zone 10N

0 0.02 0.04 0.08
1:3,000 KM

ISL

FIGURE	2.2.3
DATE	2025-03-20
PROJECT NO.	34053
AUTHOR	

Document Path: O:\Projects\34053_VCU_LWMP_Planning\34053_VCU_LWMP_Planning_ProProject\34053_VCU_LWMP_Planning_ProProject.aprx

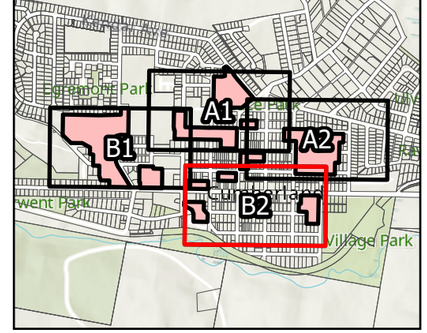


LEGEND

- Cadastre
- Combined Sewer Areas
- Existing Storm Culvert
- Existing Sanitary Manhole
- Existing Storm Manhole
- Existing Storm Catchbasin
- Existing Sanitary Main
- Existing Storm Main
- Open Drainange Channel
- Sanitary Flow Directions
- Proposed Sanitary Sewer Remediation
- Proposed Sanitary Manhole Replacement
- Proposed Storm Mains
- Proposed Storm Manhole

Note: Proposed storm mains are offset from proper alignments for visibility and may be drawn outside of road ROW. Alignments are conceptual.

KEYPLAN



TITLE

COMBINED SEWER REMEDIATION PROJECTS

PROJECT
LWMP PLANNING

CLIENT
VILLAGE OF CUMBERLAND

DATA SOURCES
- Topographic Map: World Topographic Map: Esri Canada, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, US Census Bureau, USDA, NRCan, Parks Canada

PROJECTION
NAD 1983 UTM Zone 10N

0 0.02 0.04 0.08
1:3,000 KM

FIGURE	2.2.4
DATE	2025-03-20
PROJECT NO.	34053
AUTHOR	

Document Path: Q:\Projects\34053_VCU_LWMP_Planning\34053_VCU_LWMP_Planning_ProProject\34053_VCU_LWMP_Planning_ProProject.aprx

ID	Items	Material	Quantity	Units	Unit Cost	Sub-Total	Mobilization, and General Conditions (10%)	Contingency (30%)	Engineering (10%)	Total Cost
Project 1	Excavation, backfill, supply and installation 450mm Storm Main	PVC	499	Metres	$1,028	$512,999	$51,300	$153,900	$76,950	$800,000
	Excavation, backfill, supply and installation 250mm Sanitary Main	PVC	484	Metres	$399	$193,116	$19,312	$57,935	$28,967	$300,000
	Supply and install 1050 mm dia. Storm Manhole	Concrete	10	Each	$7,224	$72,240	$7,224	$21,672	$10,836	$120,000
	Supply and install 1050 mm dia. Sanitary Manhole	Concrete	8	Each	$7,224	$57,792	$5,779	$17,338	$8,669	$90,000
	Top Inlet Catch Basin c/w CB Lead	Concrete	10	Each	$5,681	$56,691	$5,669	$17,007	$8,504	$90,000
	Service Connection (Sanitary)	PVC	21	Lump Sum	$4,295	$90,185	$9,018	$27,055	$13,528	$140,000
	Service Connection (Storm)	PVC	21	Lump Sum	$5,072	$106,502	$10,650	$31,950	$15,975	$170,000
	Road Restoration - Asphalt	Asphalt	983	Metres	$147	$144,501	$14,450	$43,350	$21,675	$230,000
					Project 1 Sub-Total:	**$1,234,026**	**$123,403**	**$370,208**	**$185,104**	**$1,940,000**
Project 2	Excavation, backfill, supply and installation 450mm Storm Main	PVC	282	Metres	$1,028	$289,912	$28,991	$86,973	$43,487	$450,000
	Excavation, backfill, supply and installation 250mm Sanitary Main	PVC	237	Metres	$399	$94,563	$9,456	$28,369	$14,184	$150,000
	Supply and install 1050 mm dia. Storm Manhole	Concrete	6	Each	$7,224	$43,344	$4,334	$13,003	$6,502	$70,000
	Supply and install 1050 mm dia. Sanitary Manhole	Concrete	2	Each	$7,224	$14,448	$1,445	$4,334	$2,167	$30,000
	Top Inlet Catch Basin c/w CB Lead	Concrete	6	Each	$5,681	$32,038	$3,204	$9,611	$4,806	$50,000
	Service Connection (Sanitary)	PVC	12	Lump Sum	$4,295	$51,534	$5,153	$15,460	$7,730	$80,000
	Service Connection (Storm)	PVC	12	Lump Sum	$5,072	$60,858	$6,086	$18,257	$9,129	$100,000
	Road Restoration - Asphalt	Asphalt	519	Metres	$147	$76,293	$7,629	$22,888	$11,444	$120,000
					Project 2 Sub-Total:	**$662,990**	**$66,299**	**$198,897**	**$99,448**	**$1,050,000**
Project 3	Excavation, backfill, supply and installation 450mm Storm Main	PVC	284	Metres	$1,028	$291,968	$29,197	$87,590	$43,795	$460,000
	Excavation, backfill, supply and installation 250mm Sanitary Main	PVC	282	Metres	$399	$112,518	$11,252	$33,755	$16,878	$180,000
	Supply and install 1050 mm dia. Storm Manhole	Concrete	2	Each	$7,224	$14,448	$1,445	$4,334	$2,167	$30,000
	Supply and install 1050 mm dia. Sanitary Manhole	Concrete	2	Each	$7,224	$14,448	$1,445	$4,334	$2,167	$30,000
	Top Inlet Catch Basin c/w CB Lead	Concrete	6	Each	$5,681	$32,265	$3,227	$9,680	$4,840	$60,000
	Service Connection (Sanitary)	PVC	12	Lump Sum	$4,295	$51,534	$5,153	$15,460	$7,730	$80,000
	Service Connection (Storm)	PVC	12	Lump Sum	$5,072	$60,858	$6,086	$18,257	$9,129	$100,000
	Road Restoration - Asphalt	Asphalt	566	Metres	$147	$83,202	$8,320	$24,961	$12,480	$130,000
					Project 3 Sub-Total:	**$661,241**	**$66,124**	**$198,372**	**$99,186**	**$1,070,000**
Project 4	Excavation, backfill, supply and installation 450mm Storm Main	PVC	86	Metres	$1,028	$88,413	$8,841	$26,524	$13,262	$140,000
	Excavation, backfill, supply and installation 250mm Sanitary Main	PVC	81	Metres	$399	$32,319	$3,232	$9,696	$4,848	$60,000
	Supply and install 1050 mm dia. Storm Manhole	Concrete	2	Each	$7,224	$14,448	$1,445	$4,334	$2,167	$30,000
	Supply and install 1050 mm dia. Sanitary Manhole	Concrete	3	Each	$7,224	$21,672	$2,167	$6,502	$3,251	$40,000
	Top Inlet Catch Basin c/w CB Lead	Concrete	2	Each	$5,681	$9,770	$977	$2,931	$1,466	$20,000
	Service Connection (Sanitary)	PVC	6	Lump Sum	$4,295	$25,767	$2,577	$7,730	$3,865	$40,000
	Service Connection (Storm)	PVC	6	Lump Sum	$5,072	$30,429	$3,043	$9,129	$4,564	$50,000
	Road Restoration - Asphalt	Asphalt	167	Metres	$147	$24,549	$2,455	$7,365	$3,682	$40,000
					Project 4 Sub-Total:	**$247,367**	**$24,737**	**$74,210**	**$37,105**	**$420,000**
Project 5	Excavation, backfill, supply and installation 450mm Storm Main	PVC	409	Metres	$1,028	$420,474	$42,047	$126,142	$63,071	$660,000
	Excavation, backfill, supply and installation 250mm Sanitary Main	PVC	361	Metres	$399	$144,039	$14,404	$43,212	$21,606	$230,000
	Supply and install 1050 mm dia. Storm Manhole	Concrete	6	Each	$7,224	$43,344	$4,334	$13,003	$6,502	$70,000
	Supply and install 1050 mm dia. Sanitary Manhole	Concrete	3	Each	$7,224	$21,672	$2,167	$6,502	$3,251	$40,000
	Top Inlet Catch Basin c/w CB Lead	Concrete	8	Each	$5,681	$46,466	$4,647	$13,940	$6,970	$80,000
	Service Connection (Sanitary)	PVC	21	Lump Sum	$4,295	$90,185	$9,018	$27,055	$13,528	$140,000
	Service Connection (Storm)	PVC	21	Lump Sum	$5,072	$106,502	$10,650	$31,950	$15,975	$170,000
	Road Restoration - Asphalt	Asphalt	770	Metres	$147	$113,190	$11,319	$33,957	$16,979	$180,000
					Project 5 Sub-Total:	**$985,872**	**$98,587**	**$295,762**	**$147,881**	**$1,570,000**
Project 6	Excavation, backfill, supply and installation 450mm Storm Main	PVC	330	Metres	$1,028	$339,258	$33,926	$101,777	$50,889	$530,000
	Excavation, backfill, supply and installation 250mm Sanitary Main	PVC	317	Metres	$399	$126,483	$12,648	$37,945	$18,972	$200,000
	Supply and install 1050 mm dia. Storm Manhole	Concrete	4	Each	$7,224	$28,896	$2,890	$8,669	$4,334	$50,000
	Supply and install 1050 mm dia. Sanitary Manhole	Concrete	3	Each	$7,224	$21,672	$2,167	$6,502	$3,251	$40,000
	Top Inlet Catch Basin c/w CB Lead	Concrete	7	Each	$5,681	$37,491	$3,749	$11,247	$5,624	$60,000
	Service Connection (Sanitary)	PVC	15	Lump Sum	$4,295	$64,418	$6,442	$19,325	$9,663	$100,000
	Service Connection (Storm)	PVC	15	Lump Sum	$5,072	$76,073	$7,607	$22,822	$11,411	$120,000
	Road Restoration - Asphalt	Asphalt	647	Metres	$147	$95,109	$9,511	$28,533	$14,266	$150,000
					Project 6 Sub-Total:	**$789,399**	**$78,940**	**$236,820**	**$118,410**	**$1,250,000**
Project 7	Excavation, backfill, supply and installation 450mm Storm Main	PVC	184	Metres	$1,028	$189,162	$18,916	$56,749	$28,374	$300,000
	Excavation, backfill, supply and installation 250mm Sanitary Main	PVC	124	Metres	$399	$49,476	$4,948	$14,843	$7,421	$80,000
	Supply and install 1050 mm dia. Storm Manhole	Concrete	3	Each	$7,224	$21,672	$2,167	$6,502	$3,251	$40,000
	Supply and install 1050 mm dia. Sanitary Manhole	Concrete	1	Each	$7,224	$7,224	$722	$2,167	$1,084	$20,000
	Top Inlet Catch Basin c/w CB Lead	Concrete	4	Each	$5,681	$20,904	$2,090	$6,271	$3,136	$40,000
	Service Connection (Sanitary)	PVC	14	Lump Sum	$4,295	$60,123	$6,012	$18,037	$9,018	$100,000
	Service Connection (Storm)	PVC	14	Lump Sum	$5,072	$71,001	$7,100	$21,300	$10,650	$120,000
	Road Restoration - Asphalt	Asphalt	308	Metres	$147	$45,276	$4,528	$13,583	$6,791	$80,000
					Project 7 Sub-Total:	**$464,838**	**$46,484**	**$139,452**	**$69,726**	**$780,000**
Project 8	Excavation, backfill, supply and installation 450mm Storm Main	PVC	266	Metres	$1,028	$273,463	$27,346	$82,039	$41,019	$430,000
	Excavation, backfill, supply and installation 250mm Sanitary Main	PVC	212	Metres	$399	$84,588	$8,459	$25,376	$12,688	$140,000
	Supply and install 1050 mm dia. Storm Manhole	Concrete	4	Each	$7,224	$28,896	$2,890	$8,669	$4,334	$50,000
	Supply and install 1050 mm dia. Sanitary Manhole	Concrete	4	Each	$7,224	$28,896	$2,890	$8,669	$4,334	$50,000
	Top Inlet Catch Basin c/w CB Lead	Concrete	5	Each	$5,681	$30,220	$3,022	$9,066	$4,533	$50,000
	Service Connection (Sanitary)	PVC	13	Lump Sum	$4,295	$55,829	$5,583	$16,749	$8,374	$90,000
	Service Connection (Storm)	PVC	13	Lump Sum	$5,072	$65,930	$6,593	$19,779	$9,889	$110,000
	Road Restoration - Asphalt	Asphalt	478	Metres	$147	$70,266	$7,027	$21,080	$10,540	$110,000
					Project 8 Sub-Total:	**$638,087**	**$63,809**	**$191,426**	**$95,713**	**$1,030,000**
Project 9	Excavation, backfill, supply and installation 450mm Storm Main	PVC	199	Metres	$1,028	$204,583	$20,458	$61,375	$30,687	$320,000
	Excavation, backfill, supply and installation 250mm Sanitary Main	PVC	216	Metres	$399	$86,184	$8,618	$25,855	$12,928	$140,000
	Supply and install 1050 mm dia. Storm Manhole	Concrete	4	Each	$7,224	$28,896	$2,890	$8,669	$4,334	$50,000
	Supply and install 1050 mm dia. Sanitary Manhole	Concrete	3	Each	$7,224	$21,672	$2,167	$6,502	$3,251	$40,000
	Top Inlet Catch Basin c/w CB Lead	Concrete	4	Each	$5,681	$22,608	$2,261	$6,783	$3,391	$40,000
	Service Connection (Sanitary)	PVC	12	Lump Sum	$4,295	$51,534	$5,153	$15,460	$7,730	$80,000
	Service Connection (Storm)	PVC	12	Lump Sum	$5,072	$60,858	$6,086	$18,257	$9,129	$100,000
	Road Restoration - Asphalt	Asphalt	415	Metres	$147	$61,005	$6,101	$18,302	$9,151	$100,000
					Project 9 Sub-Total:	**$537,340**	**$53,734**	**$161,202**	**$80,601**	**$870,000**
Project 10	Excavation, backfill, supply and installation 450mm Storm Main	PVC	120	Metres	$1,028	$123,367	$12,337	$37,010	$18,505	$200,000
	Excavation, backfill, supply and installation 250mm Sanitary Main	PVC	339	Metres	$399	$135,261	$13,526	$40,578	$20,289	$210,000
	Supply and install 1050 mm dia. Storm Manhole	Concrete	4	Each	$7,224	$28,896	$2,890	$8,669	$4,334	$50,000
	Supply and install 1050 mm dia. Sanitary Manhole	Concrete	6	Each	$7,224	$43,344	$4,334	$13,003	$6,502	$70,000
	Top Inlet Catch Basin c/w CB Lead	Concrete	2	Each	$5,681	$13,633	$1,363	$4,090	$2,045	$30,000
	Service Connection (Sanitary)	PVC	9	Lump Sum	$4,295	$38,651	$3,865	$11,595	$5,798	$60,000
	Service Connection (Storm)	PVC	9	Lump Sum	$5,072	$45,644	$4,564	$13,693	$6,847	$80,000
	Road Restoration - Asphalt	Asphalt	459	Metres	$147	$67,473	$6,747	$20,242	$10,121	$110,000
					Project 10 Sub-Total:	**$496,268**	**$49,627**	**$148,880**	**$74,440**	**$810,000**

ID	Items	Material	Quantity	Units	Unit Cost	Sub-Total	Mobilization, and General Conditions (10%)	Contingency (30%)	Engineering (10%)	Total Cost
Project 11	Excavation, backfill, supply and installation 450mm Storm Main	PVC	155	Metres	$1,028	$159,349	$15,935	$47,805	$23,902	$250,000
	Excavation, backfill, supply and installation 250mm Sanitary Main	PVC	160	Metres	$399	$63,840	$6,384	$19,152	$9,576	$100,000
	Supply and install 1050 mm dia. Storm Manhole	Concrete	3	Each	$7,224	$21,672	$2,167	$6,502	$3,251	$40,000
	Supply and install 1050 mm dia. Sanitary Manhole	Concrete	2	Each	$7,224	$14,448	$1,445	$4,334	$2,167	$30,000
	Top Inlet Catch Basin c/w CB Lead	Concrete	3	Each	$5,681	$17,610	$1,761	$5,283	$2,641	$30,000
	Service Connection (Sanitary)	PVC	5	Lump Sum	$4,295	$21,473	$2,147	$6,442	$3,221	$40,000
	Service Connection (Storm)	PVC	5	Lump Sum	$5,072	$25,358	$2,536	$7,607	$3,804	$40,000
	Road Restoration - Asphalt	Asphalt	315	Metres	$147	$46,305	$4,631	$13,892	$6,946	$80,000
					Project 11 Sub-Total:	**$370,053**	**$37,005**	**$111,016**	**$55,508**	**$610,000**
Project 12	Excavation, backfill, supply and installation 450mm Storm Main	PVC	705	Metres	$1,028	$724,779	$72,478	$217,434	$108,717	$1,130,000
	Excavation, backfill, supply and installation 250mm Sanitary Main	PVC	953	Metres	$399	$380,247	$38,025	$114,074	$57,037	$590,000
	Supply and install 1050 mm dia. Storm Manhole	Concrete	12	Each	$7,224	$86,688	$8,669	$26,006	$13,003	$140,000
	Supply and install 1050 mm dia. Sanitary Manhole	Concrete	17	Each	$7,224	$122,808	$12,281	$36,842	$18,421	$200,000
	Top Inlet Catch Basin c/w CB Lead	Concrete	14	Each	$5,681	$80,095	$8,010	$24,029	$12,014	$130,000
	Service Connection (Sanitary)	PVC	30	Lump Sum	$4,295	$128,835	$12,884	$38,651	$19,325	$200,000
	Service Connection (Storm)	PVC	30	Lump Sum	$5,072	$152,145	$15,215	$45,644	$22,822	$240,000
	Road Restoration - Asphalt	Asphalt	1,658	Metres	$147	$243,726	$24,373	$73,118	$36,559	$380,000
					Project 12 Sub-Total:	**$1,919,323**	**$191,932**	**$575,797**	**$287,898**	**$3,010,000**
Project 13	Excavation, backfill, supply and installation 450mm Storm Main	PVC	44	Metres	$1,028	$45,234	$4,523	$13,570	$6,785	$80,000
	Excavation, backfill, supply and installation 250mm Sanitary Main	PVC	234	Metres	$399	$93,366	$9,337	$28,010	$14,005	$150,000
	Supply and install 1050 mm dia. Storm Manhole	Concrete	2	Each	$7,224	$14,448	$1,445	$4,334	$2,167	$30,000
	Supply and install 1050 mm dia. Sanitary Manhole	Concrete	4	Each	$7,224	$28,896	$2,890	$8,669	$4,334	$50,000
	Top Inlet Catch Basin c/w CB Lead	Concrete	1	Each	$5,681	$4,999	$500	$1,500	$750	$10,000
	Service Connection (Sanitary)	PVC	12	Lump Sum	$4,295	$51,534	$5,153	$15,460	$7,730	$80,000
	Service Connection (Storm)	PVC	12	Lump Sum	$5,072	$60,858	$6,086	$18,257	$9,129	$100,000
	Road Restoration - Asphalt	Asphalt	278	Metres	$147	$40,866	$4,087	$12,260	$6,130	$70,000
					Project 13 Sub-Total:	**$340,201**	**$34,020**	**$102,060**	**$51,030**	**$570,000**
Project 14	Excavation, backfill, supply and installation 450mm Storm Main	PVC	179	Metres	$1,028	$184,022	$18,402	$55,207	$27,603	$290,000
	Excavation, backfill, supply and installation 250mm Sanitary Main	PVC	191	Metres	$399	$76,209	$7,621	$22,863	$11,431	$120,000
	Supply and install 1050 mm dia. Storm Manhole	Concrete	4	Each	$7,224	$28,896	$2,890	$8,669	$4,334	$50,000
	Supply and install 1050 mm dia. Sanitary Manhole	Concrete	4	Each	$7,224	$28,896	$2,890	$8,669	$4,334	$50,000
	Top Inlet Catch Basin c/w CB Lead	Concrete	4	Each	$5,681	$20,336	$2,034	$6,101	$3,050	$40,000
	Service Connection (Sanitary)	PVC	14	Lump Sum	$4,295	$60,123	$6,012	$18,037	$9,018	$100,000
	Service Connection (Storm)	PVC	14	Lump Sum	$5,072	$71,001	$7,100	$21,300	$10,650	$120,000
	Road Restoration - Asphalt	Asphalt	370	Metres	$147	$54,390	$5,439	$16,317	$8,159	$90,000
					Project 14 Sub-Total:	**$523,873**	**$52,387**	**$157,162**	**$78,581**	**$860,000**
					Total:	**$9,870,878**	**$987,088**	**$2,961,264**	**$1,480,632**	**$15,840,000**

Assumptions:

All proposed sanitary mains estimated as SDR 28 PVC sewer pipe buried 1.2 m deep (approx. MMCD minimum), including excavation, bedding, and import backfill.

All proposed sanitary mains estimated as SDR 28 PVC sewer pipe buried 1.2 m deep (approx. MMCD minimum), including excavation, bedding, and import backfill.

Asphalt road restoration is estimated to be 2m wide restoration above the pipe trench. Full road restoration is not included in the estimate.

Sanitary Mains are assumed to be replaces along the same alignment as existing combined sewers

Proposed Storm Main alignments are conceptual in nature. Detail design May update alignments and quantities.

Catch basins are estimated at an assumed spacing of one catch basin on each side of the street every 100m

Rock removal has not been included in the estimates

General conditions include Mobilization/Demobilization, Traffic control, Environmental Protection; Erosion and Sediment Control, Survey, and Record Drawings

Costs are representative of 2024

The final total cost of each project has been rounded to the nearest $10,000

This cost estimate is class D as defined by Appendix A of EGBC's Budget Guidelines for Consulting Engineering Services

APPENDIX F
MOE DISCHARGE PERMITS (PE-0189 (1997) AND PE-0189 (2019))

BRITISH COLUMBIA

MINISTRY OF ENVIRONMENT
LANDS AND PARKS

[illegible] Region
Pollution Prevention
2080-A Labieux Road
Nanaimo, British Columbia
V9T 6J9
Telephone: (250) 751-3100
Fax: (250) 751-3103

PERMIT

PE-00197

Under the Provisions of the Waste Management Act

Village of Cumberland

PO Box 340

Cumberland, British Columbia

V0R 1S0

is authorised to discharge effluent to Maple Lake Creek which is a tributary to the Trent River from a municipal wastewater treatment system located in the Village of Cumberland, British Columbia, subject to the conditions listed below. Contravention of any of these conditions is a violation of the Waste Management Act and may result in prosecution.

1. AUTHORISED DISCHARGES

1.1 This subsection applies to the discharge of effluent from a **MUNICIPAL COLLECTION AND TREATMENT SYSTEM SERVING THE VILLAGE OF CUMBERLAND.** The site reference number for this discharge is E100753.

1.1.1 The authorized rate of discharge based on an annual averaging period is 910 m^3/d.

1.1.2 The maximum authorized rate of discharge of domestic sewage and stormwater is 7,600 m^3/d.

After September 1, 2015, the authorized maximum rate of discharge of domestic sewage and stormwater is 2710 m^3/d.

J.O. Finnie, P.Eng.
Assistant Regional Waste Manager

Date Issued: August 25, 1967
Date Amended:
(most recent) DEC 03 1997

1.1.3 The characteristics of the discharge shall not exceed:

5-Day Biochemical Oxygen Demand	- 30 mg/L
Total Suspended Solids	- 60 mg/L

After May 1, 1999, the characteristics of the discharge shall not exceed:

5-Day Biochemical Oxygen Demand	- 30 mg/L
Total Suspended Solids	- 30 mg/L
Faecal Coliform bacteria	- 200 MPN/100 ml (Maximum)
Total Phosphorus	- 1.0 mg/L

1.1.4 The authorised works are mechanical screens, an aerated lagoon, a stabilization pond, and related appurtenances approximately located as shown on attached Site Plan A.

After May 1, 1999, the authorized works are to include disinfection and nutrient removal facilities or alternate disposal methods.

1.1.5 The authorised works must be complete and in operation on and from the date of this amended permit or as otherwise indicated in Subsection 1.1.4.

1.1.6 The location of the facilities from which the discharge originates is Lot A, Plan 23092, District Lot 24, Nelson Land District..

1.1.7 The location of the point of discharge is Maple Lake Creek..

2. GENERAL REQUIREMENTS

2.1 Maintenance of Works and Emergency Procedures

The permittee shall inspect the authorised works regularly and maintain them in good working order. In the event of an emergency or condition beyond the control of the permittee which prevents effective operation of the approved method of pollution control, the permittee shall notify the Regional Waste Manager immediately and take appropriate remedial action.

2.2 Bypasses

The permittee shall ensure that no waste is discharged without being processed through the authorised works unless prior written approval is received from the Regional Waste Manager.

J.O. Finnie, P.Eng.
Assistant Regional Waste Manager

2.3 Process Modifications

The permittee shall have prior written approval from the Regional Waste Manager, prior to implementing changes to the authorised works or to any process that may affect the quality and/or quantity of the discharge.

2.4 Plans - New Works

Plans and specifications of the disinfection facilities and the nutrient reduction facilities authorised in Subsection 1.1.4 shall be certified by a qualified professional licensed to practice in the Province of British Columbia, and submitted to the Regional Waste Manager for review before construction commences. A qualified professional licensed to practice in the Province of British Columbia must certify that the works have been constructed in accordance with the submitted plans.

2.5 Posting Requirements

The permittee shall erect signs along the alignment of Maple Lake Creek at all recognized access points to the Creek and at all road crossings and at the confluence with the Trent River. The signs shall identify the Creek as containing treated sewage effluent and should warn the public that the water is not safe for drinking purposes or personal contact. The wording , size and locations of signs requires the approval of the Regional Waste Manager. The signs must be erected on or before March 31, 1998.

2.6 Standby Power

The Permittee shall provide auxiliary power facilities to insure the continuous operation of the sewage treatment plant.

2.7 Sludge Wasting and Screenings Disposal

Sludge and screenings from the treatment plant shall be disposed of in a manner authorised by the Regional Waste Manager.

2.8 Effluent Upgrading

Based on receiving environment monitoring data and/or other information obtained in connection with this discharge, the permittee may be required to provide additional treatment facilities.

2.9 Disinfection

Disinfection of the effluent is required by May 1, 1999. If disinfection is by chlorination, dechlorination facilities will also be required.

J.O. Finnie, P.Eng.
Assistant Regional Waste Manager

2.10 Odour

Should objectionable odours, attributable to the operation of the sewage treatment plant occur beyond the property boundary, or attributable to the effluent in Maple Lake Creek or the Trent River, as determined by the Regional Waste Manager, measures or additional works will be required to reduce the odour to acceptable levels.

2.11 Foam

Should objectionable amounts of foam, attributable to the effluent, occur on the receiving waters, measures will be required to either eliminate the cause of the foam or to eliminate the foam by additional treatment.

2.12 Facility Classification and Operator Certification

The permittee shall have the works authorised by this permit classified (and the classification shall be maintained) by the Environmental Operators Certification Program Society (Society). The works shall be operated and maintained by persons certified within and according to the program provided by the Society. Certification must be completed to the satisfaction of the Regional Waste Manager. In addition, the Regional Waste Manager shall be notified of the classification level of the facility and certification level of the operators, and changes of operators and/or operator certification levels within 30 days of any change.

Alternatively, the works authorised by this permit shall be operated and maintained by persons who the permittee can demonstrate to the satisfaction of the Regional Waste Manager, are qualified in the safe and proper operation of the facility for the protection of the environment.

2.13 Land Requirements

The Permittee shall secure and hold in reserve sufficient land to allow for future expansion and upgrading of the sewage treatment facilities.

2.14 Liquid Waste Management Planning

The Regional District of Comox-Strathcona is developing a Liquid Waste Management Plan that may include the Cumberland area. Notwithstanding the terms and conditions of this permit, the authorized discharge is subject to the provisions of the Liquid Waste Management Plan once approved by the Minister.

J.O. Finnie, P.Eng.
Assistant Regional Waste Manager

If the regional district plan does not incorporate the Cumberland area or if the plan is not progressing satisfactorily, as determined by the Regional Waste Manager, then the Permittee shall undertake the following activities:

Source Control Program
Stormwater Management Plan
Sludge Wasting and Screening Disposal and Biosolids Management Plan
Inflow and Infiltration Control Program
Sanitary and Storm Sewer Separation Plan

Terms of reference, development schedules and implementation timetables for the above activities shall be submitted to the Regional Waste Manager by December 31, 1999 for approval and shall be implemented as directed by the Regional Waste Manager.

3. MONITORING AND REPORTING REQUIREMENTS

3.1 Discharge Monitoring

3.1.1 Flow Measurement

Provide and maintain a suitable flow measuring device and record once per day the effluent volume discharged over a 24-hour period.

3.1.2 Sampling And Analyses

The permittee shall install a suitable sampling facility and obtain a grab sample of the effluent once every month.

Obtain analyses of the sample for the following:

5 - Day Biochemical Oxygen Demand
Total Suspended Solids
Faecal Coliform
Total Phosphorus
Ammonia Nitrogen

J.O. Finnie, P.Eng.
Assistant Regional Waste Manager

In addition, the permittee shall obtain a grab sample of the effluent once per year and obtain analysis of the sample for the following:

Aluminium (total);	Manganese (dissolved);
Arsenic (total);	Methlene Blue Active Substances;
Barium (dissolved);	Mercury (total);
Boron (dissolved);	Molybdenum (total);
Chromium (total);	Nickel (total);
Cadmium (dissolved);	Oil and Grease;
Copper (total and dissolved);	Selenium (Total);
Cobalt (dissolved);	Silver (total);
Cyanide (total);	Sulphate (dissolved);
Iron (dissolved);	Sulphide (dissolved);
Lead (total);	Tin (total); and
Toxicity (LC_{50}) – Federal lab	Zinc (total)

3.2 Receiving Environment Monitoring

Beginning January 1, 1998 the Permittee shall conduct a receiving environment monitoring program that will consist of monitoring of Maple Lake Creek and Trent River at the following locations.

Location	Seam Site
Maple Lake Creek, 100m upstream from confluence	0140124
Trent River, 100 m upstream from confluence	0127581
Trent River, 100m downstream from confluence	0127582
Trent River, 400 m downstream from confluence	E227350

Water samples will be collected in the months of March, May, July, September, and November and analyzed for pH, temperature, dissolved oxygen, specific conductance, faecal coliform, ammonia nitrogen, nitrite and nitrate nitrogen, total phosphorus and ortho-phosphate.

During the months of May, July and September each year, the Permittee will also undertake a monitoring program for chlorophyll a on the Trent River at three locations (100 m upstream from, and 100 m and 400 m downstream from the confluence with Maple Lake Creek)

Based on the results of this monitoring program, the permittee monitoring requirements may be extended or altered by the Regional Waste Manager

J.O. Finnie, P.Eng.
Assistant Regional Waste Manager

3.3 Sampling and Analytical Procedures

Flow Measurement shall be carried out in accordance with the procedures described in "Field Criteria for Sampling Effluents and Receiving Waters", April 1989, or by suitable alternative procedures as authorised by the Regional Waste Manager.

Copies of the above manual are may be purchased from the Pollution Prevention Division, Ministry of Environment, Lands and Parks, PO Box 9342, Stn. Prov. Govt. Victoria, British Columbia, V8W 9M1. The manual is also available for review at all Pollution Prevention Offices.

Sampling shall be carried out in accordance with the procedures described in the "British Columbia Field Sampling Manual for Continuous Monitoring Plus the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment, and Biological Samples. 1996 Edition (Permittee)", or by suitable alternative procedures as authorised by the Regional Waste Manager.

Analyses are to be carried out in accordance with procedures described in the "British Columbia Environmental Laboratory Manual for the Analysis of Water, Wastewater, Sediment and Biological Materials (March 1994 Permittee Edition)", or by suitable alternative procedures as authorised by the Regional Waste Manager.

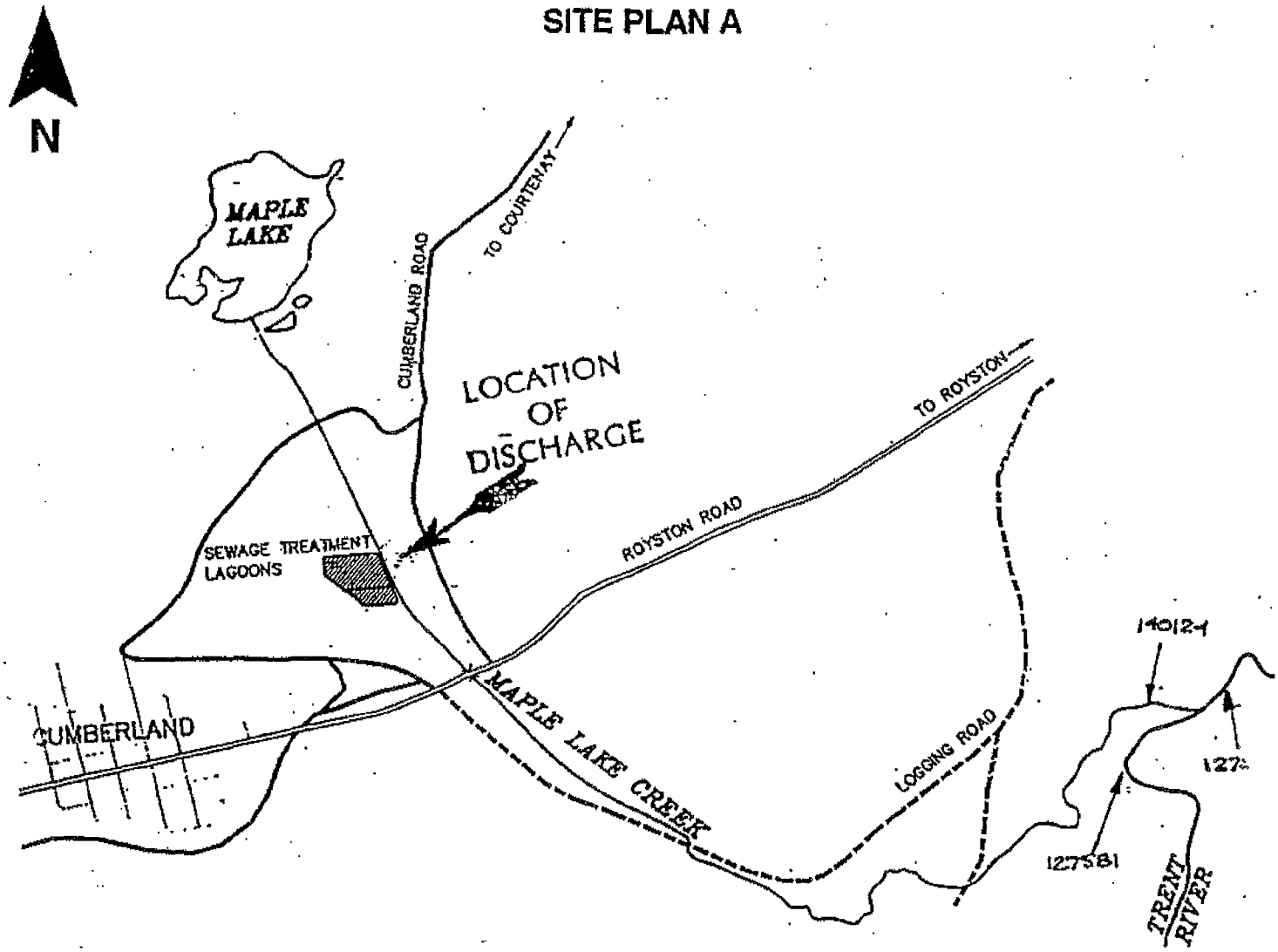
Copies of the above manuals may be purchased from the Queen's Printer Publications Centre, P. O. Box 9452, Stn. Prov. Gov't. Victoria, British Columbia, V8W 9V7 (1-800-663-6105 or (250) 387-6409), and are also available for inspection at all Pollution Prevention offices.

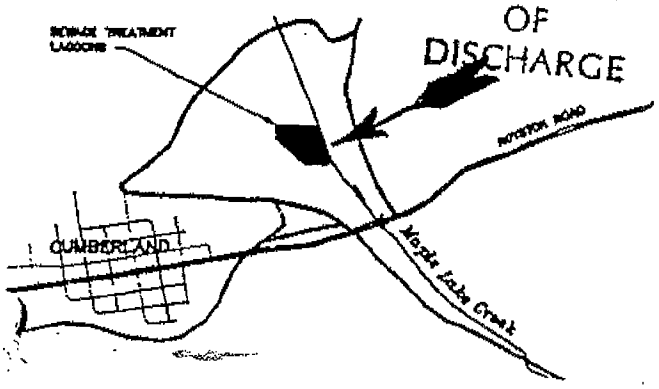
3.4 Reporting

Maintain data of analyses and flow measurements for inspection and every three months submit the data, suitably tabulated, to the Regional Waste Manager for the previous ~~week~~ quarter. The first report is to be submitted by March 31, 1998. Based on the results of the monitoring program, the permittee monitoring requirements may be extended or altered by the Regional Waste Manager.

J.O. Finnie, P.Eng.
Assistant Regional Waste Manager

SITE PLAN A





Scale: Not to Scale

Permit: PE-00197

Date:

DEC 03 1997

J. O. Finnie
Assistant Regional Waste Manager
Vancouver Island Region

September 16, 2019

Tracking Number: 372248
Authorization Number: 197

REGISTERED MAIL

The Corporation of the Village of Cumberland
Box 340 Cumberland
British Columbia
V0R 1S0

Dear Permittee:

Enclosed is Amended Permit 197 issued under the provisions of the *Environmental Management Act*. Your attention is respectfully directed to the requirements outlined in the permit. An annual fee will be determined according to the Permit Fees Regulation.

This permit does not authorize entry upon, crossing over, or use for any purpose of private or Crown lands or works, unless and except as authorized by the owner of such lands or works. The responsibility for obtaining such authority rests with the Permittee. This permit is issued pursuant to the provisions of the *Environmental Management Act* to ensure compliance with Section 120(3) of that statute, which makes it an offence to discharge waste, from a prescribed industry or activity, without proper authorization. It is also the responsibility of the Permittee to ensure that all activities conducted under this authorization are carried out with regard to the rights of third parties, and comply with other applicable legislation that may be in force.

This decision may be appealed to the Environmental Appeal Board in accordance with Part 8 of the *Environmental Management Act*. An appeal must be delivered within 30 days from the date that notice of this decision is given. For further information, please contact the Environmental Appeal Board at (250) 387-3464.

Ministry of Environment and Climate Change Strategy
Environmental Protection Division
1259 Dalhousie Dr.
Kamloops BC V2C 5Z5
Authorizations - South Region
Telephone: (250) 371-6200
Facsimile: (250) 828-4000

Administration of this permit will be carried out by staff from the Environmental Protection Division's Regional Operations Branch. Plans, data and reports pertinent to the permit are to be submitted by email or electronic transfer to the Director, designated Officer, or as further instructed.

Yours truly,



Bryan Vroom
for Director, *Environmental Management Act*
Authorizations - South Region

MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

PERMIT

197

Under the Provisions of the Environmental Management Act

THE CORPORATION OF THE VILLAGE OF CUMBERLAND
2934 Ulverston Avenue,
Cumberland, BC,
V0R 1S0

is authorized to discharge effluent to Maple Lake Creek which is a tributary to the Trent River from a municipal wastewater treatment system located in the Village of Cumberland, British Columbia, subject to the requirements listed below. Contravention of any of these requirements is a violation of the *Environmental Management Act* and may lead to prosecution.

This permit supersedes and replaces all previous versions of Permit 197 issued under Section 14 of the *Environmental Management Act.*

Capitalized terms referred to in this authorization are defined in the attached Glossary. Other terms used in this authorization have the same meaning as those defined in the *Environmental Management Act* and applicable regulations.

Where this authorization provides that the Director may require an action to be carried out, the Permittee must carry out the action in accordance with the requirements of the Director.

Date issued: August 25, 1967
Date amended: September 16, 2019
(most recent)

Bryan Vroom
for Director, *Environmental Management Act*
Authorizations - South Region

1. AUTHORIZED DISCHARGES

1.1 Authorized Source

This section applies to the discharge of effluent from a **MUNICIPAL COLLECTION AND TREATMENT SYSTEM**. The site reference number for this discharge is E100753.

1.1.1 The maximum authorized Average Dry Weather Flow is 1,000 cubic metres per day.

1.1.2 The maximum authorized rate of discharge is 2,710 cubic meters per day.

1.1.3 The characteristics of the discharge must be equivalent to or better than:

5-day biochemical oxygen demand, 30 mg/L

Total suspended solids (non-filterable residue), 30 mg/L

Fecal Coliform, 200 MPN/100mL

Total Phosphorus, 1 mg/L

1.1.4 The Authorized Works are mechanical screens, an aerated lagoon, a stabilization pond, disinfection and nutrient removal facilities (or alternate disposal methods) and related appurtenances approximately located as shown on the Site Plan.

1.1.5 The Permittee must not discharge under this authorization unless the Authorized Works are complete and fully operational.

1.1.6 The location of the facilities from which the discharge is authorized to originate is Lot A, Plan 23092, District Lot 24, Nelson Land District.

The location of the point where the discharge is authorized to occur is Maple Lake Creek.

Date issued: August 25, 1967
Date amended: September 16, 2019
(most recent)



Bryan Vroom
for Director, *Environmental Management Act*
Authorizations - South Region

2. GENERAL REQUIREMENTS

2.1 Maintenance of Works and Emergency Procedures

The Permittee must regularly inspect the Authorized Works and maintain them in good working order.

In the event of an emergency or condition beyond the control of the Permittee which prevents effective operation of the Authorized Works or leads to an unauthorized discharge, the Permittee must take remedial action to restore the effective operation of the Authorized Works and to prevent any unauthorized discharges. The Permittee must immediately report the emergency or condition and the remedial action that has and will be taken to the RAPP line (1-877-952-7277, #7277 from mobile phone) or electronically at this link: http://www.env.gov.bc.ca/cos/rapp/form.html.

The Director may require the Permittee to reduce or suspend operations until the Authorized Works have been restored, and/or corrective steps have been taken to prevent unauthorized discharges.

2.2 Bypasses

The Permittee must not allow any discharge authorized by this authorization to bypass the Authorized Works, except with the prior written approval of the Director.

2.3 Plans - Works

The Permittee must ensure the plans and specifications of the works described in Subsection 1.1.4 of the definition of Authorized Works are certified by a Qualified Professional and are submitted to the Director for review before construction commences. The Permittee must cause a Qualified Professional to certify that the works have been constructed in accordance with the submitted plans.

2.4 Standby Power

The Permittee must provide auxiliary power facilities to ensure continuous operation of the Authorized Works during power outages.

Date issued: August 25, 1967
Date amended: September 16, 2019
(most recent)

Bryan Vroom
for Director, *Environmental Management Act*
Authorizations - South Region

2.5 Odour Control

Should objectionable odours, attributable to the operation of the Facility, occur beyond the property on which the Facility is located, the Permittee must undertake measures or additional works to reduce odour to acceptable levels.

2.6 Posting of Outfall

The Permittee must erect and maintain signage along the alignment of Maple Lake Creek at all recognized access points to the Creek and at all road crossings and at the confluence with the Trent River. The signs must identify the nature of the works and warn the public that the water is not safe for drinking purposes or personal contact. The Permittee must confirm whether the wording and size of the sign is acceptable to the Director prior to installing the sign.

2.7 Treatment Plant Sludge Wasting and Disposal

The Permittee must dispose of sludge wasted from the treatment plant at a site and in a manner approved by the Director, or as authorized by regulation under the *Environmental Management Act*.

2.8 Effluent Upgrading

Based on the receiving environment monitoring data and other information obtained in connection with this discharge, the Permittee may be required to provide additional treatment facilities.

2.9 Foam

Should foam, attributable to the effluent, become objectionable in receiving waters as determined by the Director, the Director may require the Permittee to carry out additional treatment to remove the foam or eliminate the cause of the foam on a timeline specified by the Director.

Date issued: August 25, 1967
Date amended: September 16, 2019
(most recent)



Bryan Vroom
for Director, *Environmental Management Act*
Authorizations - South Region

2.10 Facility Classification and Operator Certification

The Permittee, in a manner and on timelines specified by the Director, must have the Authorized Works classified (and the classification must be maintained) by the Environmental Operators Certification Program Society (Society). The Permittee must cause the Authorized Works to be operated and maintained by:

a. persons certified within and according to the program provided by the Society to the satisfaction of the Director, or

b. persons who are qualified in the safe and proper operation of the facility for the protection of the environment, as demonstrated to the satisfaction of the Director.

The Permittee must notify the Director of the classification level of the facility and certification levels of the operators, and changes of operators and/or operator certification levels within 30 days of any change.

2.11 Land Requirements

The Permittee must secure and hold in reserve sufficient land to allow for future expansion and upgrading of the sewage treatment facilities.

2.12 Liquid Waste Management Planning

The Village of Cumberland is developing a Liquid Waste Management Plan. Notwithstanding the terms and conditions of Permit 197, the authorized discharge is subject to the provisions of the Liquid Waste Management Plan once approved by the Minister.

If the Director determines that the plan is not progressing satisfactorily, then the Permittee must undertake the following activities:

Source Control Program
Stormwater Management Plan
Sludge Wasting, Screening Disposal and Biosolids Management Plan
Inflow and Infiltration Control Program
Sanitary and Storm Sewer Separation Plan

Date issued: August 25, 1967
Date amended: September 16, 2019
(most recent)

Bryan Vroom
for Director, *Environmental Management Act*
Authorizations - South Region

Terms of reference, development schedules and implementation timetables for the above activities must be submitted to the Director for approval and must be implemented as directed by the Director.

3. MONITORING REQUIREMENTS

3.1 Sampling Procedures

The Permittee must carry out sampling in accordance with the procedures described in the "British Columbia Field Sampling Manual for Continuous Monitoring and the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment, and Biological Samples, 2013 Edition (Permittee)" or most recent edition, or by alternative procedures as authorized by the Director.
A copy of the above manual is available on the Ministry web page at www.env.gov.bc.ca/epd/wamr/labsys/lab_meth_manual.html.

3.2 Analytical Procedures

The Permittee must carry out analyses in accordance with procedures described in the "British Columbia Laboratory Manual (2015 Permittee Edition)", or the most recent edition or by alternative procedures as authorized by the Director.
A copy of the above manual is available on the Ministry web page at: www.env.gov.bc.ca/epd/wamr/labsys/lab_meth_manual.html.

Date issued: August 25, 1967
Date amended: September 16, 2019
(most recent)

Bryan Vroom
for Director, *Environmental Management Act*
Authorizations - South Region

3.3 Grab Sampling

The Permittee must install and maintain a suitable sampling facility. The Permittee must obtain a grab sample of the effluent authorized by Section 1 once a month and obtain analyses of the sample for the following parameters:

5-day biochemical oxygen demand, mg/L
Total suspended solids (non-filterable residue), mg/L
Faecal coliform, MPN/100 ml
Total phosphorus, mg/L
Ammonia nitrogen, mg/L

In addition, the Permittee must obtain a grab sample of the effluent once per year and obtain analysis of the sample for the following:

Aluminium (total)	Manganese (dissolved)
Arsenic (total)	Methlene Blue Active Substances
Barium (dissolved)	Mercury (total)
Boron (dissolved)	Molybdenum (total)
Chromium (total)	Nickel (total)
Cadmium (dissolved)	Oil and Grease
Copper (total and dissolved)	Selenium (total)
Cobalt (dissolved)	Silver (total)
Cyanide (total)	Sulphate (dissolved)
Iron (dissolved)	Sulphide (dissolved)
Lead (total)	Tin (total)
Toxicity (LC_{50})	Zinc (total)

The Permittee must take due care in sampling, storing and transporting the samples to control temperature and avoid contamination, breakage, and any other factor or influence that may compromise the integrity of the samples.

3.4 Flow Measurement

The Permittee must install and maintain a suitable to the Director, flow measuring device, and record once per day the effluent volume discharged over a 24-hour period. The Permittee must retain the records for inspection by Ministry staff.

Date issued: August 25, 1967
Date amended: September 16, 2019
(most recent)



Bryan Vroom
for Director, *Environmental Management Act*
Authorizations - South Region

3.5 Receiving Environment Monitoring

The Permittee must carry out a receiving environment monitoring program in the months of March, May, July, September, and November of each year. The program must consist of sampling events during the months listed above at the following sites:

- Maple Lake Creek, 100 meters upstream from the confluence with the Trent River (seam site: 0140124).
- Trent River, 100 meters upstream from the confluence with Maple Lake Creek (seam site: 0127581).
- Trent River, 100 meters downstream from the confluence with Maple Lake Creek (seam site: 0127582).
- Trent River, 400 meters downstream from the confluence with Maple Lake Creek (seam site: E227350).

The samples must be analyzed for the following parameters:

pH	Ammonia nitrogen
Temperature	Nitrite and nitrate nitrogen
Dissolved oxygen	Total phosphorus
Specific conductance	Ortho-phosphate
Faecal coliform	

During the months of May, July and September of each year, the Permittee must also undertake a monitoring program for chlorophyll a at the three Trent River sites listed above.

Based on the results from the analyses of the above samples, the Director may extend or alter the monitoring requirements of the Permittee.

Date issued: August 25, 1967
Date amended: September 16, 2019
(most recent)

Bryan Vroom
for Director, *Environmental Management Act*
Authorizations - South Region

4. REPORTING REQUIREMENTS

4.1 Quarterly Reporting

The Permittee must collect and maintain data of analyses and flow measurements required under this authorization for inspection when requested by Ministry staff. Every three months, the Permittee must submit the data for the previous week to the Director in a form satisfactory to the Director. Based on the results of the monitoring program, the monitoring requirements may be extended or altered by the Director.

The Permittee must submit all data required to be submitted under this section by email to the Ministry's Routine Environmental Reporting Submission Mailbox (RERSM) at EnvAuthorizationsReporting@gov.bc.ca or as otherwise instructed by the Director. For guidelines on how to properly name the files and email subject lines or for more information visit the Ministry website:

http://www2.gov.bc.ca/gov/content/environment/waste-management/waste-discharge-authorization/data-and-report-submissions/routine-environmental-reporting-submission-mailbox

4.2 Non-compliance Reporting and Exceedances

If the Permittee fails to comply with any of the requirements of this authorization, the Permittee must, every three months, submit to the Director a written report that is satisfactory to the Director and includes, but is not necessarily limited to, the following:

a. a statement outlining the number of exceedances of permitted discharges that occurred during the reporting period,

b. the dates of each such exceedance,

c. all relevant test results obtained by the Permittee related to the noncompliance,

d. an explanation of the most probable cause(s) of the noncompliance, and

e. a description of remedial action planned and/or taken by the Permittee to prevent similar noncompliance(s) in the future.

Date issued: August 25, 1967
Date amended: September 16, 2019
(most recent)

Bryan Vroom
for Director, *Environmental Management Act*
Authorizations - South Region

If no exceedances occurred over the reporting period, the required statement may instead indicate that no exceedance of permitted discharges occurred during the reporting period.

The Permittee must submit all non-compliance reporting required to be submitted under this section by email to the Ministry's Compliance Reporting Submission Mailbox (CRSM) at EnvironmentalCompliance@gov.bc.ca and to the Ministry's Routine Environmental Reporting Submission Mailbox (RERSM) at EnvAuthorizationsReporting@gov.bc.ca or as otherwise instructed by the Director. For guidelines on how to report a non-compliance or for more information visit the Ministry website:

http://www2.gov.bc.ca/gov/content/environment/waste-management/waste-discharge-authorization/data-and-report-submissions/non-compliance-reporting-mailbox

4.3 Spill Reporting

The Permittee must immediately report all spills to the environment (as defined in the Spill Reporting Regulation) in accordance with the Spill Reporting Regulation, which among other things, requires notification to Emergency Management BC at 1-800-663-3456.

4.4 Licence to Publish Documents

a. Subject to paragraph b, the Permittee authorizes the Province to publish on the Ministry of Environment website the entirety of any Regulatory Document.

b. The Province will not publish any information that could not, if it were subject to a request under section 5 of the Freedom of Information and Protection of Privacy Act, be disclosed under that Act.

c. The Permittee will indemnify and save harmless the Province and the Province's employees and agents from any claim for infringement of copyright or other intellectual property rights that the Province or any of the Province's employees or agents may sustain, incur, suffer or be put to at any time that arise from the publication of a Regulatory Document.

Date issued: August 25, 1967
Date amended: September 16, 2019
(most recent)

Bryan Vroom
for Director, *Environmental Management Act*
Authorizations - South Region

GLOSSARY

"Authorized Works" means mechanical screens, an aerated lagoon, a stabilization pond, disinfection and nutrient removal facilities (or alternate disposal methods) and related appurtenances approximately located as shown on the Site Plan and as stated in Section 1.1.4.

"Average Dry Weather Flow" means the daily municipal wastewater flow to a wastewater facility that occurs after an extended period of dry weather such that the inflow and infiltration has been minimized to the greatest extent practicable. It is calculated by dividing the total flow to the wastewater facility during the dry weather period by the number of days in that period.

"Facility" means a municipal wastewater treatment system located in the Village of Cumberland, British Columbia

"Qualified Professional" means an applied scientist or technologist specializing in an applied science or technology applicable to the duty or function, including, if applicable and without limiting this, agrology, biology, chemistry, engineering, geology or hydrogeology and who

i. is registered with the appropriate professional organization, is acting under that organization's code of ethics and is subject to disciplinary action by that organization, and

ii. through suitable education, experience, accreditation and/or knowledge, may be reasonably relied on to provide advice within their area of expertise.

All documents submitted to the Director by a Qualified Professional must be signed by the author(s).

"Province" means Her Majesty the Queen in right of British Columbia;

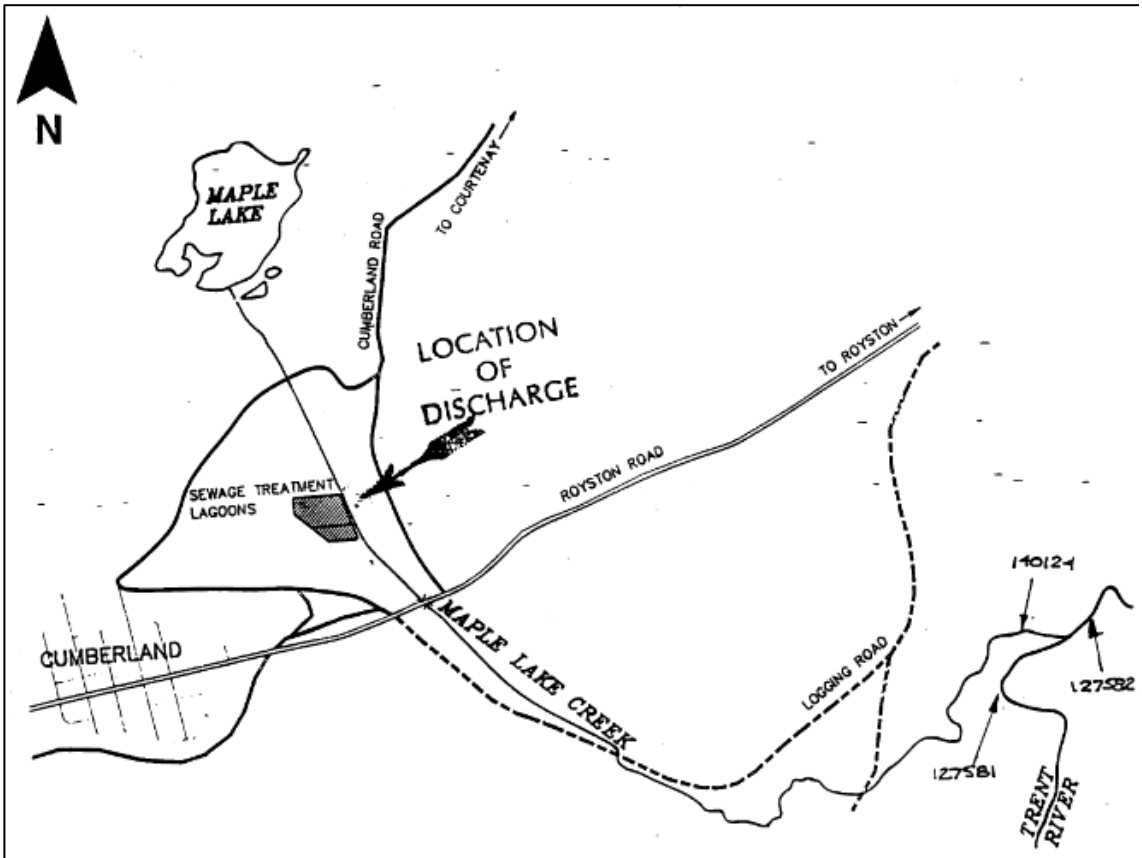
"Regulatory Document" means any document that the Permittee is required to provide to the Director or the Province pursuant to: (i) this authorization; (ii) any regulation made under the *Environmental Management Act* that regulates the facility described in this authorization or the discharge of waste from that facility; or (iii) any order issued under the *Environmental Management Act* directed against the Permittee that is related to the facility described in this authorization or the discharge of waste from that facility.

Date issued: August 25, 1967
Date amended: September 16, 2019
(most recent)



Bryan Vroom
for Director, *Environmental Management Act*
Authorizations - South Region

SITE PLAN



Scale: Not to Scale

Permit: PE-00197

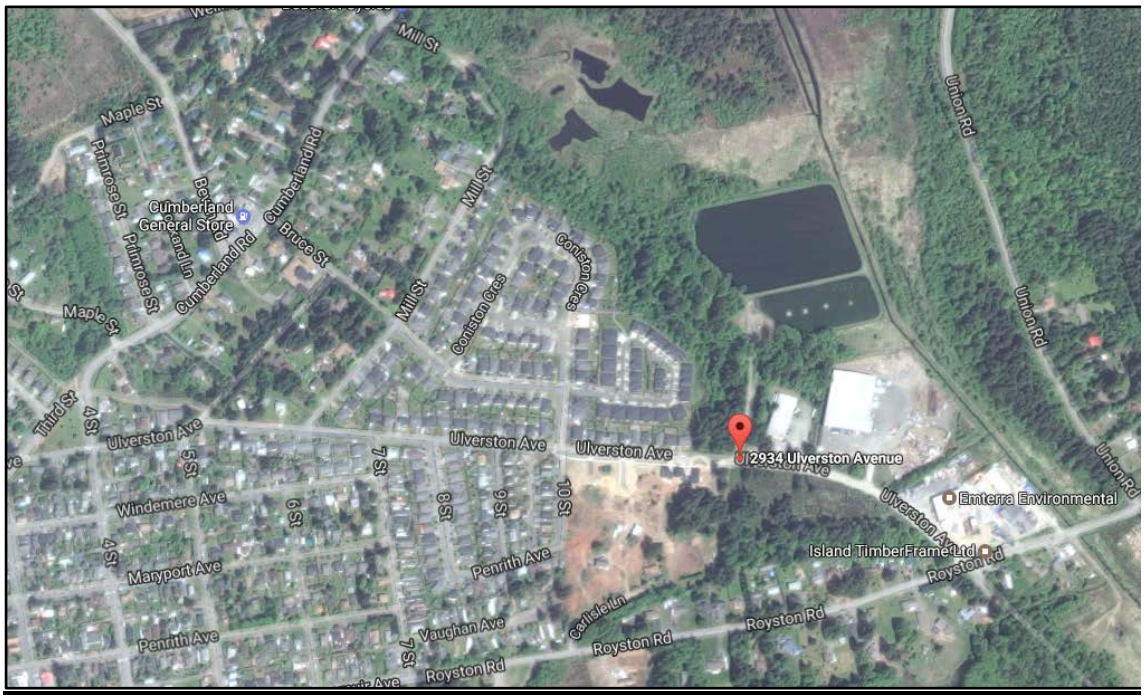
Date: DEC 03 1997

J. O. Finnie
Assistant Regional Waste Manager
Vancouver Island Region

Date issued: August 25, 1967
Date amended: September 16, 2019
(most recent)

Bryan Vroom
for Director, *Environmental Management Act*
Authorizations - South Region

LOCATION MAP



Date issued: August 25, 1967
Date amended: September 16, 2019
(most recent)

Bryan Vroom
for Director, *Environmental Management Act*
Authorizations - South Region

APPENDIX G
CLIMATE CHANGE POSTER

Achieving Climate Resiliency Takes Some Energy!

The Cumberland "High Performance Wastewater Lagoon Upgrade Project" is building in climate resiliency measures in response to BC's weather extremes of 2021.
This has led to the counter-intuitive result of increased energy use and a greater carbon footprint!

The Village of Cumberland is a fast-growing community of 4000 people on Vancouver Island, BC. It is a former coal mining village, founded in 1898, proud of its heritage and embracing its future with a strong environmental focus.



Aerated lagoon on a good day...

Project Description

The Wastewater Project is an upgrade to a lagoon system built in 1967, with improved lagoon aeration, post-lagoon nutrient removal, filtration and disinfection to meet a "10-10" effluent. Two additional features are a "biochar media reed bed" (constructed wetland) for effluent polishing to remove pharmaceuticals, and then using the treated water to maintain flow through the adjacent natural wetland area. All in all, a very innovative "re-invention" of a lagoon system.

Project cost is approx. $14M with funding from:

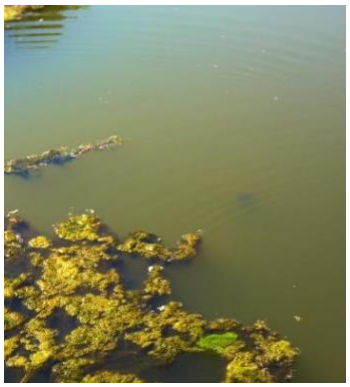
- Canada-BC Investing In Canada Infrastructure Program, $7.1M
- Federation of Canadian Municipalities Green Municipal Fund, $5.06 M
- Village of Cumberland, $ 2M

Climate Resiliency Trumps Climate Mitigation!

The original goal was to achieve ***Climate Mitigation*** by minimising energy use and GHG's by;

1. Continue using and expand the simple floating surface aeration system
2. Avoid pumping by having the post lagoon treatment as gravity flow to the wetlands

BUT…. The two extreme weather events in BC in 2021 - the June "heat dome" and November "atmospheric river" - saw record heat and flooding. This led to a rethink of the design conditions for the wastewater project, to build in ***Climate Resiliency*** to handle these new weather extremes.



Aerated lagoon during the heat dome

1. The 40 degree heat…

Led to a lagoon water temperature of 33C and the surface aerators are unable to provide adequate aeration and mixing, with the water having excess algae growth, turning anoxic and being way out of compliance for BOD and suspended solids.

This forced a design change to a subsurface diffused air system, supplied by external blowers and piped air. This will provide much better mixing and oxygenation in hot weather but doubled the electrical power of the aeration from 35 to 75hp. It will now use more energy than the rest of the treatment system put together.



Re-design for Subsurface Aeration

2. The record rain and flooding…

Saw the highest creek water levels ever observed, which flooded out the proposed post lagoon treatment area. This forced a design relocation to higher ground, which requires pumping instead of gravity flow, creating another increase in energy use. It also required clearing of a forested area that was going to be left intact.



Relocated post lagoon treatment area, before clearing



Originally planned post-lagoon treatment area, during record rain

These two changes have ***increased climate resiliency*** by ensuring the treatment system can perform, and survive, under these adverse conditions.

But it has come at a price of ***decreased climate mitigation*** by doubling the energy use of the facility, and using considerably more machinery, pipe and concrete, with their associated GHG emissions.

In consideration of the critical nature of wastewater treatment infrastructure, there is no choice but to make it resilient to these climate change induced conditions - even if it sometimes means contributing to said climate change!

CUMBERLAND
Wastewater Upgrades

APPENDIX H
DETAILED DESIGN BRIEF

McElhanney

BEST MANAGED COMPANIES
Platinum member



HIGH PERFORMANCE WASTEWATER LAGOON PROJECT

DETAILED DESIGN BRIEF

January 31, 2025

Submitted to: Village of Cumberland
Prepared by Dragan Rokic, P.Eng.

Contact
Mark DeGagne, P.Eng.
Project Manager
250-370-9221
mdegagne@mcelhanney.com

Address
500 – 3960 Quadra Street, Victoria BC Canada, V8X 4A3

Our file: 2241-24007-00

Your Challenge.
Our Passion.

Contents

1. BACKGROUND AND PURPOSE 1

2. TREATMENT PROCESS DESIGN 1

2.1. Existing Process Description 1
2.2. Wastewater Treatment Process Upgrades 5
2.3. Design Flow Rate and Loadings 8
2.4. Influent wastewater quality 9
2.5. Treatment Objectives 10

3. WWTP RELIABILITY CATEGORY 12

4. TREATMENT PROCESS DESCRIPTION 13

4.1. Treatment Components 13
4.2. Headworks 14
4.3. Screen Bypass 14
4.4. Pipeline Connection to Lagoon 15
4.5. Lagoon Baffle Curtains and Aeration Laterals 15
4.6. Lagoon Aeration System 16
4.7. Lagoon Interconnect 16
4.8. Lagoon Overflows to Maple Lake Creek (MLC) 16
4.9. Lagoon Discharge 16
4.10. SAF Lift Station 17
4.11. Suspended Air Floatation 17
4.12. Tertiary Filtration 18
4.13. Disinfection 18
4.14. Sludge Dewatering 19
4.15. Reed Bed 19

5. CIVIL WORKS 20

6. BUILDINGS 20

6.1. Operations Building 20
6.2. Workshop 21
6.3. Tent A Enclosure – Wastewater Treatment Train 21
6.4. Tent B Enclosure -Sludge Treatment Train 21
6.5. Chemical Storage 22

7. CLOSURE 22

Appendix A – Statement of Qualifications 23

Appendix B - Reed Bed & Natural Wetlands Wastewater Polishing Feasibility Study 25

TABLES

Table 1 General Site Conditions 3
Table 2 Sanitary System Historical Flow Conditions 4
Table 3 Key Wastewater Treatment Components 5
Table 4 Design Flow Rate and Loadings 8
Table 5 Influent Wastewater Characterization 9
Table 6 Average Wastewater Quality Parameter Concentrations (April 25 to September 25, 2017) 10
Table 7 Treated Effluent Water Quality Objectives 11
Table 8: BC MWR Reliability Categories (MWR, 2012) 12
Table 9: WWTP Design Features Compared to BC MWR Reliability Category I 13
Table 10 Inlet Screening System Performance Criteria 14

FIGURES

Figure 1 Village of Cumberland – Wastewater Lagoon Location and Configuration 1
Figure 2 Village of Cumberland – Existing Wastewater Lagoon Configuration 2
Figure 3 Upgraded Treatment Facility Layout 6
Figure 4 Process Schematics 7
Figure 5 Lagoon Baffle Curtains and Aeration Diffuser Layout 15
Figure 6 Reed Bed Cross Section 20
Figure 7 Operations Building Layout – Current 21
Figure 8 Operations Building Layout – Future 21

1. BACKGROUND AND PURPOSE

The Village of Cumberland (Cumberland) has embarked on a process to upgrade its wastewater treatment system. The project has been structured in two phases. The first phase requires necessary upgrades (nutrient removal and disinfection) to meet Permit requirements, as the existing lagoon treatment system is out of compliance. The second phase includes the relocation of the discharge from the creek to the adjacent wetland, development of a reed bed for effluent polishing prior to discharge to the receiving environment, and seismic improvements to the lagoons. The result of the combined phases will be a High-Performance Lagoon (HPL) system followed by secondary clarification, tertiary filtration, effluent UV disinfection, and polishing via the reed bed, thus bringing the entire treatment process up to current day standards and regulations.

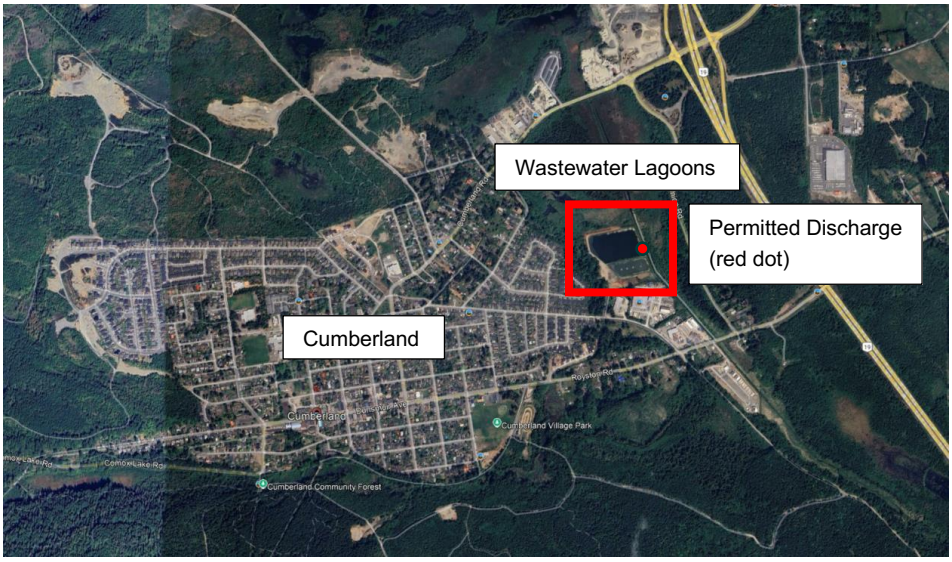
The purpose of this Detailed Design Brief is to document the key decisions made during the design process and design requirements for the Cumberland's Wastewater Treatment Plant (WWTP) upgrade works, including support facilities and components.

2. TREATMENT PROCESS DESIGN

2.1. EXISTING PROCESS DESCRIPTION

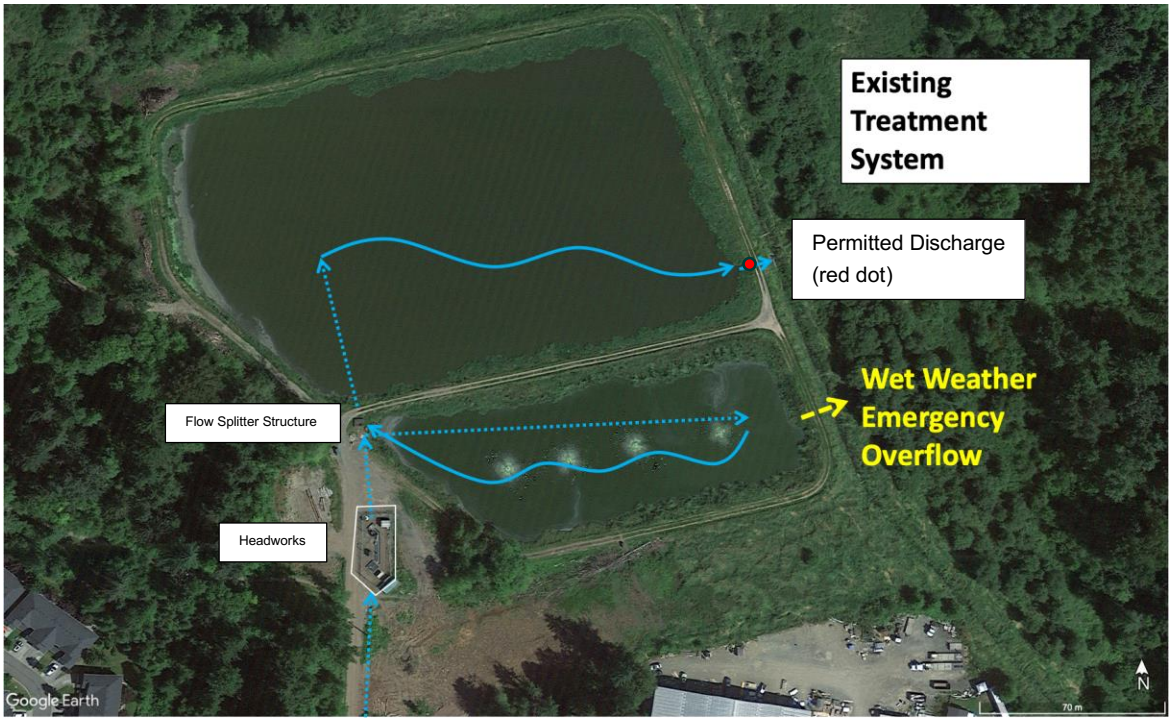
The Village of Cumberland, served by a partial combined sewer system, treats wastewater collected within the community in two wastewater treatment lagoons generating secondary effluent quality. The lagoons are located east of Cumberland and west of Highway 19 and Maple Lake Creek, as shown in Figure 1.

Figure 1 Village of Cumberland – Wastewater Lagoon Location and Configuration



The existing wastewater treatment system consists of a single headworks screen followed by a flow splitting structure that directs the incoming wastewater to a small lagoon with four (4) 5 HP surface aerators. The flow is then directed from the smaller aerated lagoon into a larger facultative lagoon which, in turn, discharges treated effluent to Maple Lake Creek over a flow measuring weir (refer to Figure 2).

Figure 2 Village of Cumberland – Existing Wastewater Lagoon Configuration



The general site conditions and lagoon geometry are summarized in Table 1.

Table 1 General Site Conditions

Site Parameter	Unit	Value
General Site Location		
Site Coordinates		49.623920, -125.010996
Ambient Temperatures (Comox Valley Airport)		
Highest Temperature (1944 – 2021)	°C	38.0 (27 June, 2021)
Lowest Temperature (1944 - 2021)	°C	-21.1 (January 1950)
Average Maximum	°C	23.0
Average Minimum	°C	13.2
Lagoon Geometry		
Bottom Elevation	m	133.85 (surveyed)
Water Surface Elevation	m	135.3 - 135.6 (normal operation) 135.3 - 135.9 (max at EWWF)
Water Depth	m	1.45-1.75 (normal operation) 1.45-2.05 (max at EWWF)
Top of Berm Elevation	m	136.0 (low point) 136.2 (highest point)
Freeboard	m	0.6 (normal operation) 0.1 (min at EWWF)
Large Lagoon Surface Area	m^2	24,700
Small Lagoon Surface Area	m^2	9,300
Large Lagoon Water Volume	m^3	39,000 (normal operation)
Small Lagoon Water Volume	m^3	14,000 (normal operation)
Total Water Volume	m^3	53,000 (normal operation)
Retention Time at 1,000 m^3/day (permitted ADWF)	days	53

Source: Environment Canada - Almanac Averages and Extremes – Comox Airport and Village of Cumberland, High Performance Wastewater Lagoon Upgrade Project, Design Basis Memorandum, Integrated Sustainability, 2021.
ADWF – Average Dry Weather Flow; EWWF – Excess Wet Weather Flow

2.1.1. Discharge Permit Status

The current discharge is authorized by the provincial government with a Discharge Permit PE-00197, initially issued in 1967 and last amended in 2019. The Discharge Permit authorizes a discharge of secondary effluent to Maple Lake Creek (MLC) and stipulates the following effluent quality:

- an Average Dry Weather Flow (ADWF) up to 1,000 m^3/d;
- Maximum Daily Flow (MDF) of 2,710 m^3/d;
- maximum $cBOD_5$ and TSS of 30 mg/L;
- Fecal Coliforms (FC) of less than 200 MPN/100 mL; and
- total phosphorus concentration of less than 1 mg-P/L.

The existing WWTP does not have treatment processes in places that specifically target phosphorus removal and effluent disinfection, thus resulting in regulatory non-compliance with the discharge permit.

2.1.2. Flow Conditions

The Cumberland sanitary sewer system dates back to the early 1900's and began as a combined storm-sanitary collection system. Most of the old combined system has been separated and replaced with major works occurring in 2017 and thereafter. However, as of 2025, there still remains approximately 18 ha of area within the village core that is on combined sewer. This area of combined sewer contributes to significant wet weather flow. Additionally, older parts of the dedicated sanitary sewer system, dating back to the 1960's, also contribute to high wet weather flows (refer to Table 2).

Table 2 Sanitary System Historical Flow Conditions

Year	Average Dry Weather Flow (m^3/day)	Maximum Day Flow (m^3/day)
2018	730	~20,000
2019	900	6,900
2020	830	7,400
2021	830	10,250
2022	830	~20,000
2023	700	10,800
2024	760	7,430

While Cumberland is expected to make continued progress on reducing peak wet weather flows, they are expected to remain high into the future. The highest flows typically only occur for one to three days at a time, but can occur several times in any given year.

A unique factor of the Cumberland system is the large lagoon area of 34,000 m^2. This means that the effluent (discharge) volume is larger than the influent volume on rainy days. Recorded peak day rain events are in the order of 100 mm, which equates to approximately 3,600 m^3 falling onto the lagoon surface.

The design future *influent* ADWF is set at 1,800 m^3/day and a nominal design wet weather multiplier of 2xADWF equates to 3,600 m^3/day. Combined with the 3,600 m^3 from rain falling on the lagoon surface, the design wet weather *effluent* (discharge) flow is then 7,200 m^3/day. The tertiary treatment capacity has been set at 7,200 m^3/day (refer to Table 4).

2.2. WASTEWATER TREATMENT PROCESS UPGRADES

The proposed wastewater treatment upgrades are designed to bring the entire treatment process up to current day standards and regulations, not just for effluent quality but also safety, redundancy, and current best engineering practice. They will be built in the same location as the existing two-cell lagoon wastewater treatment facility.

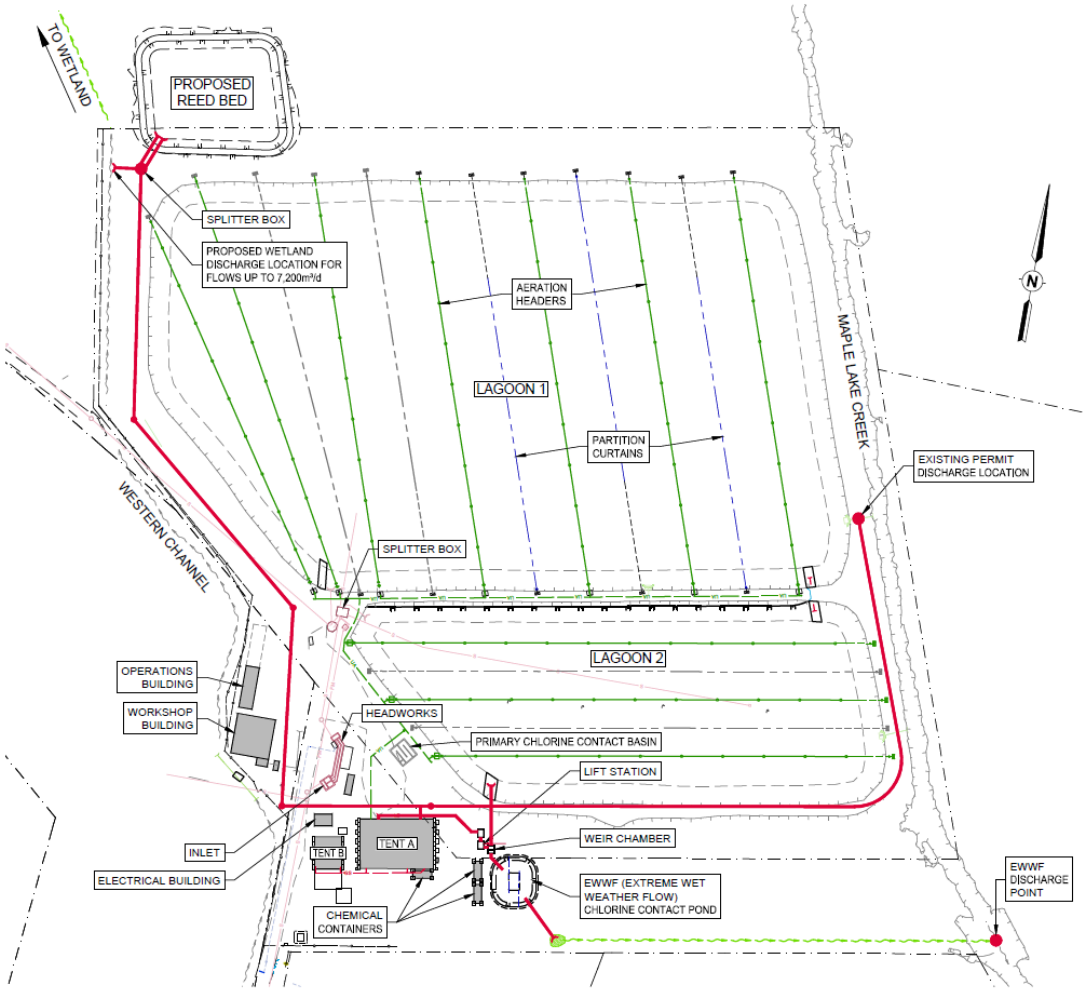
The upgraded wastewater treatment facility will consist of the key configuration components outlined in Table 3. The combination of these process components is expected to meet effluent water quality objectives outlined in Table 7.

Table 3 Key Wastewater Treatment Components

Treatment Component	Component Location
Two new headworks screens	Within the WWTP fenced area and existing screen channel
Two sequential fine-bubble aerated lagoons	Aerators are located within lagoon cells
Duplex aeration blower station	Tent A
Duplex lagoon effluent transfer lift station	Within the WWTP fenced area
Two parallel suspended-air-flotation (SAF) units for solids-liquid separation and phosphorus removal	Tent A
Two tertiary disk filters for residual solids-liquid separation and polishing phosphorus removal	Tent A
Two UV disinfection units for effluent disinfection	Tent A
Primary chlorine contact basin (future)	Within the WWTP fenced area
Excess Wet Weather Flow (EWWF) chlorine contact pond	Within the WWTP fenced area
Reed bed for polishing removal of emerging contaminants	NW of Lagon Cell 1
Two sludge dewatering bins	Tent B

The site layout is shown in Figure 3 while the treatment process is schematically illustrated in Figure 4.

Figure 3 Upgraded Treatment Facility Layout

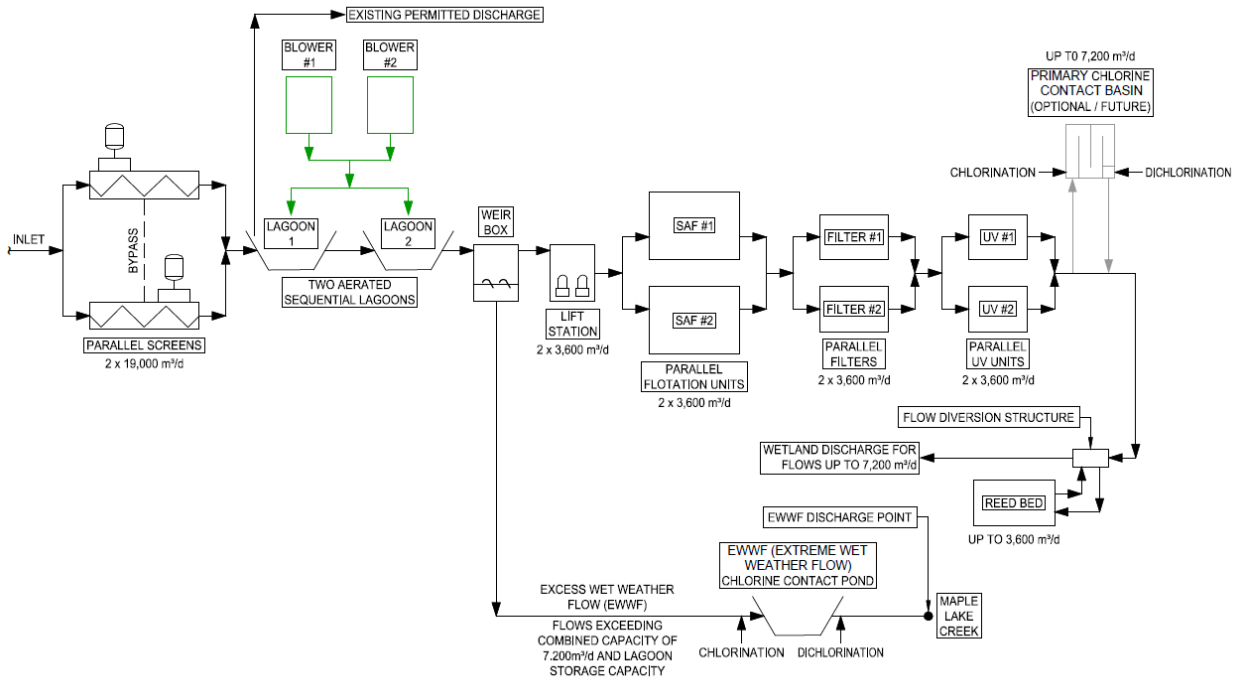


Pre-screened wastewater from the headworks will flow into partial-mix, fine-bubble aerated lagoons that operate in series for biological treatment. Daily flow up to 7,200 m^3/d that has been treated through the lagoons will be processed in two 3,600 m^3/day parallel treatment trains and pumped to two parallel Suspended Air Flotation (SAF) units and tertiary disk filters for solids removal, and subsequently to UV disinfection modules. Concurrently, a chemical coagulant will be injected ahead of the SAFs and disk filters to precipitate and remove phosphorus.

Water passing through the SAF units and disk filters will be disinfected with ultraviolet (UV) light and discharged to a natural channel located west of the WWTP site. This channel is hydraulically connected with, and discharges to, natural wetlands located on the north side of the lagoon system. Disinfected effluent flows up to 3,600 m^3/day will be passed through a reed bed during dry weather conditions prior to being used to augment flows within the surrounding wetlands.

In severe wet weather, flows exceeding the tertiary treatment capacity of 7,200 m^3/day and available wet weather lagoon storage capacity will be discharged to Maple Lake Creek via the Excess Wet Weather Flow (EWWF) basin.

Figure 4 Process Schematics



Although the existing discharge Permit only authorizes a discharge to Maple Lake Creek (MLC), Cumberland is in the process of completing a Liquid Waste Management Plan which includes an application to send the treated effluent to the adjacent wetlands for beneficial flow augmentation purposes.

2.3. DESIGN FLOW RATE AND LOADINGS

The design flow rates and loadings for the upgrade of the wastewater treatment system are summarized in Table 4.

Table 4 Design Flow Rate and Loadings

Parameter	Unit	Value
Design Population	people	8,500
Per Capita ADWF	L/c/d	210
Average Dry Weather Flow (ADWF)	m^3/day	1,800
Design Flow Rate (2 x ADWF)	m^3/day	3,600
Maximum Solids-Liquid Separation Capacity (2x3,600)	m^3/day	7,200
Maximum Tertiary Filtration Capacity (2x3,600)	m^3/day	7,200
Maximum UV Disinfection Capacity (2x3,600)	m^3/day	7,200
Minimum Design Flow Rate (with one unit/train out of service)	m^3/day	3,600
$cBOD_5$ Mass Loading (65 g/c/d x 8,500 people)	kg/day	550
TSS Mass Loading (75 g/c/d x 8,500 people)	kg/day	640
Nitrogen Mass Loading (12 g/c/d x 8,500 people)	kg/day	102
Phosphorus Mass Loading (1.5 g/c/d x 8,500 people)	kg/day	12.8
Lowest / Highest Influent Temperature	°C	8.5 / 21
Lowest / Highest Effluent Temperature	°C	3.5 / 33

Source: Village of Cumberland, High Performance Wastewater Lagoon Upgrade Project, Design Basis Memorandum, Integrated Sustainability, 2021.
ADWF – Average Dry Weather Flow; $cBOD_5$ – Carbonaceous Biochemical Oxygen Demand after 5 Days; TSS – Total Suspended Solids

All wastewaters will flow through the screens and the two aerated lagoons. The design basis is for flows up to 7,200 m^3/d to be pumped from a diversion chamber, connected to an outlet of the second aerated lagoon, to the two (2) parallel SAF solids-liquid separation unit process systems, and then flow by gravity through the remainder of the treatment components (tertiary filters and UV disinfection) to effluent discharge. Each SAF, filter, and UV disinfection unit has the capacity to process up to 3,600 m^3/d (42 L/s). A discharge point for flows up to 7,200 m^3/day is a natural channel located, and running along, the western boundary of the WWTP site (refer to Figure 3). Extreme wet weather flows through the lagoons, exceeding the combined processing capacity of 7,200 m^3/day and lagoon storage capacity, will be discharged to a localized wetland area overgrown with canary grass and eventually released to Maple Lake Creek (refer to Figure 3).

Table 4 also shows the expected influent raw-wastewater and effluent lagoon-discharge water temperatures indicating the wastewater temperature is expected to drop from about 8.5 °C to about 3.5 °C during winter and increase from 21°C to up to 33 °C during summer.

2.4. INFLUENT WASTEWATER QUALITY

The influent (raw) wastewater characterization data is summarized in Table 5.

Table 5 Influent Wastewater Characterization

Parameter	Yr 2021 (Reference)	Yr 2045 (Design)
Connected Population (people)	4,350	8,500
Temperature		
Maximum Summer Wastewater Temperature (°C)	21	21
Minimum Winter Wastewater Temperature (°C)	8.5	8.5
pH and Alkalinity		
Wastewater pH	6.5-7.5	6.5-7.5
Assumed Alkalinity (mg/L as $CaCO_3$)	min. 100	min. 100
Biochemical Oxygen Demand ($cBOD_5$)		
Per Capita Loading (g/c/day)	65	65
Average Day Loading (kg/day)	280	550
Concentration at ADWF (mg/L)	310	310
Total Suspended Solids (TSS)		
Per Capita Loading (g/c/day)	75	75
Average Day Loading (kg/day)	325	640
Concentration at ADWF (mg/L)	360	360
Total Kjeldahl Nitrogen (TKN)		
Per Capita Loading (g/c/day)	12	12
Average Day Loading (kg/day)	52	102
Concentration at ADWF (mg/L)	57	57
Total Phosphorus		
Per Capita Loading (g/c/day)	1.5	1.5
Average Day Loading (kg/day)	6.4	12.8
Concentration at ADWF (mg/L)	7.0	7.0
Grit		
Average Annual (L/1000 m^3)	40	40
Average Annual (m^3/day)	0.036	0.068
Average Annual (kg/day)	58	110
Peaking Ratio (Daily max/average annual)	2	2
Screenings		
Average Annual (L/1000 m^3)	20	20
Average Annual (m^3/day)	0.018	0.034
Average Annual (kg/day)	13	24
Peaking Ratio (Daily max/average annual)	2	2

Source: Village of Cumberland, High Performance Wastewater Lagoon Upgrade Project, Design Basis Memorandum, Integrated Sustainability, 2021.

The parameters outlined in Table 5 were used for the WWTP upgrade. They approximate or exceed the influent wastewater characterization parameters observed in the field and summarized in Table 6.

The lagoon secondary effluent characterization data is also summarized in Table 6. This data is used for design of the mechanical (advanced secondary and tertiary) treatment process components located in Tent A, i.e., the SAFs, disk filters, and UV disinfection.

Table 6 Average Wastewater Quality Parameter Concentrations (April 25 to September 25, 2017)

Location	BOD_5 (mg/L)	TSS (mg/L)	TP (mg-P/L)	Ortho-P (mg-P/L)	$NH4^+$ (mg-N/L)	E. Coli (CFU/100 mL)	FC (CFU/100 mL)
Influent	292	282	6.8	4.08	41.4	1,350,000	2,176,750
Aerated Lagoon	38	100	6.4	4.46	43.2	16,100	115,500
Final Effluent	17	49	4.7	3.5	24.6	2,692	12,618

BOD_5 – Biochemical Oxygen Demand after 5 Days; TSS – Total Suspended Solids; TP – Total Phosphorus; Ortho-P – Ortho Phosphorus; $NH4^+$ - Ammonia Nitrogen; FC – Fecal Coliforms

Information summarized in Table 6 is based on a water quality monitoring program carried out to collect data from various process locations to determine the degree of reduction of key contaminants as the wastewater flows through the lagoons. The monitoring program was conducted over a five-month period from April 25 to September 25, 2017.

2.5. TREATMENT OBJECTIVES

The overall objective is to treat up to 7,200 m^3/d through the entire wastewater treatment process (i.e., headworks, aerated lagoons, solids-liquid separation, tertiary filtration, and UV disinfection) to meet the effluent water quality requirements outlined in Table 7. Extreme wet-weather flows, exceeding the combined processing capacity of 7,200 m^3/day and lagoon storage capacity, will be screened, treated through the aerated lagoons to a secondary treatment level, disinfected using chlorine, then dechlorinated and discharged to Maple Lake Creek.

The design objective for the upgraded wastewater treatment process is to meet the current discharge Permit water quality requirements, federal Wastewater Systems Effluent Regulations (WSER) water quality requirements, and the BC Provincial Municipal Wastewater Regulations (MWR) Greater Exposure Potential (GEP) reclaimed wastewater reuse water quality requirements.

Table 7 Treated Effluent Water Quality Objectives

Parameter	Unit	Value (Permit and WSER)	Value (OC and MWR GEP)
Discharge to		MLC	Western Channel/Wetland (≤ 7,200 m^3/day); and MLC (EWWF)
Average Dry Weather Flow (ADWF)	m^3/day	1,000	1,800
Nominal Design Flow (2 x ADWF)	m^3/day		3,600
Maximum WWTP Daily Flow Capacity	m^3/day	2,710	7,200
$cBOD_5$	mg/L	≤ 25 (avg) ≤ 30 (max)	≤ 10
TSS	mg/L	≤ 25 (avg) ≤ 30 (max)	≤ 10
Total Phosphorus	mg-P/L	≤ 1	≤ 1 (Note 1)
Orthophosphate	mg-P/L)	≤ 0.5	≤ 0.5 (Note 1)
Fecal Coliforms	CFU/100mL	≤ 200	≤ 1 (median); ≤ 14 (maximum)
Turbidity	NTU	n/a	≤ 2 (avg) ≤ 5 (max)
pH		6 to 9	6.5 to 9
Un-ionized Ammonia	mg/L-N/L at 15°C	≤ 1.25 (Note 2)	≤ 1.25 (Note 2)
Effluent Toxicity – 96-hr RBT(Note 4)		Pass	Pass
Chlorine Residual	mg/L	≤ 0.02 (Note 2)	min. 0.5 (MWR GEP) (Note 3) ≤ 0.02 (Note 2)
Trent River In-stream Total Phosphorus Objective (May 1-Sep 30)	mg-P/L	n/a	≤ 0.005 (avg) ≤ 0.01 (max)

Notes:
Note 1 – Phosphorus criteria required for discharge to streams, rivers, and estuaries with dilutions greater than 10:1, or lakes with surface area greater than 100 ha, and maximum daily flows grater than 50 m^3/d.
Note 2 – Federal Fisheries Act – Wastewater Systems Effluent Regulations requirement for discharges of 100 m^3/day or more to surface water bodies.
Note 3 – MWR requirement for disinfection of reclaimed water unless the addition of chlorine will detrimentally impact aquatic flora and fauna.
Note 4 – Rainbow trout single concentration acute toxicity test in a 100% effluent concentration.
WSER - Wastewater Systems Effluent Regulations; OC – Operational Certificate; MWR – Municipal Wastewater Regulation; GEP – Greater Exposure Potential; EWWF – Excess Wet Weather Flow; ADWF – Average Dry Weather Flow; MLC - Maple Lake Creek; $cBOD_5$ – Carbonaceous Biochemical Oxygen Demand after 5 Days; TSS – Total Suspended Solids; CFU – Colony Forming Units; NTU – Nephelometric Turbidity Units; RBT – Rainbow Trout Toxicity

3. WWTP RELIABILITY CATEGORY

Part 3 of the MWR outlines three reliability categories for the design of wastewater treatment facilities with Category I being the most stringent and Category III being the least stringent. The system is classified as a Category I if a short-term degradation of the effluent over several hours could cause permanent or unacceptable damage to the receiving environment, whereas a Category II system would cause permanent or unacceptable damage if a long-term degradation in the effluent occurs over several days. Category III is for facilities that do not fall within reliability Category I or II.

Treatment systems designed to meet the requirements of Category I require duplication of treatment units and standby power. Duplication of most treatment units is also required for reliability Category II while standby power is either required or optional, under the MWR regulation. As for Reliability Category III, duplication of critical treatment units, such as disinfection, aeration blowers, and final filtration, is also required while, in general, standby power is not required with the exception of final effluent filtration.

The design requirements of each reliability category are specified in Part 3, Division 1, Section 35 of the MWR. The BC MWR Reliability Categories and equipment redundancy requirements are summarized in Table 8.

Table 8: BC MWR Reliability Categories (MWR, 2012)

	Reliability Category					
	I		II		III	
Components	Treatment System	Power Source	Treatment System	Power Source	Treatment System	Power Source
blowers or mechanical aerators	multiple units	yes	multiple units	optional	2 minimum	no
aeration basins	multiple units[b]	yes	multiple units[b]	optional	single unit	no
disinfection basins	multiple units[b]	yes	multiple units[a]	yes	multiple units[a]	no
trickling filters	multiple units[b]	yes	multiple units[b]	optional	no backup	no
primary sedimentation	multiple units[a]	yes	multiple units[a]	yes	2 minimum[a]	yes
chemical sedimentation	multiple units[b]	optional	no backup	optional	no backup	no
final sedimentation	multiple units[b]	yes	multiple units[a]	optional	2 minimum[a]	no
degritting	n/a	optional	n/a	no	n/a	no
chemical flash mixer	2 minimum or backup	optional	no backup	optional	no backup	no
flocculation	2 minimum[a]	optional	no backup	optional	no backup	no
aerobic digesters	2 minimum[a]	yes	2 minimum[a]	optional	single unit	no
anaerobic digesters	2 minimum[a]	yes	2 minimum[a]	optional	2 minimum	no
effluent filters	2 minimum[b]	yes	2 minimum[b]	yes	2 minimum[b]	yes
facultative lagoons	2 cells[b]	n/a	2 cells	n/a	2 cells	n/a
aerated lagoons	2 cells[b]	yes	2 cells	optional	2 cells	no
package treatment plants	multiple unitsb or ability to repair within 48 hours	yes	2 units or ability to repair within 48 hours	yes	single unit	no

Notes: (a) 50% of the design maximum flow where the notation “a” appears, and
(b) 75% of the design maximum flow where the notation “b” appears.

Reliability categories are based on the sensitivity of the receiving environment and the potential for harm in the event of a failure of the wastewater treatment facility. They are usually determined based on the findings of an Environmental Impact Study (EIS). The Cumberland WWTP is designed to meet or exceed the requirements of Reliability Category I, as outlined in Table 9.

Table 9: WWTP Design Features Compared to BC MWR Reliability Category I

Component	# of Units	Unit Capacity (m^3/day)	Unit Capacity as % of Nominal Design Flow (2xADWF-3,600 m^3/day) with the Largest Unit out of Service (Note 1)	Unit Capacity as % of Max WWTP Flow Capacity (4xADWF-7,200 m^3/day) with the Largest Unit out of Service	Standby Power Source (Note 2)
Reliability Category I	2	As stated below	min. 75%	-	Yes
Aerated Lagoons	2 Cells	-	-	-	-
Blowers (1 duty, 1 standby)	2	2,300 scfm	100%	100% (Note 3)	No
Pumps (1 duty, 1 standby)	2	3,600	100%	50%	Yes
SAF (1 duty, 1 standby)	2	3,600	100%	50%	Yes
Chem Dosing (1 duty, 1 standby)	2	3,600	100%	50%	Yes
Filtration (1 duty, 1 standby)	2	3,600	100%	50%	Yes
UV (1 duty, 1 standby)	2	3,600	100%	50%	Yes

Notes:
Note 1 - MWR definition of the max. flow for design purposes, i.e., 2 x ADWF per Table 7.
Note 2 – Duty unit only
Note 3 – Expected capacity due to dilutions
SAF – Suspended Air Flotation

4. TREATMENT PROCESS DESCRIPTION

4.1. TREATMENT COMPONENTS

This section describes the treatment components for the WWTP upgrade including headworks screens, connecting pipe modifications, lagoon aeration system, flow splitting with flows up to 7,200 m^3/d pumped to a suspended-air-flotation (SAF) solids liquid separation process, followed by tertiary filtration, and effluent UV disinfection. Extreme wet weather flows through the lagoon, exceeding the combined processing capacity of 7,200 m^3/day and lagoon storage capacity, will bypass mechanical treatment components located in Tent A and be chlorinated/dechlorinated, then discharged to a localized wetland area overgrown with canary grass, and eventually released to Maple Lake Creek.

Collected solids from the SAF and filtration processes will be dewatered in sludge dewatering bins located in Tent B.

4.2. HEADWORKS

Raw wastewater is conveyed through a 600 mm (24”) concrete sanitary gravity sewer to a manhole that also receives wastewater from the Hope Rd Lift Station located onsite and serves a nearby subdivision.

The wastewater entering the manhole is conveyed through a 600 mm concrete pipe to the existing two-channel headworks. One of the channels currently contains a “Muffin Monster” macerator and an auger screen, which will be removed and replaced by two Claro 6 mm step screens (Model 3100-400-6mm) along with two wash presses (Model TP200-1600) and a local control panel. Each screen has a design flow capacity of 19,000 m^3/d and each wash press can process up to 1.0 m^3/h of wet screenings. The collected screenings will be washed, compacted and placed into two 2 cubic yard self-dumping bins for removal and disposal off-site. Two (2) davit cranes will also be installed adjacent to the screens to facilitate screen removal from the channels for repairs and maintenance.

The inlet screening performance criteria and operating requirements are summarized in Table 10.

Table 10 Inlet Screening System Performance Criteria

Parameter	Value	Units
Number of screens	2 new (one existing)	-
Configuration	In parallel	-
Upgraded Screen Capacity – maximum (2 x 19,000)	38,000	m^3/day
Existing Screen Capacity	16,000	m^3/day
Wash Press Capacity – maximum (2 x 24)	48	m^3/day
Channel depth	2,400	mm
Screen width	610	mm
Material	Stainless Steel	-
Ambient annual low / high temperature	-15 / 36	^{O}C
Environment	Outdoor	-
Duty	24	hours

4.3. SCREEN BYPASS

The headworks screens will be installed in a staggered manner to facilitate the installation of a bypass opening in the concrete wall that separates the two channels. The bypass will be created by cutting a 1,200 mm x 500 mm (W x H) opening in the concrete wall separating the two channels and located between the two staggered screens. The bottom of the cut wall section will be 900 mm from the screen channel bottom.

This bypass is intended only to operate in the event of severe failure and/or blockage of both screens.

4.4. PIPELINE CONNECTION TO LAGOON

An existing 600 mm diameter concrete pipe conveys screened wastewater from the headworks via a concrete splitter box into the south-west corner of the large lagoon.

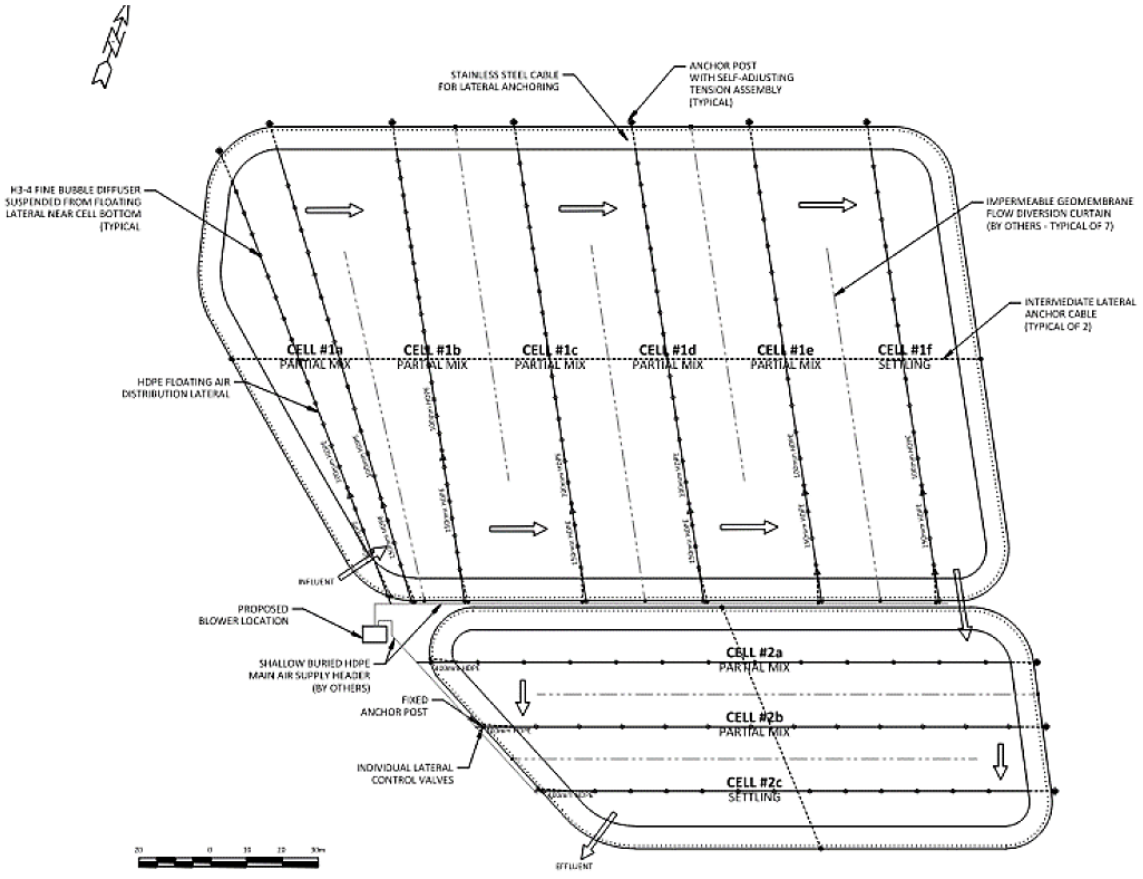
4.5. LAGOON BAFFLE CURTAINS AND AERATION LATERALS

Five (5) floating baffle-curtains will be installed within the large lagoon and two (2) floating baffle curtains will be installed within the small lagoon to create a serpentine (plug) flow-path that will direct the water through the large lagoon into the small lagoon and through to a discharge point located at the south-west corner of the small lagoon.

Seven (7) aeration laterals will be installed within the large lagoon and three (3) aeration laterals will be installed within the small lagoon to provide air for biological oxidation and partial lagoon mixing.

The layout of lagoon baffle curtains and aeration laterals is shown in Figure 5 as well as the serpentine flow path within the lagoon cells.

Figure 5 Lagoon Baffle Curtains and Aeration Diffuser Layout



4.6. LAGOON AERATION SYSTEM

The four (4) existing 5 HP surface aerators currently installed in the small lagoon will be removed once the new fine-bubble aeration system is in place and operating. The diffused aeration system will be supplied by compressed air using two (2) 120 HP blower packages with variable frequency drives (VFDs). Each blower can deliver 2,300 SCFM of air at a maximum pressure of 6.2 PSIG. The blowers will be installed inside Tent A that will also accommodate the SAFs, disk filters, and UV disinfection equipment. The duty and standby blowers are designed to run 24/7; however, they will alternate. Residual heat from the blowers will be used for heating of Tent A.

A total of 169 Nexom OPTAER H3-4 fine-bubble diffusers will be installed within the two lagoons and distributed along the aeration laterals placed between the floating baffle curtains within the lagoon cells, as illustrated in Figure 5 .

4.7. LAGOON INTERCONNECT

There is an existing interconnection between the small and large lagoons consisting of a 24” diameter pipe with a sluice gate control structure. This structure will remain with the sluice gate closed.

A second similar connecting structure without a sluice gate will be installed across the center berm separating the two lagoons, which will be located at the south-east corner of the large lagoon to direct flow from the last channel within the large lagoon to the first channel within the small lagoon.

The second connection consists of a 750 mm culvert with the invert elevation at approximately 134.9 m to allow the water level in the lagoons to be lowered simultaneously to 135.0 m for maintenance purposes, as requested by the Village of Cumberland.

4.8. LAGOON OVERFLOWS TO MAPLE LAKE CREEK (MLC)

The large and small lagoons have existing high-water-level overflows that discharge into the section of MLC that flows along the base of the lagoons’ east berm. Both high-water-level overflows may be maintained and modified to enable a controlled overflow in an extreme wet weather event or disaster scenario, to prevent overtopping of the lagoon berms. Cumberland is proposing to relocate the section of MLC along the base of the berms in the future to enable the berm to be reinforced. A large diameter pipe may be installed within the existing creek channel to receive any overflows from the two lagoons and convey the water downstream to connect with MLC. Optionally, both high-water-level overflows may be decommissioned as part of the MLC infill project and a spillway provision in the weir box, located next to an EWWF chlorine contact pond (refer to Section 4.13.3), may be used for evacuation of extreme wet weather flows. Additional regulatory input on the preferred option is required to guide future design decisions.

4.9. LAGOON DISCHARGE

Water passing through the small lagoon will exit through the south-west corner of the lagoon and flow by gravity to a pre-cast concrete box-culvert weir-box (1.8 m (W) x 2.4 m (L) x 2.8 m (H)) with a bottom elevation set at 133.8 m. The weir box has following purposes:

- As an intake structure to enable the lift station pumps to transfer up to 7,200 m^3/d of lagoon secondary effluent to the SAF solids-liquid separation units.
- To provide a means of monitoring the water level in the lagoons for the purpose of controlling the operation of the lift station pumps.
- To allow excess wet-weather flows (EWWF) to be diverted over a weir to Maple Lake Creek.
- To provide a dosing location and mixing energy (as a result of the overflow) for chlorine injection into the excess wet-weather flow (EWWF) stream/basin for disinfection.

The weir box will contain a 1.4 m (W) x 0.6 m (H) broad-crested weir set at 135.3 m with an adjustable gate. The normal lagoon operational level range will be between 135.3 m and 135.6 m; however, it can be increased up to 135.9 m during peak flows under extreme wet weather conditions. There is a 450 mm pipe that connects the weir box with a wet well housing the SAF feed pumps.

The water level within the weir box will reflect the water elevation in the lagoons, enabling the water level to be used for monitoring of the storage volume in the lagoons for the purpose of controlling the operation of the SAF lift station pumps with a combined maximum capacity of 7,200 m^3/day. If the incoming flow exceeds the combined capacity of the SAF pumps, excess wet-weather flows (EWWF) will be diverted over the weir and released through a localized wetland to Maple Lake Creek.

4.10. SAF LIFT STATION

The lagoon effluent will be transferred from the weir box into a lift station via a new 450 mm pipe. The lift station will transfer up to 7,200 m^3/d (84 L/s) of water to the Heron Innovators SAF solids-liquid separation systems. The lift station will be equipped with two (2) identical-capacity pumps, each rated at 3,600 m^3/d at the required total dynamic heads. A hydrostatic level/pressure transducer will be used for level monitoring in the lagoons and lift station wet well. Four (4) float switches will also be used for level indication and pump control as a back-up.

The pumps will be equipped with VFDs that will be controlled by lagoon water levels and signals from the SAF magnetic flow meters.

4.11. SUSPENDED AIR FLOATATION

Two (2) identical Heron SAF units consisting of two (2) CF250 Flotation Cells and two (2) Model F50 Froth Generators, each with a design maximum flow rate of 3,600 m^3/d, will serve to remove suspended solids, turbidity, particulate BOD fraction, and phosphorus from the lagoon secondary effluent.

Each SAF unit has its own dedicated polymer dilution system, polymer dosing system, coagulant dosing system, and froth generator and injection lines. These chemical systems are designed to deliver chemicals to treat up to 3,600 m^3/d through each SAF unit. Each chemical feed systems are pre-assembled in a container with two rollup doors to allow for moving chemical totes with a forklift.

Coagulant such alum or ferric chloride will be dosed prior to SAF units to remove phosphorus by chemical precipitation to a maximum of 1.0 mg-P/L of the SAF effluent.

4.12. TERTIARY FILTRATION

Two (2) identical tertiary disk filters, each with a design flow rate of 3,600 m^3/d, will serve to remove residual suspended solids, turbidity, and phosphorus from the SAF effluent. Coagulant such as alum or ferric chloride will be dosed prior to filters to further remove phosphorus by chemical filtration down to approximately 0.2 mg-P/L.

Addition of coagulant prior to filtration blended with residual polymer in the SAF effluent will also be an initial step in virus removal, per section 110 (2) (a) of the MWR.

4.13. DISINFECTION

4.13.1. UV Disinfection

Two (2) identical Wedeco LBX 850e UV disinfection modules, each with a design flow rate of 3,600 m^3/d, will serve to disinfect treated effluent prior to environmental discharge. The UV modules will be closed vessel systems with low-pressure, high-intensity UV lamps able to deliver a variable UV dose ranging from 40 mJ/cm^2 to 90 mJ/cm^2 for effectiveness against bacteria and viruses. As the UV dose for inactivation of viruses is greater that the one required for bacteria inactivation, the UV modules with a variable UV dose will be effective at inactivation of a wide range of viruses. The UV modules will have UV transmittance (UVT) and UV intensity (UVI) monitors and be equipped with automatic wiping system that prevents fouling of the quartz sleeves.

4.13.2. Chlorine Disinfection - Primary Chlorine Contact Basin

The WWTF upgrade has a design provision for a future addition of advanced virus removal by chlorination to operate in conjunction with UV disinfection as a two-stage disinfection process subject to further clarification of the virus removal criteria by the province. Chlorine can be added to a primary disinfection contact basin with the plug flow configuration that is sized for flows up to 7,200 m^3/d (84 L/s) to complement mechanical treatment in Tent A with a minimum contact time of 10 minutes at 7,200 m^3/d and 20 minutes at 3,600 m^3/d. The primary disinfection basin consists of three (3) 6.1 m (L) x 1.22 m (W) x 2.2 m (H) channels, one (1) 4.68 m (L) x 1.22 m (W) x 2.2 m (H) channel, and one (1) 1.22 m (L) x 1.22 m (W) x 2.2 m (H) contact chamber for dichlorination. The basin height is 2.2 m while the water depth is about 1.8 m.

4.13.3. Chlorine Disinfection - EWWF Chlorine Contact Pond

The EWWF disinfection contact pond is sized to discharge/process sporadic EWWF flows, exceeding the combined processing capacity of the mechanical plant (7,200 m^3/day) and the maximum lagoon storage (equalization) capacity (estimated at approximately 22,000 m^3), totaling 29,200 m^3. The EWWF contact pond is sized for flows up to 10,800 m^3/d (125 L/s) with a minimum contact time of about 15 minutes. The EWWF disinfection pond has a trapezoidal shape with interior side slopes 2.5 H : 1 V and HDPE liner on the sides and bottom. The pond consists of three (3) plug flow channels separated by partition curtains with the wet volume of 114 m^3. A vertical stand pipe is provided for injection of a dichlorination chemical followed by flow along a 140 m long linear channel prior to environmental discharge to Maple Lake Creek. The basin height is 1.7 m while the water depth is about 1.4 m.

4.14. SLUDGE DEWATERING

Solids removed by the SAF and filter units will be pumped to dewatering bins containing double walled filtration baffles, allowing the solids to dewater within the bins. Two 20-cubic yard bins (Model: AquaCat SludgeKing II) by Park Process were selected to be installed within a small tent (Tent B). Water from the dewatering bins will drain by gravity to an existing manhole located upstream of the screen channels and be reprocessed.

Dewatered sludge will be sent to the Comox Valley Regional District's composting facility for co-composting with sludge from the CVRD's main wastewater plant.

4.15. REED BED

The WWTF upgrade has a design provision for the polishing removal of residual constituents and emerging contaminants. Up to 3,600 m^3/day of reclaimed disinfected effluent can be directed to a reed bed. Reclaimed disinfected effluent in excess of 3,600 m^3/day will bypass the reed bed and be discharged to a natural wetland located north of the lagoon site.

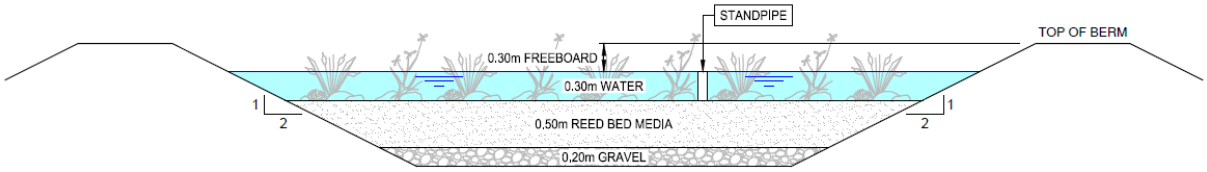
A site trial of various reed bed configurations was carried out in 2021 to assess treatment and hydraulic performance (Appendix B), and the reed bed design has been based on those results.

The reed bed will be a vertical flow configuration with a 500 mm deep layer of sand mixed with a custom blend of peat and biochar underlain by a 200 mm deep gravel underdrain. The key design parameters for the reed bed are summarized below:

- approximate base area of 1,000 m^2;
- hydraulic loading rate of up to 3.6 m^3/m^2/day (150 L/m^2/hr);
- overall depth of 1.3 m;
- side slope of 2:1 (H:V);
- 300 mm freeboard from top of surrounding berm;
- 300 mm free-standing water depth;
- 500 mm layer of sand (60% to 80% by volume) containing a uniform mix of ¼" minus biochar (15% to 20% by volume) and peat (5% to 20% by volume); and
- 200 mm layer of 3-32 mm gravel underlain with drainpipe.

The reed bed is designed to be filled at the surface and operate with horizontal flow across the surface, vertical flow through the media, and horizontal flow in the underdrain layer before discharge to the wetland. The berms are 600 mm above the media surface and there will be an overflow standpipe at 300 mm above the media surface, that discharges to the wetland. The reed bed cross section is schematically shown in Figure 6.

Figure 6 Reed Bed Cross Section



5. CIVIL WORKS

The new WWTP will be located to the southwest of the existing lagoons (refer to Figure 3). The main area of the new WWTP includes Tents A and B, established at a general working elevations between 137.3 m (Tent A) and 137.6 m (Tent B). Site drainage will be collected through catch basins and site grading, and then directed to the existing headworks.

New site piping will be provided to convey potable water, sanitary, and stormwater. The pipe diameters are selected based on the head and flow depending on service requirements. All buried pipes will be installed with sufficient soil cover or insulation to prevent freezing and expected weight loads, if located under the roads or areas where vehicle traffic is expected. The pipe materials proposed for this project are selected and vary based on the service requirements.

6. BUILDINGS

6.1. OPERATIONS BUILDING

The prefabricated operations building will include office space, lab space, change room, shower room, and bathroom. The following general specifications have been considered:

- Building size: 44’ long x 14’wide, with consideration for size expansion.
- Changeroom/shower/bathroom (12’ x 7’); Office (20’ x 12’) and Lab (12’ x 12’).
- 26 Gauge standing seam metal roofing & 426 Gauge metal siding.
- Painted drywall & vinyl plank flooring.
- 208Y/120V, 80 A, 3-phase, electrical (equivalent to 240V split phase, 125A service).

Figure 7 and Figure 8 show the current and future operations building layouts.

Figure 7 Operations Building Layout – Current

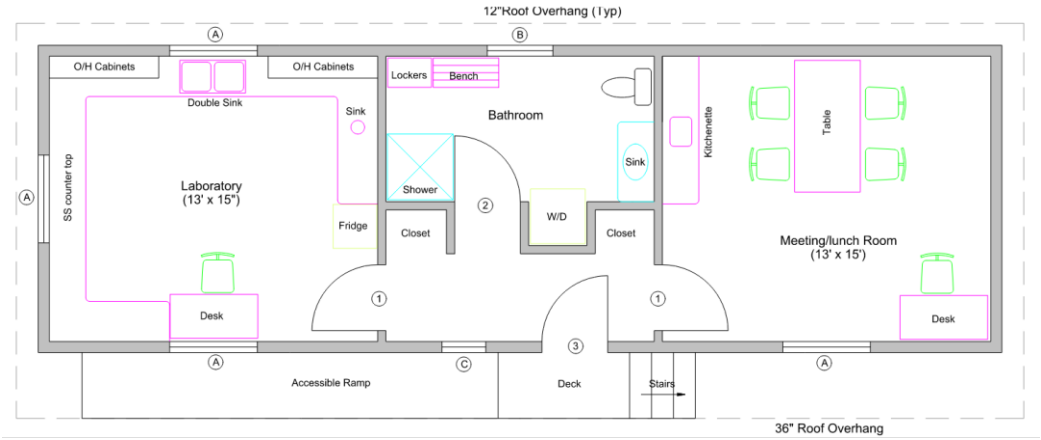
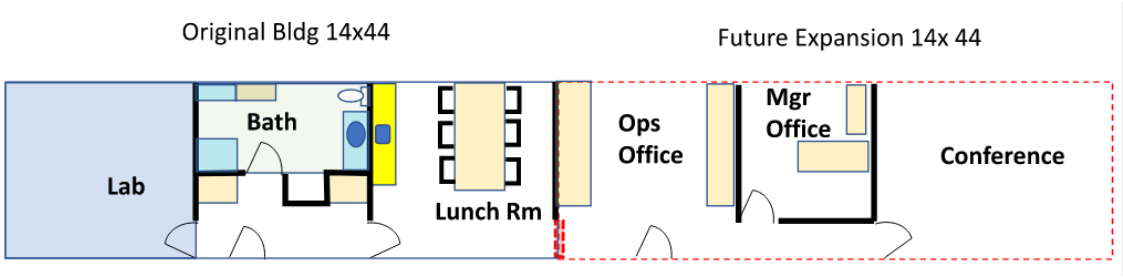


Figure 8 Operations Building Layout – Future



6.2. WORKSHOP

The workshop will be used to store spare parts and maintenance equipment. It has a 12’ x 12’ roll-up door to allow the use of forklift in and out of the workshop. The workshop will be 40’ x 30’ and with an additional covered area of 40’ x 12’. The roll-up door faces east.

6.3. TENT A ENCLOSURE – WASTEWATER TREATMENT TRAIN

Tent A is a prefabricated metal frame/tent structure approximately 24 (W) x 16 m (L), which will be positioned so that it may be extended to a total length of 30 m should a further treatment capacity be required in the future. The tent enclosure will include an HVAC system.

6.4. TENT B ENCLOSURE -SLUDGE TREATMENT TRAIN

Two (2) 20-cubic-yard dewatering bins will be located within a prefabricated metal frame/tent structure approximately 10 (W) x 10 m (L) located to the west of Tent A. The tent enclosure will include an HVAC system.

6.5. CHEMICAL STORAGE

Standard 20 ft shipping containers will be used to store process chemicals. The containers are sized to store chemicals for up to 30 days based on design flow of 3,600 m^3/d. Additional containers can be added in the future, if and when necessary.

Storage for up to three (3) totes of coagulant (used for phosphorus precipitation) and for a single polymer and single surfactant tote are currently considered sufficient. Limited storage is required for the polymer and surfactant as a single tote is expected to last up to a year.

Additional totes may be required for chlorination/dichlorination chemicals on an as-required basis and subject to WWTP operational conditions.

A forklift with 48” or 76” fork is expected to be required to move the chemical totes.

7. CLOSURE

We trust that this detailed design brief meets the needs of Cumberland and provides sufficient WWTP design and upgrade details for regulatory review.

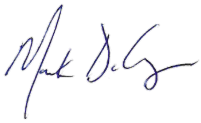
Do not hesitate to contact the undersigned should you have any questions or additional comments.

Prepared by:



Dragan Rokic, P.Eng.
Senior Water/Wastewater Engineer
drokic@mcelhanney.com
250-370-9221

Reviewed by:



Mark DeGagne, P.Eng., M.Sc.
Senior Water/Wastewater Engineer, QA/QC
mdegagne@mcelhanney.com
778-560-2001

PERMIT TO PRACTICE
McElhanney Ltd.
PERMIT NUMBER: 1003299
Engineers and Geoscientists of BC

APPENDIX A

Statement of Limitations

Statement of Limitations

Use of this Report. This report was prepared by McElhanney Ltd. ("**McElhanney**") for the particular site, design objective, development and purpose (the "**Project**") described in this report and for the exclusive use of the client identified in this report (the "**Client**"). The data, interpretations and recommendations pertain to the Project and are not applicable to any other project or site location and this report may not be reproduced, used or relied upon, in whole or in part, by a party other than the Client, without the prior written consent of McElhanney. The Client may provide copies of this report to its affiliates, contractors, subcontractors and regulatory authorities for use in relation to and in connection with the Project provided that any reliance, unauthorized use, and/or decisions made based on the information contained within this report are at the sole risk of such parties. McElhanney will not be responsible for the use of this report on projects other than the Project, where this report or the contents hereof have been modified without McElhanney's consent, to the extent that the content is in the nature of an opinion, and if the report is preliminary or draft. This is a technical report and is not a legal representation or interpretation of laws, rules, regulations, or policies of governmental agencies.

Standard of Care and Disclaimer of Warranties. This report was prepared with the degree of care, skill, and diligence as would reasonably be expected from a qualified member of the same profession, providing a similar report for similar projects, and under similar circumstances, and in accordance with generally accepted engineering/planning/etc. and scientific judgments, principles and practices. McElhanney expressly disclaims any and all warranties in connection with this report.

Information from Client and Third Parties. McElhanney has relied in good faith on information provided by the Client and third parties noted in this report and has assumed such information to be accurate, complete, reliable, non-fringing, and fit for the intended purpose without independent verification. McElhanney accepts no responsibility for any deficiency, misstatements or inaccuracy contained in this report as a result of omissions or errors in information provided by third parties or for omissions, misstatements or fraudulent acts of persons interviewed.

Independent Judgments. McElhanney will not be responsible for the independent conclusions, interpretations, interpolations and/or decisions of the Client, or others, who may come into possession of this report, or any part thereof. This restriction of liability includes decisions made to purchase, finance or sell land or with respect to public offerings for the sale of securities.

APPENDIX B

Appendix B Reed Bed & Natural Wetlands Wastewater Polishing Feasibility Study

REPORT

March 31, 2021

VILLAGE OF CUMBERLAND

Reed Bed & Natural Wetlands Wastewater Polishing Feasibility Study: IPGP #175474

Submitted to:

Village of Cumberland

Box 340, 2673 Dunsmuir Avenue

Cumberland, British Columbia V0R 1S0



Reference: 1018-01-2021-R-(Rev0) IPGP#175474 Reed Bed & Natural Wetlands Wastewater Polishing Feasibility Study

Distribution:

1 Electronic Copy – Village of Cumberland

Troy David Vassos Inc.

Table of Contents

1.0 DOCUMENT SCOPE 1

1.1 Document Purpose 1

1.2 Document Structure 1

2.0 CUMBERLAND STAGE 1 & 2 LIQUID WASTE MANAGEMENT PLAN (LWMP) – WETLANDS WATER REUSE CONSIDERATIONS 2

2.1 Water Reclamation and Reuse 2

2.2 Maple Lake Creek 2

2.3 Wetlands Along Maple Lake Creek 3

2.4 Wetlands in the Vicinity of the Wastewater Lagoons 3

2.5 Discharge to the Natural Wetlands 4

2.6 Effluent Polishing 4

2.7 Use of Biochar 5

2.8 Carbon Footprint 5

2.9 Constructed and Natural Wetlands 7

2.10 Wetlands Assessment 7

2.11 Wetlands Characterization 7

2.12 Augmented Wetlands 9

2.13 Community Vision 9

2.14 Environmental and Community Benefits 11

2.15 Expected Environmental and Social Impacts 12

3.0 BC INFRASTRUCTURE PLANNING GRANT PROGRAM 13

3.1 Proof of Concept 13

3.2 Deliverables 14

4.0 REED BED PILOT PROGRAM 15

4.1 Pilot Program Objectives 15

4.2 Experimental Setup 15

4.2.1 Polyethylene Tote Setup 15

4.2.1.1 Test Unit 1: 100% Sand) 15

4.2.1.2 Test Unit 2: Mixture of 80% Sand + 20% Biochar 16

4.2.1.3 Test Unit 3: Mixture of 80% Sand + 20% Biochar (4 x Flow) 16

4.2.1.4 Test Unit 4: Mixture of 60% Peat + 20% Sand + 20% Biochar 16

4.2.1.5 Test Unit 5: Layer of 50% Sand + 50% Biochar over Peat 16
4.2.1.6 Summary of Reed Bed Test Unit Media Composition and Loading 17
4.3 Flow Splitting and Test Unit Layout 17
4.4 Initial Drainage Rates 17
4.5 Wetland Plants 20
4.6 Temporary Test Cessation Due to Freezing 21
4.7 Flow Regime Change 21
4.8 Sampling Events 21
4.9 March 3, 2021 Water Quality Sampling Event 21
4.9.1 Water Analyses 21
4.9.2 Visual Appearance and Clarity 22
4.9.3 Media Compaction 23
4.9.4 Hydraulic Flow Rates 23
4.10 Chemical Analyses 24
4.11 Summary of Findings to Date 26
4.11.1 Preliminary Observations 26
4.11.2 Biochar Enhancement of Constructed Wetlands 26
4.11.3 Hydraulic Performance 28
5.0 ECOFISH WETLANDS ASSESSMENT 29
5.1 Background 29
5.2 Wetland Assessment Methods 29
5.3 Wetlands Assessment Results 30
5.3.1 Best Locations for Water Augmentation to Enhance Habitat 30
5.3.2 Biochar Media Reed Bed Location 31
5.3.3 Habitat Enhancement Opportunities within the East Wetlands 31
6.0 CONSTRUCTED REED BED 33
6.1 General Considerations 33
6.2 Initial Pilot Program Findings 33
6.2.1 Water Quality Improvement 33
6.2.2 Hydraulic Loading 33
6.2.3 Construction Considerations 34
6.2.4 Selection of Group 2 Media Mix (80% sand + 20% biochar) 34
6.3 Hydraulic Profile 34

6.4 Operating Considerations 34

7.0 CAPITAL COST ESTIMATE 35

7.1 Biochar Sources 35

7.2 Reed Bed with 80% Sand and 20% Biochar 35

7.3 Wetland Augmentation and Habitat Enhancement. 37

8.0 CLOSURE 39

List of Figures

Figure A Cumberland Wetlands Map (Ecofish Research Ltd., 2020) 8

Figure B Pilot Test Tote Media Characteristics 15

Figure C Lagoon Feed to Reed Bed Pilot Totes 18

Figure D Transfer of Liquid from Lagoon 2 to Pilot Test Totes 18

Figure E Test Totes Effluent Distribution Layout 19

Figure F Photo Showing Connecting Pipe from Chamber Pumps to Totes 19

Figure H Tote Plants 20

Figure I Photo of the Constructed Pilot-Scale Reed Beds 21

Figure J March 3, 2021 - Visual Clarity - Water Quality Sampling. 22

Figure K Apparent Order of March 3 Sample Clarity 23

List of Tables

Table A Testing Program Objectives 16

Table B Summary of Pilot-Scale Testing of Reed Bed Media and Loading Tests 17

Table C Initial Drainage Rates After 24 Hours of Hydraulic Loading with Fresh Water * 20

Table D Drainage Rates in March 2021 23

Table E Comparison of Drainage Rates Between October, 1 2020 and March 3, 2021 24

Table F March 3 2021 Sampling Event Analytical Results 25

Table G 2015 District of Sechelt Biochar Test Results 26

Table H Estimated Areas and Media Quantities 36

Table I Estimated Project Costs – Reed Bed Only 37

Table J Estimated Total Project Costs - Reed Bed and Conveyance 38

DEFINITIONS

ADWF	Average Dry Weather Flow
BOD	Biochemical Oxygen Demand
CARIP	Climate Action Revenue Incentive Program ()
CBOD	Carbonaceous Biochemical Oxygen Demand
GEP	Greater Exposure Potential
GHG	Greenhouse Gas
in/min	inches per minute
IPGP	Infrastructure Planning Grant Program
IPR	Indirect Potable Reuse
kg-P/d	Kilograms of Phosphorus per Day
LWMP	Liquid Waste Management Plan
mm	millimetres
m/d	metres per day
mm/min	millimetres per min
m^2	square metres
m^3	cubic metres
m^3/d	cubic metres per day
MEP	Moderate Exposure Potential
mg/L	milligrams per Litre
MLC	Maple Lake Creek
MoE	Ministry of Environment and Climate Change Strategy
MWR	Municipal Wastewater Regulation
N	Nitrogen
NH4	Ammonia
OCP	Official Community Plan
P	Phosphorus
TSS	Total Suspended Solids
TURB	Turbidity
ug/L	micrograms per Litre
UVT	Ultraviolet Transmissivity
VoC	Village of Cumberland

1.0 DOCUMENT SCOPE

1.1 Document Purpose

This document represents the compendium of work undertaken by the Village of Cumberland to investigate and assess constructed and enhanced wetland options as a polishing stage and dispersed discharge mechanism for the upgraded treatment works contemplated by the community during the Stage 1 & 2 Liquid Waste Management Plan (LWMP) process completed in 2018.

The document also serves as the Feasibility Study Report for Infrastructure Planning Grant Program (IPGP) #175474.

1.2 Document Structure

This report consists of the following technical elements/sections:

SECTION 1 DOCUMENT SCOPE

SECTION 2 CUMBERLAND STAGE 1 & 2 LIQUID WASTE MANAGEMENT PLAN (LWMP) – WETLANDS WATER REUSE CONSIDERATIONS

SECTION 3 BC INFRASTRUCTURE PLANNING GRANT PROGRAM

SECTION 4 REED BED PILOT PROGRAM

SECTION 5 ECOFISH WETLANDS ASSESSMENT

SECTION 6 CONSTRUCTED REED BED

SECTION 7 CAPITAL COST ESTIMATE

SECTION 8 CLOSURE

2.0 CUMBERLAND STAGE 1 & 2 LIQUID WASTE MANAGEMENT PLAN (LWMP) – WETLANDS WATER REUSE CONSIDERATIONS

2.1 Water Reclamation and Reuse

The Village of Cumberland Stage 1 & 2 Liquid Waste Management Plan (LWMP) contemplates upgrading the wastewater treatment facilities that serve the community to attain reclaimed wastewater quality. The BC Municipal Wastewater Regulation (MWR) and supporting guideline documents provide for several water quality water reuse standards, with the three highest being Moderate Exposure Potential (MEP), Greater Exposure Potential (GEP) and Indirect Potable Reuse (IPR). The "exposure" term is in reference to the potential for the general public to come into contact with the reclaimed water through the reuse application. The MEP water quality is intended to reuse application that have a moderate potential to come into public contact. Such applications include agricultural irrigation, silviculture irrigation, wetlands augmentation, and potentially urban applications where the reuse application is at night or use for subsurface irrigation. The GEP reclaimed water quality makes it suited to applications where there is a high probability the public will come into contact with the reclaimed water and includes a wide range of non-potable water applications including: toilet/urinal flushing; surface and subsurface irrigation of landscape, park, playground and agricultural vegetation; vehicle washing; building cooling; ornamental water features; recreational impoundments, dust suppression; fire-fighting and suppression; recreational ice surfaces; etc. The IPR category is primarily intended for applications where there is a potential to indirectly contribute to a potable groundwater or surface water source downstream of the discharge.

Under the BC MWR, effluent meeting the above reclaimed water criteria can be used for beneficial reuse in application to stream augmentation as well as wetlands augmentation without the need for dilution. However, Ministry policy regarding the enabling BC regulation also requires that an alternative means of treated effluent disposal must be available for reuse applications to be implemented. The MWR also requires that reuse water quality applications also include an alternate means of effluent disposal and allows for wetland applications to be considered a satisfactory alternative where the director is satisfied the discharge to the wetlands does not pose an environmental or public health risk.

During the Village of Cumberland LWMP environmental study work in 2017, a new option, not previously considered, was developed – using the treated water for year-round "augmentation of the natural wetlands" to the north side of the lagoons. The release of reclaimed wastewater to benefit and enhance the natural habitat of the wetlands associated with Maple Lake Creek (MLC) was explored through the Stage 1 & 2 LWMP as a key integrated water management strategy component.

2.2 Maple Lake Creek

The Village of Cumberland (VoC) lagoon wastewater treatment system directly discharges into MLC, which flows a distance of about 4.5 kilometers into the Trent River and eventually Baynes Sound. Water enters MLC from several sources and travels towards the Trent River through a series of wetlands along with treated wastewater effluent from the Cumberland lagoons.

In fall, winter and spring, water also enters MLC from storm and overland flows through the wetlands surrounding the wastewater lagoons. Storm water enters the northwestern part of the site from

Cumberland Road, where it flows both to the south and east. Overland flow also enters the site from the hillside along Union Road and from the forest on the western side.

In summer the dry weather and reduced subsurface drainage from the wetlands results in the wastewater lagoon effluent being the only substantial source of water in MLC

2.3 Wetlands Along Maple Lake Creek

The Village of Cumberland inherited a large area surrounding the existing lagoon wastewater treatment facility that used to be farmed a very long time ago. In the 1930's a channel was excavated through the area, to drain it for agriculture use. Once agricultural activities ceased, over time, the cultivated lands became overgrown with emergent vegetation and the natural degradation of the plant roots formed a thick layer of natural peat.

The discharge of phosphorus from the Cumberland lagoons into MLC has been continuous for over a hundred years. This has been of significant value to the wetland receiving environment along MLC. An environmental sampling program carried out during the summer of 2017 demonstrated the natural wetlands along MLC have responded and adapted to the nutrients contained in the lagoon discharge. Water sampling along MLC and into the Trent River demonstrate the wetlands along MLC are passively absorbing and removing up to 97 percent of the nitrogen and phosphorus in the effluent, a level of performance that cannot reliably be achieved in any equipment -based wastewater treatment process. In addition, the wetlands along MLC achieve a 4-Log reduction in fecal coliforms and also remove micro-contaminants and metals from the effluent and stormwater that drains through the area. The natural wetlands on Maple Lake Creek are a real-world example of an “eco-asset”, performing a valuable function for Cumberland.

2.4 Wetlands in the Vicinity of the Wastewater Lagoons

The area to the north of the lagoons is a flat wetland area of peat soils that was extensively farmed in the 1930’s but was abandoned in the 50’s. The area receives ground and surface water drainage from the wooded lands just to the north, and is characterized by a high incidence of introduced species as well as a large diversity of habitat types, with evidence of many different mammal and bird species, including seven distinct communities in the area (Mimulus, 2011).

The habitat that is provided by the bog communities north of the lagoons and west of MLC are considered sensitive and environmentally valuable; however, the 'sensitive’ area does not include the grass-dominated habitat (Wet Meadow community) located immediately adjacent and to the north of the lagoons, or vegetated wetland areas located on the east side of MLC.

The introduction of reclaimed wastewater to either area would require a hydrological assessment to assess whether water recharge to the bog would not be affected by the dispersion of effluent from the lagoons. Bogs develop under nutrient poor conditions, and the addition of nitrogen and phosphorus from the lagoon effluent lagoons could have a detrimental effect on the adjacent bog habitat. Offsetting this concern is the augmented wetlands may be enhanced adding an additional type of wetland habitat to the existing mosaic.

2.5 Discharge to the Natural Wetlands

The MWR establishes a reclaimed water quality criteria for wetlands flow augmentation under conditions whereby there is a low potential for public contact, referred to as a Moderate Exposure Potential (MEP) reclaimed water quality - with a required BOD and TSS of less than or equal to 25 mg/L. As the MEP water quality requirement does not require tertiary filtration to remove colloidal particles, it is less expensive to achieve than a GEP reclaimed water quality. A constructed wetland (Reed-Bed) could also be used to provide initial treatment.

Passage of the treated wastewater effluent through the wetlands is expected to result in a significant reduction in the residual phosphorus concentration due to plant uptake and mineralization, some chemical phosphorus treatment may be required prior to release to the wetlands. The strategy developed through the Stage 1 & 2 LWMP was to disperse MEP reclaimed water in a subsurface manner to the natural wetlands, allowing the water to flow through the wetlands and drain into Maple Lake Creek on a year-round basis, while discharging treated effluent flows greater than 2 x ADWF, and that exceed the wetlands hydraulic capacity, directly to Maple Lake Creek during the winter months.

The reclaimed water that is released to the wetlands will be subjected to passive treatment as it passes through the wetlands and eventually drains into Maple Lake Creek, including:

- residual BOD and TSS concentrations will be reduced as a result of bacterial treatment through the wetlands;
- ammonia will be nitrified to nitrate, and phosphorus and nitrogen concentrations will be reduced as a result of plant uptake and phosphorus mineralization.

There are many possibilities for how and where reclaimed water could be dispersed for beneficial augmentation purposes to the natural wetland. The process of installing the reclaimed water distribution system to the wetlands could also be used to create paths, elevated boardwalks, or public walking trails through the wetlands, increasing the amenity value. The use of reclaimed wastewater to augment flows in the wetlands is also expected to enhance the wildlife habitat within the wetlands.

2.6 Effluent Polishing

The concept of “effluent polishing” generally refers to passive or natural means of treatment occurring after conventional wastewater treatment and is typically intended to further remove remaining dissolved organics (BOD) and nutrients (phosphorus and nitrogen). Because of the lack of controls or adjustments, effluent polishing is generally applied as a tertiary or quaternary treatment measure to remove micro-contaminants, improve effluent quality and serve as an additional barrier to the release of contaminants to the environment in the event of incidental water quality exceedances. Incorporated into the design of a wastewater treatment process these polishing stages serve as a means to better ensure the required water quality will be met. The natural wetlands located downstream of the lagoons are a good example, as the water quality of the lagoon discharge to Maple Lake Creek continues to improve and achieve an extremely high quality as a result of uncontrolled natural processes within the wetlands – “polishing” the lagoon effluent.

Constructed wetlands are engineered processes designed to replicate and optimize biological, physical, and chemical treatment that is achieved when water passes through a natural wetland. There are well

established design guidelines and criteria for constructed wetlands to provide secondary and tertiary wastewater treatment, and levels of treatment comparable to mechanical treatment processes, and are highly engineered systems designed to achieve specific treatment objectives.

2.7 Use of Biochar

Biochar is mostly carbon, and is made from natural carbonaceous sources, typically wood waste but also from other organic waste including animal manures and, most recently wastewater biosolids. Biochar acts in many ways like clay. Exposed to water it tends to swell and absorb the water and, if present in soil, it can impede the flow of water and retain moisture. Like clay particles, it also has a measurable cation exchange capacity, enabling it to adsorb ammonia and metals and, because it is conductive, it also facilitates electron transfer between microorganisms. As a consequence, biochar facilitates biodegradation and can be used to enhance inert media that can, at best, serve as an attached growth surface for bacteria.

A constructed engineered reed-bed concept was developed as part of the Stage 1 & 2 LWMP process consisting of plants growing in porous media containing biochar, where water flows through the media and plant root zone below the surface, and there is no free water surface. The concept of effluent polishing by the reed-bed, incorporating charcoal within the growing media to adsorb and biodegrade emerging contaminants was established as part of the LWMP, with secondary objectives of carbon credits and aesthetics. The reed bed can provide initial polishing treatment of the water before it is used to augment flow through the wetlands.

2.8 Carbon Footprint

There is a general global desire to reduce carbon and greenhouse gas (GHG) emissions and to look for opportunities to reduce the "carbon footprint" of human activities. BC municipalities are required to annually quantify and report their emissions in an effort to achieve carbon neutrality through the Climate Action Revenue Incentive Program (CARIP). Options to achieve this objective include eliminating or reducing activities that result in carbon emissions and buying carbon credits to offset carbon emissions that can't be further reduced.

Wastewater treatment processes are typically very energy intensive, and energy is equated with carbon emissions. Although we are fortunate in British Columbia to have an excess of hydroelectric power, other Canadian provinces and US states are not as fortunate and have to rely on fossil fueled power generation. Hydropower generation is associated with about 35 times less GHG release than a natural-gas power generating station, and about 70 times less than a coal-fired generating station. (https://www.hydroquebec.com/sustainable-development/specialized-documentation/ghg-reservoir.html). However, hydroelectric dams do produce carbon dioxide and methane, with the amount varying from dam to dam.

There are also global considerations regarding energy use. British Columbia sells hydroelectric power to the US, thereby reducing the demand for fossil fuel sources of electricity. Consequently, increased electricity use in British Columbia has an indirect result in increased carbon emissions in the US. The US EPA hosts a web site that enables individuals to convert electrical consumption to carbon dioxide equivalents (https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator).

Consequently, a key consideration in process design and technology selection is the amount of energy consumed and methods to reduce energy use and GHG emissions in new or upgrade wastewater projects. The lagoon technology historically implemented by Cumberland consumes much less energy per cubic metre of wastewater that is treated in comparison to conventional mechanical wastewater treatment technologies. However, the technologies required to upgrade the water quality to meet current regulatory water quality standards will require greater amounts of electricity and, therefore, will inherently increase the carbon footprint and overall GHG emissions. For Cumberland to be able to reduce emissions the treatment system would have to be carbon negative, and there are no known examples of such a system.

Municipal wastewater treatment principally involves aerobically growing bacteria that consume biologically degradable organic matter contained in the wastewater, converting the organic matter into more bacteria (biomass). The biomass generated is then removed from the process and is then often subject to some form of aerobic or anaerobic treatment to reduce the amount of waste biosolids requiring disposal - often applied to land as a soil amendment. Cumberland is proposing to investigate converting the waste biosolids generated by the upgraded wastewater treatment process into biochar, which will be incorporated into the constructed reed bed media to enhance emerging contaminant removal from treated effluent.

The most common form of biochar that many people are familiar with is charcoal. Charcoal is typically created by partially burning wood under high temperatures while leaving a high level of energy in the charcoal produced for further combustion and heat extraction. Cumberland's concept is to combine the waste biosolids with waste organic matter to create biochar, and then incorporate the biochar in the reed bed media. The production of biochar releases some carbon into the atmosphere, but since the waste biosolids and other components are organic and a natural carbon source (not fossil fuels) they are considered carbon neutral, as are any carbon emissions that may occur during the charring process.

When biochar is applied to the ground as a soil amendment it is considered to remain permanently in the soil as a large portion of the biochar is effectively non-biodegradable and referred to as "fixed carbon". Biochar used as part of the constructed reed-bed media will be there for 10 to 20 years, or longer. If the reed bed media needs to be removed, the media containing the biochar can be used beneficially as a soil amendment and the carbon associated with the biochar is still considered sequestered.

There is presently no officially accepted methodology in Canada or the United States for quantifying and certifying carbon sequestration from biochar. However, there is a recently developed protocol in Europe, developed as part of the European Biochar Certificate Guidelines for the Certification of Biochar based Carbon Sinks [EBC (2020), Certification of the carbon sink potential of biochar, Ithaka Institute, Arbaz, Switzerland. (http://European-biochar.org). Version 2.1E of 1st February 2021]. The principle is that the feedstock itself - being organic - is carbon neutral. However, when the feedstock is transformed into biochar the carbon in the biochar degrades extremely slowly under natural conditions over a sufficiently long enough timeline as to be considered permanently transformed. This is the basis of the sequestration concept, with some carbon release during the production and transport of the biochar produced. When the biochar is applied as a soil amendment the carbon release is in the order of 0.3% per year, leaving 74% of the original carbon after 100 years. As a conservative rough rule-of-thumb, the carbon in biochar added to land is often assumed to release fifty percent (50%) over 100 years. Consequently, if 100 tons of biochar were incorporated into the reed bed media, the estimated sequestration value would be approximately 50 tons of carbon; equivalent to 183 tons of CO_2.

For calendar year 2015, the net CO_2 emissions for the Village of Cumberland were estimated to be 52 tons, so the amount of CO_2 associated with the proposed use of biochar in the reed bed media would offset all of the carbon emissions associated with the Village of Cumberland over three years.

2.9 Constructed and Natural Wetlands

The approach developed in the Stage 1 & 2 LWMP process was to integrate two treatment processes (wetland and biochar) by putting biochar into the plant support media, thus maximizing the treatment performance. The two processes are expected to complement each other very well, each providing something that the other does not.

An interesting possibility that arises with the use of a vertical flow wetland is the concept of a combined vertical and surface flow wetland in high flow or stormwater conditions. If engineered correctly, the normal vertical flow pattern can continue, while excess flow is introduced at the surface, to flow across the surface through the plant stems. This surface flow acts in the same ways as "rain gardens" for municipal stormwater, slowing the flow of water and trapping and settling fine suspended solids.

2.10 Wetlands Assessment

In order to contemplate wetlands augmentation using reclaimed wastewater, a hydrological assessment is required to verify the ability of the wetlands to accept 3,600 m3/day, representing 2 x ADWF. As algae is expected to exceed the maximum TSS criteria of 25 mg/L during the summer, some form of solids/liquid separation will likely be required following lagoon treatment prior to disinfection and release to the wetland.

The wetland discharge could also maintain free water ponds and soil moisture during extended summers, enhancing wildlife habitat and tree growth. A project of distributing water to the wetlands area would also open the way for a network of walking paths to be built in the area, increasing the public amenity of the wetlands. A habitat enhancement program could also be undertaken to remove some invasive plant species and plant native forest species, to be irrigated with the reclaimed water. With careful design implementation and maintenance, a highly functional habitat could be created on this abandoned farmland.

2.11 Wetlands Characterization

The Village of Cumberland commissioned Ecofish Research Ltd. to carry out an assessment of the wetlands in conjunction with the proposed use of the wetlands as part of the Village's Liquid Waste Management Plan (Ecofish Research Ltd., 2020) to support the decision-making process relating to the proposed reuse of treated wastewater effluent for water augmentation in a wetland area located adjacent to the wastewater treatment lagoons. The overall purpose for the assessment was to assess and report on the current conditions of the various wetland areas and advise on potential impacts and/or benefits to the wetlands from increased water and nutrient inputs associated with the proposed reclaimed water augmentation and to support a proposal for a field trail to verify the efficacy of the concept.

The wetlands were previously characterized by Mimulus Biological Consultants (Mimulus 2001) and consist of two primary wetland areas: 1) the southwest wetland section located just north of the existing wastewater treatment lagoons; and 2) the east wetland section located on the east side of Maple Lake Creek (**Figure A**). Both wetland sections are within a land parcel that was gifted to Cumberland as a nature area under Environment Canada's Eco Gift program and have been previously approved by Environment Canada



Figure A Cumberland Wetlands Map (Ecofish Research Ltd., 2020)

for use as treatment wetlands (Environment Canada 2007). A third wetland section, referred to as the northwest wetland section has been identified as environmentally sensitive to nutrient inputs and must not be negatively impacted by the proposed wetland trial or reclaimed water augmentation, as mandated by Environment Canada (2007).

2.12 Augmented Wetlands

In considering augmenting one or more sections of the Cumberland wetlands with reclaimed water for the purpose of micro-pollutant removal in conjunction with a field trial program, a concept was developed to construct a reed bed effluent treatment process that would incorporate biochar within media to provide an initial level of effluent polishing to remove residual wastewater constituents and micro-pollutants prior to release to the site wetland areas for augmentation. The regulatory challenge is the existing discharge permit does not allow for wetlands augmentation, and only authorizes a direct discharge to Maple Lake Creek. As having a 54-year-old permit amended is unlikely, an alternative strategy has been proposed to obtain a short term authorization to implement the Reed Bed pilot program and use the data to support a second authorization application to extend testing to the augmented wetland areas. If there are unacceptable adverse effects on the wetlands the effluent can be once again directed into Maple Lake Creek. However, given the existing lagoon discharge has established a healthy and flourishing downstream wetlands, an adverse impact is unlikely. If there are no adverse effects, the wetland augmentation could become a

permanent component of the Liquid Waste Management Plan and included as part of the Operational Certificate. Positive impacts will also support future habitat enhancement plans, as the primary intention of the water augmentation program is to restore natural wet conditions in the wetlands. A possible secondary benefit is an increase in

2.13 Community Vision

A fundamental goal from the outset of planning this project was to achieve as many of Cumberland's community goals as possible and, in particular, goals that are not normally associated with a wastewater project, such as habitat enhancement.

In 2016, the Village of Cumberland Strategic plan set the following goal for wastewater treatment; "to develop an environmentally sustainable method to treat the liquid waste that is produced by the Village." At the goal setting meeting the Wastewater Advisory Committee expanded their mandate of establishing a recommended means of improved wastewater treatment to developing “an environmentally sustainable method to treat the liquid waste that is produced by the Village that is Economically Productive, Environmentally Enhancing and Socially Beneficial", associated with augmenting the summer flow in Maple Lake Creek through the controlled release of stored water from the wetlands. The Committee produced a set of 20 project goals that the Committee deemed important and relevant to the wastewater project, which can be grouped into the following four categories:

1. Affordability (combination of cost/tax burden, and ability to attract grant funding)
2. Economic Benefits
3. Environmental Benefits
4. Social Benefits.

These goals were then ranked in perceived importance to produce a numerical evaluation system, to be the basis if future decision making. The Committee's goals were compared to the goals contained in the 2014 Cumberland Official Community Plan and in the 2010 Comox Valley Sustainability Strategy. Of the 20 goals in the evaluation system, 19 of them are referenced in the OCP and Sustainability Plan - an outstanding example of the Committee being aligned with the town's official plans.

The major OCP goals being addressed are;

- *5.3.6.4 (p41) As resources allow, prepare a "made in Cumberland" growth management framework that is supported by the following principles;*

  (e) improved natural resources, in particular water, and

  (i) Protection and restoration of ecological systems.
- *5.5.2.5 (p47) Ensure sanitary sewage collection, treatment and disposal facilities are maintained to appropriate standards, and mitigate any detrimental environmental effects from these systems.*
- *5.5.3.5 (p48) Seek maximum funding for infrastructure development from senior levels of government by taking advantage of special financing opportunities available for innovative efficient infrastructure development.*
- *5.5.3.7 (p48) Incorporate greenhouse gas reduction criteria in infrastructure projects for valuation/modeling and procurement.*
- *5.5.6.4 (p50) Protect, restore, and where appropriate enhance the natural stream and wetland habitats that support fish and wildlife resources.*
- *6.1.2.5 (p57) Expand, preserve and promote the Village's working forest land, environmentally sensitive areas, and natural amenities as integral part of the Village's economy.*
- *7.1.2.1 (p61) Protect and enhance the integrity of the natural environment including the surrounding landforms, forests, streams, wetlands, lakes, and quality of the air, while preserving the associated recreation opportunities and respecting the natural constraints.*
- *7.1.3.1 (p62) identify opportunities and actions for improving water quality, wildlife connectivity, aquatic and terrestrial habitat, and recreational access.*
- *7.3.3.1 (p65) Continue to meet the British Columbia Climate Action Charter commitments by reducing greenhouse gas (GHG) emissions in the community and investing in local climate action projects that reduce emissions and build adaptive capacity.*
- *8.2.2.2 (p72) Provide accessible and quality parks, greenways, open spaces, and recreational corridor systems that: (a) Protect, restore or enhance biodiversity, environmentally sensitive areas and provide an ongoing supply of ecosystem services.*

Simply designing and constructing a mechanical wastewater treatment facility, in and of itself does not address many of these broader goals.

During the options development stage the goal list was frequently referenced to see how any given option could address the most goals possible. The process of identified the goals first helped to develop options that could achieve the established goals. The Biochar Media Reed Bed concept was developed through this

process. It provides a highly sustainable means of achieving quaternary levels of contaminant removal and biodegradation; removing pharmaceuticals and other emerging micro-contaminants and achieving a level of treatment that is currently not required by any regulatory agency, while also being a carbon-negatives process that also achieves habitat enhancements while reducing and removing man-made toxins. It was by a wide margin the preferred treatment option selected by the community, and the inclusion of the biochar reed bed and wetland augmentation provides an outstanding opportunity to action many of the aspirational goals within the Cumberland OCP and the CV Sustainability Strategy. It is a real-world example of leveraging "grey infrastructure" (wastewater treatment) to achieve a range of broader community and environmental goals.

2.14 Environmental and Community Benefits

The final effluent is intended to be used to augment the flow of water through an adjacent drained wetland area, establishing a wet condition throughout the summer, and a non-point diffused discharge into Maple Lake Creek. The augmented wetland area will also be replanted with native wetland species, replacing the invasive canary grass, and pipeline routed used to distribute the treated effluent through the wetlands will be covered by walking trails to provide access for public viewing opportunities and amenity value.

A unique feature of the constructed Reed Bed (engineered wetland) is the incorporation of Biochar as part of the root zone media. The Biochar provides a dual function in its ability to adsorb and remove micro-contaminants that are not removed through wastewater treatment (including personal care products, pharmaceuticals, endocrine disruptive compounds and metals) from the water.

The combined wastewater treatment system incorporates the robust and low operating cost associated with lagoon wastewater treatment, efficient solids-liquid separation and disinfection, and tertiary and quaternary treatment through the constructed Red Bed and passage through the natural (enhanced natural habitat) wetlands, while restoring and enhancing natural habitat, and providing human amenity value. The lagoon treatment system is also much better able to attenuate and treat the peak stormwater flows that occur during the winter months despite the community's efforts to separate storm and sanitary wastewater collection within the sewer system. It also represents a conscious decision to "reinvent" the lagoon treatment system, and "reanimate" the adjacent wetland area, rather than have a mechanical plant and discharge pipe.

In addition to establishing wet conditions throughout the year within the wetlands, a series of surface streams and ponds will also be created for habitat enhancement purposes and will include mulch infiltration beds and subsurface drip irrigation. Removal of Reed Canary Grass will also be carried out and replaced with plantings of native wetland species suited to the conditions established.

To increase the social value and sustainability of the project, the lagoon facility will be set up for public tours with the intent of providing an educational experience to help the general public understand what is involved in treating wastewater and to appreciate the role that mechanical and natural treatment processes perform in remediating the waste materials and constituents discharged to sewer. Like the program of painting fish symbols adjacent to catch basins to remind the public not to dispose of materials to those catch basins, as the fish symbols clearly establish the catch basins are directly connected to fish habitat. The knowledge gained from associating wastewater practices with the natural habitat of the enhanced wetlands is expected to help bring about important changes in behavior pertaining to source control of contaminants

that may otherwise be discharge to sewer in ignorance. The role of the biochar reed bed and wetlands augmentation area will also both be completely accessible, with walking trails and interpretive signage. The project will create a new network of walking trials throughout the wetland and connecting green corridors and provide wildlife viewing opportunities.

The above wetland habitat enhancement and recreational amenity values were extracted from the Cumberland Official Community Plan and grant funding applications.

2.15 Expected Environmental and Social Impacts

The LWMP envisions the final effluent will be used to irrigate (or "augment") the surrounding wetland areas, restoring a natural summer “wet” conditions and bank-flow infiltration into the creek. The augmented wetland will be replanted with native species and walking trail provided along the pipe routes for public viewing access and amenity value. The reed bed (engineered wetland) will incorporate biochar as part of the media, to assist in adsorbing and removing emerging contaminants, including pharmaceuticals, from the water. This proposed system is unique, combining fully engineered and passive natural water remediation processes to achieve a high water-quality level that would not be possible with a mechanical treatment process alone, while also restoring and enhancing natural habitat and providing community amenity value. The concept “reinvents” the lagoon treatment system, and “reanimates” the nearby wetland areas, rather than have a mechanical plant and discharge pipe.

The project will restore land for wildlife habitat: The wetlands directly north of the lagoons is a natural peat area. Maple Lake Creek is a 2 km channel that was created in the 1930's through the peat area to drain it for agriculture and the wetland dry out in the summer. Invasive Reed Canary Grass now covers most of the wetland area; however, these invasive plants can be removed and replaced, and the wetlands can be augmented to restore the natural summer "wet" conditions and create a series of surface streams and ponds for habitat diversification.

The completed project is intended to provide and enhance public access to the area, and improve public knowledge of how wastewater in Cumberland is managed and the close interrelationship with the natural environment. To enhance community education regarding wastewater management, tours will be set up of the lagoon facility and the biochar reed bed and wetlands augmentation area will both be completely accessible for public viewing, with walking trails and interpretive signage. The project will also create a new network of walking trials throughout the wetland, with wildlife viewing opportunities.

From a sustainability perspective, a fundamental goal from the outset of planning this project was to achieve as many of Cumberland's community goals as possible, including those that would not normally be associated with a wastewater project, such as habitat enhancement.

3.0 BC INFRASTRUCTURE PLANNING GRANT PROGRAM

An application was made to the BC Infrastructure Planning Grant Program by the Corporation of the Village of Cumberland for funding to carry out a Feasibility Study of Wastewater Polishing by Reed Bed and Natural Wetlands. The purpose of the project is to study the potential of integrating constructed (man-made and engineered) and natural (enhanced) wetlands as part of the funded wastewater treatment upgrades currently being planned and implemented by Cumberland. The basic concept is to upgrade the existing lagoon treatment system and then transfer the treated wastewater, meeting regulatory requirements, to a constructed Reed Bed and natural wetlands to provide a "polishing" or quaternary treatment function to remediate and remove contaminants that are not considered by the MWR; producing high quality water while also enhancing the wetlands habitat and creating a community recreational and educational amenity.

The first treatment element is the Reed Bed (constructed vertical flow wetland) which is to incorporate a unique feature to the growing medium within the root zone in the form of "biochar" (form of charcoal) within the normal sand/gravel media. Biochar is similar to activated carbon in its ability to adsorb a wide range of dissolved and particulate organic and inorganic micro-contaminants including pharmaceuticals, personal care products and metals that are not removed by conventional primary, secondary or tertiary treatment processes. The biochar carbon also helps support natural bacterial remediation activity within the Reed Bed and as biochar is made from natural organic materials (e.g biosolids and wood waste), the Reed Bed treatment process is also effectively carbon negative.

The second treatment element is Wetland Augmentation – transferring the quaternary treated water to the adjacent natural wetland area and carrying out measures to do this in a manner that enhances the natural habitat conditions through the removal of invasive Reed Canary Grass and re-introduction of native emergent plant species, while also creating a community recreational and educational amenity, while restoring the natural surface drainage flow and groundwater conditions. The water moving through the wetlands will also benefit from natural attenuation processes.

The principles behind the treatment process within a constructed Reed Bed and natural wetland are well known and were also studied as part of the Village of Cumberland Stage 2 Liquid Waste Management Plan (LWMP). However, the design of such system for each application is unique and the concept of adding biochar to enhance micro-contaminant remediation is innovative and would benefit from a pilot study to establish optimal design characteristics and conditions – a feasibility study to examine the engineering and logistical side prior to full-scale implementation and to determine cost.

3.1 Proof of Concept

The Feasibility Study is also intended to serve several purposes, including to be the basis of

1. A decision by Cumberland to proceed with either or both wetland concepts,
2. Seeking input from the community and local environmental groups as potential partners in the design and construction, and
3. Future applications to provincial and federal grant funding programs

3.2 Deliverables

The deliverables from the Feasibility Study, as stated in the grant proposal, are to include a feasibility report that establishes the following for the Biochar Reed Bed concept and augmented natural wetlands:

- Conceptual design.
- Preliminary system size and layout based on an estimation of soil hydraulic properties.
- Consideration for vertical and horizontal flow design/operating characteristics for the reed bed.
- Construction and cost considerations for the reed bed including quantities of biochar and granular media, effluent distribution, drainage, excavation and containment.
- Consideration for natural wetland water distribution – naturalised channels, mulch beds, subsurface drip, etc
- Consideration for "reanimation" of the natural wetland – including the removal of invasive Reed Canary Grass and revegetation with native species and improvement of flow and pond conditions to encourage wildlife habitat.
- Considerations for integrating public access into the natural wetland area.
- Considerations for integrated stormwater treatment by one or both wetlands.
- Projected construction costs and timelines (Class D level).
- Estimated carbon sequestration value for the biochar used in the Reed Bed media.
- Operational and maintenance expectations.
- Some relevant real world examples of other systems incorporating biochar into constructed wetlands.

The results of the draft Feasibility study are intended to be presented to the public before the feasibility report is finalized. Since this process also forms a part of the LWMP Stage 3 process, the public must have a chance at input before a decision can be made to proceed with the full-scale implementation of this project.

4.0 REED BED PILOT PROGRAM

4.1 Pilot Program Objectives

A small pilot-scale field trial was carried out to evaluate the performance of vertical flow reed beds using five different growing media formulations and/or hydraulic loading patterns using-partially treated lagoon effluent to assess hydraulic characteristics and contaminant removal performance as summarized below. The program was intended to evaluate the effects of biochar in enhancing residual contaminant removal and assess the extent to which biochar content affect the flow of water though the media.

4.2 Experimental Setup

4.2.1 Polyethylene Tote Setup

Thirteen (13) 1m^3-volume polyethylene re-purposed liquid transport totes were obtained to evaluate the performance of various media mixtures of sand, biochar and natural peat, and plumbed with a bottom drain to have a vertical (top-to-bottom) flow configuration. The top of each tote was removed and the totes were filled with a bottom 200mm layer of pea gravel and an upper 500 mm of media as illustrated in **Figure B** summarized in **Table A**

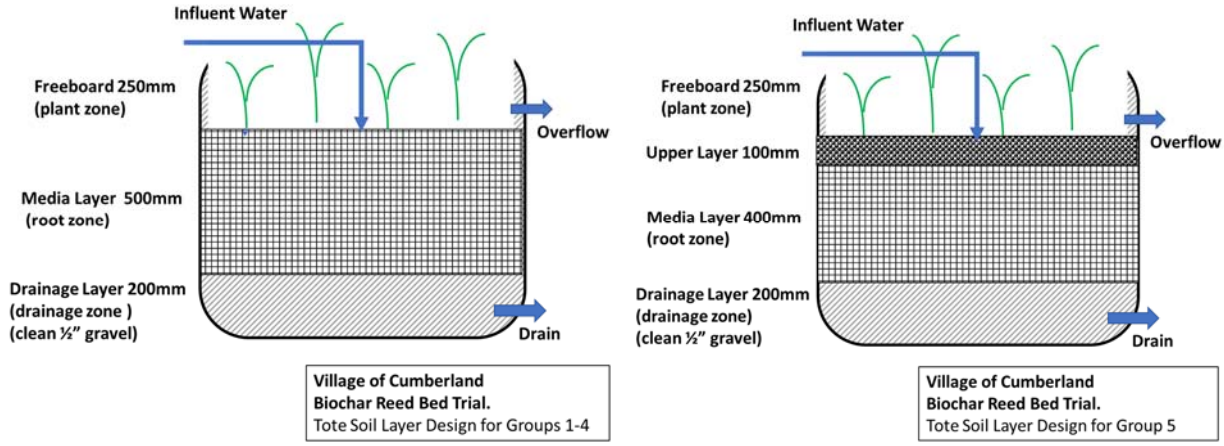


Figure B Pilot Test Tote Media Characteristics

4.2.1.1 Test Unit 1: 100% Sand)

Test Unit 1 consisted of a single tote containing 500 mm of 100% sand underlain by 200 mm of clean ½" gravel for drainage. Bacteria growing attached to the sand can be expected to adsorb contaminants as degrade residual organic constituents in the water. Although three replicates were constructed for the other test units there were insufficient totes available to be able to replicate Test Unit 1. Partially treated wastewater from the facultative lagoon was continuously fed to the top of the media for 23 out of 24 hours and allowed to freely drain from the bottom.

Table A Testing Program Objectives

Unit	Treatment Objective	Media Composition	Dosing
1	Treatment using sand.	100% sand.	Continuous
2	Treatment using a combination of sand and biochar.	80% sand and 20% biochar.	Continuous
3	Treatment using a mixture of sand and biochar with tidal operation.	80% sand and 20% biochar.	Tidal - 3-hour-fill and 21-hour-draw *
4	Treatment using a mixture of wetland peat, sand and biochar. **	60% wetland peat, 20% sand, and 20% biochar	Continuous
5	Treatment using a layer of mixed sand and biochar over wetland peat. ***	100 mm (4 inch) covering layer of 50% sand and 50% biochar over wetland peat.	Continuous

* Tidal flow draws oxygen (air) into the media as the liquid level drops.
** Simple construction with sand to aid in drainage and biochar to aid in micro-pollutant removal.
*** Low cost approach with the sand to prevent the biochar from floating away.

4.2.1.2 Test Unit 2: Mixture of 80% Sand + 20% Biochar

Test Unit 2 consisted of three (3) totes (replicates) containing 500 mm of a mixture of 80% sand and 20% biochar underlain by 200 mm of clean ½" gravel for drainage. Partially treated wastewater from the facultative lagoon was continuously fed to the top of the media for 23 out of 24 hours and allowed to freely drain from the bottom.

4.2.1.3 Test Unit 3: Mixture of 80% Sand + 20% Biochar (4 x Flow)

Test Unit 3 consisted of three (3) totes (replicates) containing 500 mm of a mixture of 80% sand and 20% biochar underlain by 200 mm of clean ½" gravel for drainage. Partially treated wastewater from the facultative lagoon was continuously fed to the top of the media for 23 out of 24 hours at a rate of four times greater than the other Test Units and allowed to freely drain from the bottom. This dosing regime was changed in late February to a tidal (fill and draw) configuration, with continuous dosing over 3 hours resulting in flooding the media, and then allowed to drain and rest without dosing for 21 hours.

4.2.1.4 Test Unit 4: Mixture of 60% Peat + 20% Sand + 20% Biochar

Test Unit 4 consisted of three (3) totes (replicates) containing 500 mm of a mixture of 60% peat, 80% sand and 20% biochar underlain by 200 mm of clean ½" gravel for drainage. Partially treated wastewater from the facultative lagoon was continuously fed to the top of the media for 23 out of 24 hours and allowed to freely drain from the bottom.

4.2.1.5 Test Unit 5: Layer of 50% Sand + 50% Biochar over Peat

Test Unit 5 consisted of three (3) totes (replicates) containing 100 mm of a mixture of 50% sand and 50% biochar over 400 mm of peat underlain by 200 mm of clean ½" gravel for drainage. Partially treated wastewater from the facultative lagoon was continuously fed to the top of the media for 23 out of 24 hours and allowed to freely drain from the bottom.

4.2.1.6 *Summary of Reed Bed Test Unit Media Composition and Loading*

Table B summarizes the pilot-scale reed bed test configurations and media loading characteristics.

Table B Summary of Pilot-Scale Testing of Reed Bed Media and Loading Tests

Test Unit	1	2	3	4	5
Totes	1	3	3	3	3
Planted	Yes	Yes	Yes	Yes	Yes
500 mm MEDIA MIXTURE COMPOSITION					
Sand	100%	80%	80%	20%	50% *
Biochar	0%	20%	20%	20%	50% *
Peat	0%	0%	0%	60%	100%*
Loading Pattern	Continuous Vertical Flow	Continuous Vertical Flow	3-hr Fill 21-hr Draw	Continuous Vertical Flow	Continuous Vertical Flow

* Group 5 media consists of a 100 mm layer of a 50/50 sand/biochar mixture over 400 mm of natural peat.

4.3 Flow Splitting and Test Unit Layout

The Test Units were fed water pumped from the facultative lagoon through an unused overflow chamber of the splitter box between the aerated and facultative lagoons as illustrated in **Figure C** and **Figure D**. This chamber is intended to bypass the aerated lagoon under excessively high influent flow conditions and transfer the excess influent wastewater directly into the second facultative lagoon. Under normal operating conditions there is no flow in the overflow chamber. Two iden tical submersible pumps were installed into the chamber to draw water from the second lagoon and transfer the water to the Test Units. As illustrated in **Figure E**, one pump was used to supply water to the ten (10) totes within Test Units 1, 2, 4 and 5 and the second pump was used to supply water to the three (3) totes in Test Unit 3.

Once the Test Units were constructed adjustments were made so that the pumped supply was equally distributed to each of the 10 totes in Test Units 1, 2 4 and 5, with each tote receiving a flow rate of 1.5 Litres per minute. A similar adjustment was made for the 3 totes in Test Unit 3, with a measured flow of 6 Litres per minute for each tote. A photo of the connecting pipe from the pumps located in the chamber to the test unit totes is presented in **Figure F**

4.4 Initial Drainage Rates

The 13 totes were loaded with media by September 29, 2020. Hydraulic testing was then initiated using clean water. The drain for each tote was turned off and the totes were filled with clean water to saturate the media. The drain was then re-opened and the rate of drainage timed and recorded. Table D summarizes the drainage rates that were observed for each tote and **Figure G** shows the individual readings take of water level and time, illustrating the draw-down for each tote was uniform and linear with time.

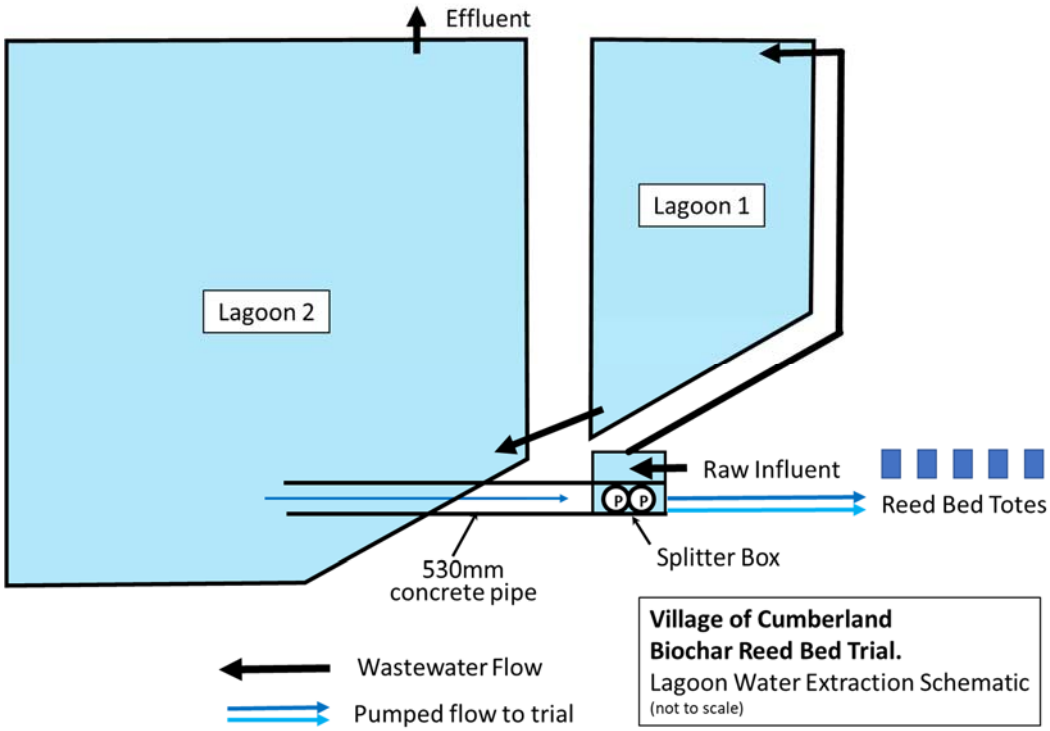


Figure C Lagoon Feed to Reed Bed Pilot Totes

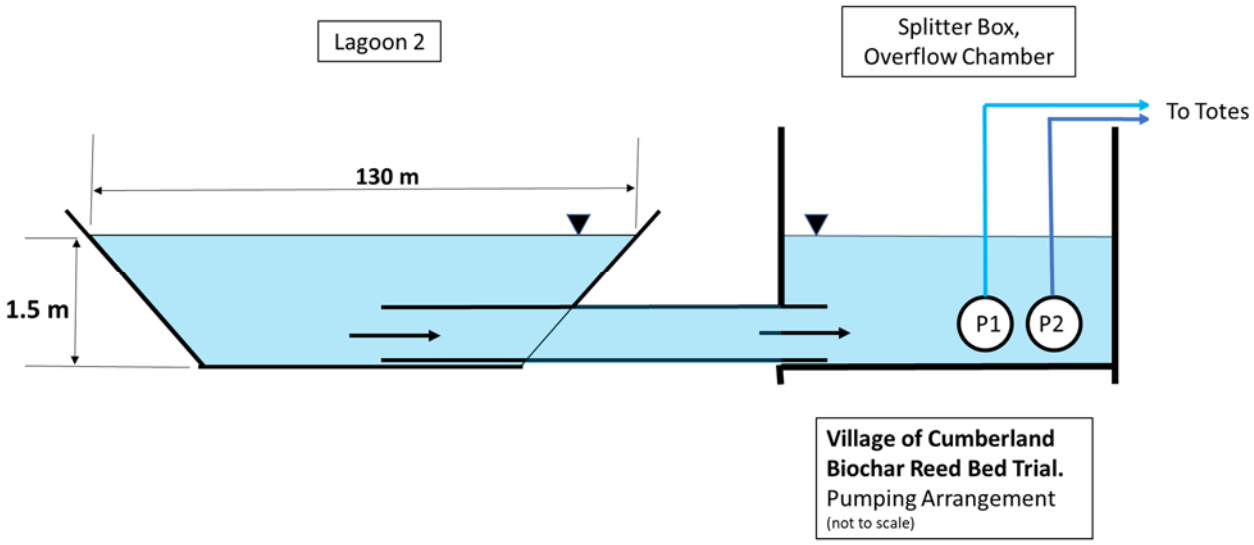


Figure D Transfer of Liquid from Lagoon 2 to Pilot Test Totes

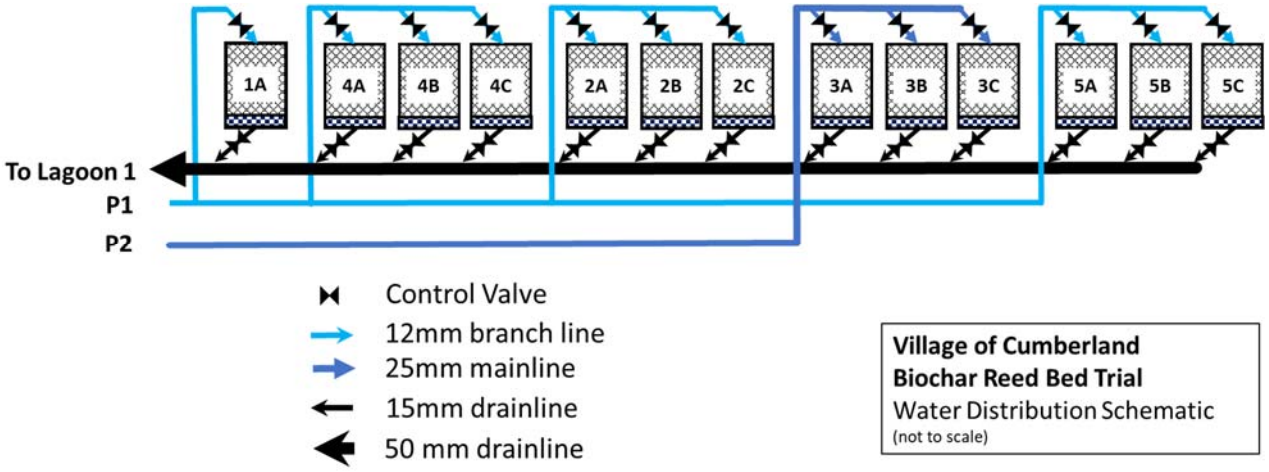


Figure E Test Totes Effluent Distribution Layout



Figure F Photo Showing Connecting Pipe from Chamber Pumps to Totes

*Table C Initial Drainage Rates After 24 Hours of Hydraulic Loading with Fresh Water **

TEST UNIT	Draw Down Rate		AREA*	RATE	DESCRIPTION
	(mm/min)	(m/day)	(m2)	(min/in)	
1	16.5	23.8	303	1.5	100% Sand
2	14.5	20.9	345	1.7	80% Sand + 20% Biochar
3	16.5	23.8	303	1.5	80% Sand + 20% Biochar
4	7.3	10.4	690	3.4	60% Peat, 20% sand, 20% biochar
5	7.5	10.8	667	3.3	50/50 sand/Biochar layer over Peat

* Area based on loading rate of 7,600 m^3/d.

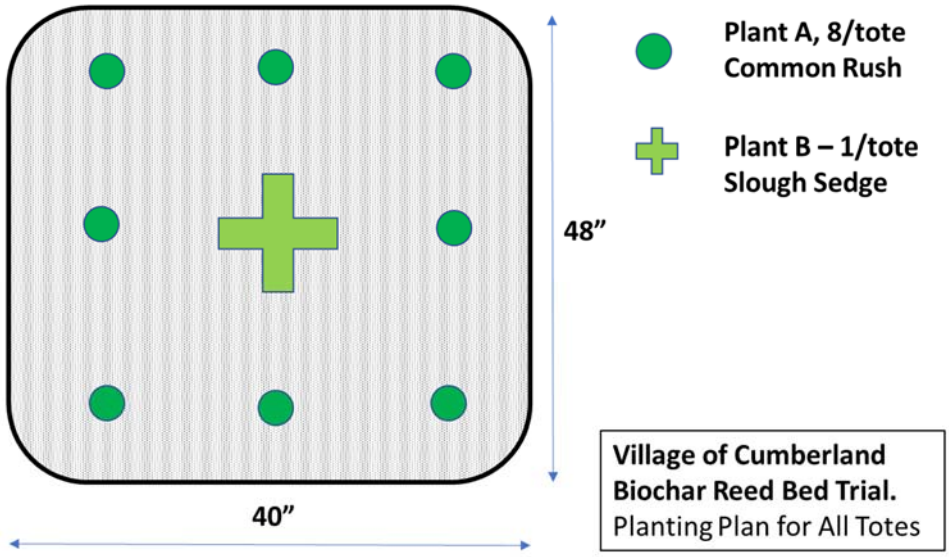


Figure G Tote Plants

4.5 Wetland Plants

On January 20, 2021, each of the totes was planted with 9 emergent plants consisting of eight (8) Common Rush and one (1) Slough Sedge, as illustrated in **Figure H**.

The totes with emergent vegetation in place are shown in **Figure I**. Once the planting was complete loading using lagoon effluent was commenced on January 21, 2021.

The drainage rate through the totes in Test Unit 1, 2 and 3 were similar, indicating the biochar did not initially have a significant impact on the initial drainage rate (approx. 16 mm per minute). However, the six totes in Test Units 4 and 5, containing a significant amount of peat, had much lower initial drainage rates (7.3 mm per minute).



Figure H Photo of the Constructed Pilot-Scale Reed Beds

4.6 Temporary Test Cessation Due to Freezing

The test units were loaded with partially treated lagoon effluent for 20 days until February 10,2021, when cold weather and freezing conditions stopped all flow to the totes.

Loading with lagoon effluent resumed on February 26 when the warm weather returned.

4.7 Flow Regime Change

Although totes in Test Unit 3 were initially continuously subjected to a hydraulic rate four times greater than the other Test Units (i.e. 8.28 m^3/d versus 2.07 m^3/d), the daily loading rate and top-down flow-through loading pattern was changed to a tidal flow pattern on February 26. As of that date the daily loading rate was decreased to 1.08 m^3/d. The totes in Test Unit 3 were filled over a 3 hour period once per day and then drained.

4.8 Sampling Events

The test program includes three (3) sampling events: 1) March 3, 2021 (completed); 2) May, 2021); and 3) mid-summer (July/Aug 2021). The timing of the third sampling event will be to coincide with an algal bloom in the lagoons.

4.9 March 3, 2021 Water Quality Sampling Event

4.9.1 Water Analyses

On March 3, five days after the test program resumed following the shut down due to freezing, water quality samples were collected for physical, chemical and biological analyses from the following locations:

1. Raw wastewater influent to the treatment lagoons (one sample)
2. Influent feed to reed bed trial, from Lagoon 2 (one sample)
3. Drainage from each test group (one litre collected from each tote to prepare a 3-litre composite sample for each of the five test groups))

The sampling program is intended to determine the water quality achieved by the first lagoon and the residual treatment achieved through the Test Units.

The following is a list of analytes included in the program:

- Carbonaceous Biochemical Oxygen Demand (CBOD)
- Total Suspended Solids (TSS)
- Chemical Oxygen Demand (COD)
- Ultraviolet Transmissivity (UVT)
- Turbidity
- Orthophosphate
- Total Phosphorus
- Ammonia
- Nitrate
- Pharmaceuticals (a package of analytes)
    - Caffeine
    - Acetominophen
    - Carbemazapine
    - Fluoxetine
    - Primidone
    - Sildenafil
    - Sulfamethoxazole
    - Trimethropin

4.9.2 Visual Appearance and Clarity

Figure J illustrates the visual clarity and appearance of the samples at the time of sampling. Furthest to the left in the photo is the raw water sample prior to discharge to the totes. The third and fourth sample provide a comparison between Test Unit 1 (labeled Tote 1 with 100% sand) and Test Unit 2 (80% sand & 20% biochar), respectively. The sample for Test Unit 2 (containing biochar) is noticeably clearer than the sample representing sand media alone.



Figure I March 3, 2021 - Visual Clarity - Water Quality Sampling.

Figure K indicates the order of reduced clarity: 1) Test Unit 2 (greatest clarity); 2) Test Unit 4; 3) Test Unit 1; 4) Test Unit 5; and 5) Test Unit 3. The sample collected for Test Unit 2 and Test Unit 5 (in particular) also appear to have a greater degree of colour than the other Test Unit samples.



TEST UNIT 2 **TEST UNIT 4** **TEST UNIT 1** **TEST UNIT 5** **TEST UNIT 3**

Figure J Apparent Order of March 3 Sample Clarity

4.9.3 Media Compaction

It was also noted the media in all of the totes had settled over the winter, reducing the overall media bed depth and dropping the top layer from 100 to 150 mm lower than originally installed in September.

4.9.4 Hydraulic Flow Rates

The March 3, 2021 sampling event also included a second draw-down test for each of the Test Units to determine the degree of reduction in hydraulic flux that occurred since they were initially tested in October 2020. **Table D** summarizes the observed draw-down rate for each of the Test Units at the time they were constructed in September and also sampled in March 2021. The draw-down rate in all 13 totes decreased over the winter, with the totes in Test Unit 3 and Test Unit 5 exhibiting the greatest percentage reduction of 73 and 63 percent, respectively. Test Unit 4 and Test Unit 2 totes exhibited the next greatest reduction of 38 and 30 percent, respectively. Test Unit 1 with 100 % sand exhibited the least reduction in flow rate of only 18 percent. **Table E** also shows the percent reduction using Test Unit 1 as the baseline reduction.

Table D Drainage Rates in March 2021

TEST UNIT	Draw Down Rate		AREA*	DESCRIPTION
	(mm/min)	(m/day)	(m^2)	
1	13.5	19.4	390	500 mm (100% Sand)
2	10.2	14.7	520	500 mm (80% Sand + 20% Biochar)
3	4.4	6.3	1210	500 mm (80% Sand + 20% Biochar)
4	4.5	6.8	1120	500 mm (60% Peat + 20% Sand + 20% Biochar)
5	2.8	4.0	1900	100 mm (50% Sand + 50% Biochar) over 400 mm Peat

- Area calculated based on 7,600 m^3/day

Table E Comparison of Drainage Rates Between October, 1 2020 and March 3, 2021

TEST UNIT	OCTOBER (mm/min)	MARCH (mm/min)	REDUCTION (%)	ADJUSTED * (%)
1	16.5	13.5	-18	0
2	14.5	10.2	-30	-11
3	16.5	4.4	-73	-55
4	7.25	4.5	-38	-20
5	7.50	2.8	-63	-44

* Adjusted by accepting the reduction in hydraulic flow rate for Tote 1 as the baseline.

4.10 Chemical Analyses

Table F presents the laboratory analytical results for various conventional wastewater parameters and pharmaceuticals (micro-constituents) for samples collected on March 3, 2021. As previously discussed, samples were collected of the raw wastewater prior to treatment, of the liquid from the second facultative lagoon (partial secondary treatment) and of composite samples collected from each of the totes in Test Units 1 through 5. Of the six pharmaceuticals that were analyzed for, five were detected in the raw wastewater at concentrations generally significantly greater than the analytical detection limit. Notable exceptions include Primidone, which was not detected, and Sildenafil, which was detected at a concentration only slightly above the analytical detection limit indicated in Table F. While treatment through the aerated lagoon was able to remove all of the acetaminophen present in the raw wastewater, significant concentrations of caffeine, carbamazepine, Fluoxetine, sulfamethoxazole, and trimethoprim were still present in the water fed to the tote Groups. Carbamazepine is well known for being resistant to degradation by normal wastewater treatment processes.

While the various mixtures of sand, biochar and peat all removed a generally high percentage of each of these residual pharmaceuticals, only Test Unit 2 (20 % biochar and 80% sand) consistently removed all pharmaceuticals to less than detection levels. With respect to conventional water quality parameters, Test Unit 2 also exhibited significant reductions in residual BOD, COD and turbidity, with modest reductions in ammonia (due to nitrification) and phosphorus adsorption while simultaneously having the greatest degree of improvement in ultraviolet transmissivity, increasing it from 27 to 57 percent transmissivity. Test Units 4 and 5, with peat content, exhibited similar reduction in conventional parameters, along with enhanced phosphorus removal, but without the improvements in UVT observed for Test Unit 2.

Table G presents pharmaceutical analytical results from tests conducted in 2015 by the District of Sechelt filtering tertiary reclaimed wastewater through biochar made from wood pellets, indicating similar reductions due to the biochar used during this pilot-scale program.

Table F March 3 2021 Sampling Event Analytical Results

PARAMETER	Units	RL	RAW	LAG 2	GROUP				
					1	2	3	4	5
CBOD	mg/L	11.1	172	46.4	23.1	16.7	41.5	14.1	19.5
COD	mg/L	20	359	150	91	66	94	63	101
TSS	mg/L	10	108	38.7	23.3	14.2	29.3	11.7	13.3
NH_4	mg/L	0.5	20.7	24.3	22.2	18.1	24.2	10.7	19.6
NO_3	mg/L	0.01	-	-	0.045	0.056	-	1.01	1.8
NO_2	mg/L	0.01	-	-	0.045	0.039	-	0.026	0.022
PO_4	mg/L	0.005	1.34	2.68	2.49	1.5	2.09	0.0495	0.426
TP	mg/L	0.005	3.11	4.12	3.32	2.37	3.09	0.496	1.24
UVT	% T	0.1	12.4	26.9	37.3	56.8	36.2	33.6	16.3
TURB	NTU	0.1	77.7	31	16.6	**18.1**	20.6	17.4	19.8
Pharmaceutical Parameters									
Acetaminophen	ug/L	0.05	152	-	-	-	-	-	-
Caffeine	ug/L	0.05	125	94.9	62.8	-	35.8	0.783	15
Carbamazepine	ug/L	0.05	0.755	0.559	0.552	-	0.193	-	0.071
Fluoxetine	ug/L	0.05	0.131	0.069	-	-	-	-	-
Primidone	ug/L	0.05	-	-	-	-	-	-	-
Sildenafil	ug/L	0.05	0.076	-	-	-	-	-	-
Sulfamethoxazole	ug/L	0.05	0.223	0.146	0.101	-	0.125	-	-
Trimethoprim	ug/L	0.05	0.261	0.206	0.173	-	-	-	-

* Values indicated as "-" are non-detect (i.e. less than the RL value indicated in the third column)

Table G 2015 District of Sechelt Biochar Test Results

Analyte	Use	CONCENTRATION (ug/L)			
		RL	Influent	Tertiary Effluent	Tertiary + Biochar
Acetominophen	pain killer	0.005	62.9	0.075	-
Carbamazepine	anti-epileptic	0.001	0.334	0.347	0.083
Diclofenac	anti-inflammatory	0.01	2.82	0.899	0.427
Naproxen	anti-inflammatory	0.025	10	0.388	0.104
Sulfamethoxazole	antibiotic	0.005	0.733	0.146	0.086
Triclosan	anti bacterial agent	0.05	0.637	0.064	-
Trimethoprim	antibiotic	0.005	0.138	0.213	0.017
Warfarin	blood anti-coagulant	0.001	0.009	0.007	0.004

4.11 Summary of Findings to Date

4.11.1 Preliminary Observations

It is too early to draw specific conclusions regarding the impact of hydraulic and organic loading on the various media mixtures and conclude which media mixture presents an optimal combination of residual constituent removal and minimal life cycle cost (i.e. considering both capital and operating costs over the expected life of the constructed reed bed before the adsorption of the media is exhausted and requires replacement. However, there are some preliminary observations that can be used to help inform a conceptual design at this stage as part of the feasibility assessment of this approach.

4.11.2 Biochar Enhancement of Constructed Wetlands

There has been extensive research carried out in the past decade on the use of biochar for contaminants removal from aqueous solutions, proving biochar to be an excellent sorbent with a broad range of feedstock sources, simple and easy preparation, and a wide range of surface and structural properties depending on the feedstock source and method of charring, including pyrolysis, hydrothermal carbonization, gasification, and torrefaction. (Wang et al., 2020).

There is an extensive international interest and effort to create and restore wetlands and their ecosystem functions, with the most common objective being to intercept nonpoint sources of contaminants from stormwater runoff including eroded sediments, excess fertilizer, and pathogenic microorganisms to prevent them from entering into streams, rivers, lakes, and coastal waters. Although natural wetlands and riparian zones can reduce the nitrogen and phosphorus content of runoff by more than 90%, they have significant long-term loading limitations and often don't meet treatment expectations. As a consequence, there has been an increase in research efforts over the past decade to develop effective methods of constructing and

restoring wetlands while also realizing their potential for contaminant removal and downstream surface-water and riparian ecosystem protection.

A wetland's ability to remediate water and remove constituents of concern depends on the condition and characteristics of the soil or growing media, as the improvements in water quality, the greenhouse gas emissions, and vegetative development depends on the physical, chemical and biochemical interactions within and between soil and water. The addition of soil or media amendments has been investigated extensively as a key element of wetlands restoration to hasten soil development and stimulate associated wetland functions. The addition of straw, topsoil, and compost to the soil and growing media of constructed wetlands has been demonstrated to significantly improve soil/media properties including decreasing bulk density, stimulating nutrient cycling and microbial community development, and increasing carbon and nitrogen pools, soil moisture, and phosphorus sorption. However, there hasn't been an extensive number of publications and sharing of information, including how different types and amounts of amendments will affect the underlying soil/media properties that influence wetland function and the trade-offs between intended or desirable effects and unintended or undesirable effects and functions – particularly regarding the effect of amendments on greenhouse gas emissions.

Biochar is a carbon-rich by-product typically created by heating biomass (e.g. wood, manure, leaves, etc.) in a closed container with little or no available oxygen. Biochar is used to revive depleted soils and improve crop production and fertilizer utilization while reducing nutrient leaching and greenhouse gas emissions. It is highly stable and serves to bind soil particles and increases carbon sequestration in soils, as well as having a high affinity for adsorbing organic (e.g. pesticides, herbicides, endocrine disruptive compounds and pharmaceuticals, and inorganic (e.g. dissolved metals) constituents from water passing through the soil/growing-media. Although there has been research demonstrating that biochar can remove a wide range of contaminants from water, the potential impact on contaminant remediation by amending wetlands media with biochar amendments has been the subject of limited investigation.

Typically produced as a co-product from the partial combustion of waste biomass and used in agriculture as a soil amendment, Biochar's adsorptive properties is influenced by the type of biomass (affecting pore size and porosity) and the production processes. Applied as a soil amendment, biochar can improve plant nutrient utilization capacity and increase soil fertility, remove pollutants and be a means of sequestering carbon. Biochar's particle size, roughness and porosity can vary greatly depending on the feedstock characteristics and charring process. Increased porosity increases surface area for attached biological growth, increased attachment sites and increased water retention to support plant growth. The ash or mineral content, affected by pyrolysis temperatures, influences heavy metal removal capacity and cation exchange capacity. The pyrolysis temperatures also influence redox potentials and electron donor or acceptance characteristics.

The literature consistently reflects that adding biochar to constructed wetlands media has a beneficial effect in the form of enhanced removal of pollutants. Gupta, Ann and Lee (2016) examined the removal of conventional contaminants by passing synthetic wastewater through constructed wetland beds with a mixture of gravel and biochar and a retention time of three days, achieving an removal rate of 90% COD, 60% TN, 60% NH3, 90% NO3-N, 80% TP, and 65% PO4. Vijay, Sudarsan and Nithiyanantham (2019) demonstrated that biochar made from coconut shells improved both turbidity and total dissolved solids levels, as well as nitrogen removal. Saeed et. al (2019) also demonstrated enhanced degradation of nitrogenous pollutants and removal of total phosphorus. Keenan (2016) noted that, when used as a soil

amendment, biochar is linked to significant reductions in greenhouse gas emissions, including nitrous oxide, carbon dioxide and methane. Simply adding a layer of biochar to the surface of a constructed subsurface-flow wetlands has been demonstrated to enhance microbial diversity within gravel media and significantly increase ammonia and total nitrogen removal efficiencies in comparison to wetland media constructed of pure gravel (Deng et al., 2019)

Activated carbon (AC) has long been recognized for it's ability to adsorb and remove both inorganic contaminants (e.g. metals and metalloids) and emerging organic contaminants in the presence of dissolved organic carbon, with treatment applications including air and water, with water including potable water sources, wastewater effluent and stormwater runoff and biochar addition to wetland substrate has been demonstrated retain well absorbing organic mico-pollutants (OMP) (AquaNES. 2016),. Metals removal is influenced by the number of deprotonated carboxyl and sulfonic groups present in the biochar as well as phenols, lead and manganese (Abedi and Mojiri, 2019). While activated carbon's effectiveness and utility in water treatment is well established, the viability of biochar as a filtration media for water treatment has been recognized only relatively recently.

4.11.3 Hydraulic Performance

Biochar, like activated carbon, absorbs water and swells and, depending on the particle size difference between the biochar and soil media and the hydrophobicity of biochar, and often reduces the hydraulic transmissivity - roughly in proportion to the amount of biochar present in the media mix. The hydraulic draw-down tests conducted in October 2020 and March 2021 indicate the 20% biochar amended sand (Tote Group 2) has a significantly slower drainage rate than sand alone, and that increased hydraulic loading and/or the addition of peat significantly impacts and slows hydraulic conductivity. While the long-term changes in hydraulic conductivity and drainage won't be determined until the summer of 2021, the data obtained to date strongly suggests that modest amounts of biochar (e.g. 20%) will significantly increase the amount of organic and inorganic constituent removal or sand alone, with a marginal reduction in drainage rate if the proportion of biochar is kept to a reasonable level.

For the purpose of this feasibility assessment, until the pilot-scale tests are complete, the results to date for the Group 2 Totes will be used to prepare a preliminary constructed reed bed design.

5.0 ECOFISH WETLANDS ASSESSMENT

5.1 Background

Ecofish Research Ltd. (Ecofish) was retained by Cumberland to assess the proposed application of reuse water for the purpose of augmentation flow through the wetland area located adjacent to the wastewater treatment lagoons. The work consisted of assessing the current conditions within the various wetland areas in the vicinity of the existing lagoons and advising on potential impacts and/or benefits to these wetlands from increased water and potentially increased nutrient inputs associated with the reuse water. The assessment is intended to support an application for a short-term authorization to carry out a demonstration-scale trial of effluent reuse in the wetland area, and to support an application by Cumberland for an Operational Certificate in conjunction with a final Liquid Waste Management Plan to be submitted to the BC Ministry of Environment – anticipated in 2025.

Two of the wetland areas shown in Figure A were considered by Ecofish for the effluent reuse demonstration trial (Wetland Trial): 1) the Southwest Wetland section; and 2) the East Wetland section. These two sections are separated by an excavated ditch named Maple Lake Creek. Both wetland sections are part of a land parcel that was gifted to Cumberland as a nature area under Environment Canada's Eco Gift program and have been approved for use as a treatment wetland (Environment Canada 2007). A third area, the Northwest Wetland section, was previously identified as being environmentally sensitive and Environment Canada has mandated this area not be negatively impacted by effluent management practices (Environment Canada, 2007).

A reed bed is proposed to be constructed with biochar incorporated into the media mix to investigate the benefits that could be derived by such a wetland in removing pharmaceuticals from the treated effluent. In addition to verifying the improvements in water quality, an assessment will be carried out to determine if the water augmentation is able to support the restoration of natural wet conditions in the wetlands as well as support future habitat enhancement plans. A possible secondary benefit is an increase in late summer flow in Maple Lake Creek through the controlled release of stored water from the wetlands' augmentation.

The Ecofish report provides an updated wetland bio-inventory and assessment of the East, Northwest, and Southwest Wetland sections during spring (characteristically wet) and late summer/early fall (characteristically dry) conditions, and provides options to guide future decision-making and planning, including the location(s) best suited for the Biochar Media Reed Bed, and the wetland communities most likely to benefit from habitat enhancement and water augmentation.

5.2 Wetland Assessment Methods

Ecofish conducted two assessments of the Cumberland Wetlands in 2020; 1) a spring assessment on June 2; and 2) a late-summer/early-fall assessment on October 1. The assessments were conducted by a professional wetland scientist, a professional biologist, a mapping specialist, and an environmental technician and consisted of wetland delineation and classification, standardized plot data collection, and water quality and water level measurements.

A preliminary wetland delineation was prepared from previous wetland mapping (Mimulus, 2001), as well as other available mapping data (CVRD 2019), and compared with current satellite images to produce a wetland map for verification in the field. Reference photos and vegetation community notes were collected

during the site assessments with a focus on targeting transitional areas between wetland types, as well as large contiguous areas of the different wetland types. Approximately 60 reference points/photos were taken during the June assessment and 35 reference points/photos in October. Vegetation species present within the delineated wetland polygons were classified by ecological community according to the provincial wetland classification system (MacKenzie and Moran 2004), or by TEM standard for terrestrial communities (MOFR 2010). Invasive species were also identified and their locations geo-referenced.

One wetland assessment plot was established in each of the three wetland sections during the spring assessment. An additional wetland assessment plot was established in the East Wetland adjacent to the area proposed for Biochar Media Reed Bed construction during the fall assessment.

Data collected within the wetland assessment plots included site characteristics, soils, water quality (where time permitted), hydrology, vegetation, and wildlife use, as outlined below. Benchmarks were established, and GPS coordinates were taken of all monitoring locations to allow for repeat sampling.

Surveys were conducted to provide an overview of the environmental condition of the wetland assessment plots and included measurements of slope and aspect, estimation of dominant substrates, and a description of microtopography and slope position, the ecological stage such as the age and structure of vegetation, and disturbances such as erosion.

Soil auger samples were collected to a depth of at least 50 cm within each wetland assessment plot and classified by standard metrics including texture, nutrient regime, moisture regime, and coarse fragment content. These metrics are indicators of the productivity of the site.

Manual water level measurements were taken relative to the surface of the ground at existing monitoring wells in the area using an electronic interface measuring tape (Solinst Model 101; 1 mm accuracy) including: three in the Southwest Wetland section, two in the East Wetland section, and two in the Northwest Wetland section. Any ponded surface water or flow was identified, photo-documented, and geo-referenced.

Water quality readings were also collected in the Southwest Wetland section included pH, specific conductivity, water temperature, and dissolved oxygen. Vegetation data were collected from 5.64 m radius (100 m^2) plots originating from the center of each wetland assessment plot. Vegetation data were collected at a high-level, focused on capturing the structure (e.g., short shrub or tree) and coverage of the dominant species and the ecological communities were classified in accordance with 1) red-listed species or ecosystem that is at risk of being lost extirpated, endangered, or threatened; 2) blue-listed species or ecosystem that is of special concern; and 3) yellow-listed species or ecosystem at least risk of being lost. Species that were exotic (non-native) or accidental were not assigned a status rank and were not placed on the lists. Incidental observations of wildlife (sightings) and wildlife use (signs) were also documented and geo-referenced.

The reader is referred to The Village of Cumberland Wetlands Assessment Report (Ecofish, 2020) for the specifics on the assessment data that was collected in 2020.

5.3 Wetlands Assessment Results

5.3.1 Best Locations for Water Augmentation to Enhance Habitat

It was observed that some habitat units in all wetland sections assessed would benefit from water augmentation, but also noted that water augmentation alone may not enhance units that are dominated by non-native invasive reed canary grass. This includes the section unit #3 of the southwest wetland section

and unit #6 of the east wetland section. Water augmentation in these areas could result in expansion of reed canary grass if no control measures or other enhancement features are implemented.

Hardhack in unit #5 and Hardhack/Crab-Apple in unit #2 (Hardhack/Crab Apple) within the east wetland section was concluded to likely benefit from augmentation to maintain swamp-characteristics that would expand the cattail communities and prevent hardhack from shading out other species. Augmentation in unit #2 would also support more skunk cabbage and lady fern and prevent a transition to Upper Forest.

The northwest wetland section is dominated by an environmentally sensitive Pine/Labrador Tea bog community within unit #4, and given the protected status of this area (Environment Canada 2007), it is recommended that water augmentation associated with the construction of the Biochar Media Reed Bed be considered for the east wetland section to avoid potential impact to the mature treed bog. However, the treed bog community was noted top be dry during the June assessment and is transitioning to upland forest, with hemlock growing in the understorey. Augmentation would be needed to maintain the bog community but before this is considered additional work is required to understand the hydrology in this and adjacent units.

5.3.2 Biochar Media Reed Bed Location

Ecofish recommends constructing the Biochar-Media Reed Bed in the east wetland section to avoid any potential effects to the environmentally sensitive Pine/Labrador Tea bog community in the Northwest wetland section, which would also eliminate the need for environmental monitoring of the northwest wetland section, as the east and northwest wetland sections are hydrologically separated by Maple Lake Creek. Unit # 5 in the east wetland is considered by Ecofish as the likely best option for a gravity feed reed bed located adjacent wetland units for habitat enhancement. A baseline groundwater assessment was initiated in this area in October 2020 and the data along with elevation data collected by Cumberland will be used to confirm the feasibility of using this wetland unit to locate the reed bed.

5.3.3 Habitat Enhancement Opportunities within the East Wetlands

Consideration for flow augmentation and habitat enhancement within the east wetland sector include:

- Remove and replace the existing reed canary grass with a cattail and bulrush marsh, with consideration for one or more connected ponds. Unit #5 in the east wetland section currently has small communities of cattail marsh growing along ditches that connect the unit to Maple Lake Creek that may provide a good seed source.
- Consider the construction of a berm to hold water due to the shallow clay layer (<0.20 m) underlying unit #6 in the east wetland section. The berm could be built when placing the pipe to pump water from the sewage lagoons to the constructed reed bed and could also be used as a base for a pedestrian path to view the wetlands. This feature would require the ability to control water levels during the growing season and/or other enhancements to reduce the dominance of reed canary grass and prevent its proliferation to other units. Water depth in these locations would need to be > 0.30 m throughout the growing season to promote the growth of emergent plants such as native cattail, burr-reed, and bulrush species. Planting native shrubs and trees around the wetlands would also help shade out reed canary grass, help reduce evaporation of water and the subsequent reduction of water levels as well as keeping water temperatures cooler during the summer to benefit invertebrates and other wildlife.

- Consider open sites within unit #3 or #4 within the east wetland section for open-water habitat creation. These units are considered to be in excellent condition and functioning as intended, so careful consideration is required when considering enhancement options that involve additional water inputs. Recontouring the old drainage ditch that connects the eastern most point of unit #4 to Maple Lake Creek to mimic natural conditions and planting native species may enhance the diversity of plant species in this unit, increase wildlife use, and increase flows to upper Maple Lake Creek, particularly during dry summer months.
- The section of Maple Lake Creek located between the east and south-east wetland sections contains small bulrushes (red-listed community) and pond weed along it's banks. It is a small community, but of high value, and appears to be healthy. Enhancement options for this area include improving conditions within Maple Lake Creek above and adjacent to the sewage lagoons by:
    - Recontouring the Creek to mimic natural conditions;
    - Creating better fish habitat within the Creek (e.g., adding complexity to the creek bed, adding woody debris, etc.);
    - Augmenting summer water inputs (currently augmented flows from the treatment lagoons discharges to Maple Lake Creek downstream of this section); and
    - Planting native riparian vegetation (including trees and shrubs) to stabilize the banks, reduce erosion, and provide shade to help reduce evaporation and keep water temperatures cool during summer months.
- The drainage ditches within the east and southwest wetland sections are hydrologically connected to Maple Lake Creek during winter and spring when water levels are high. These ditches could be enhanced and connected to marsh or shallow water wetland habitat with controls to allow additional water inputs to Maple Lake Creek when conditions are dry.
- The southwest wetland section currently contains two open-water ponds which were devoid of invertebrates, aquatic plants, and waterfowl at the time of the June field visit. Believed to be too deep to be of ecological value and lacking vegetation, these ponds could be modified to enhance habitat and they are in an ideal location for community use – the ponds could be connected by a boardwalk with viewing platforms that comprise a portion of larger nature trail through the different wetlands in the southwest wetlands section.

Effecting the above enhancement options is expected to be a multi-year effort and is expected to require adaptive management to be successful in achieving the stated enhancement objectives. It will be challenging to reduce the dominance of the reed canary grass due to it's extensive presence and seed generation potential. Removal efforts will need to be carried out multiple times a year and should include a combination of mowing, mulching/shading, hydrology management, and replacement with desired vegetation species. A controlled burn has also been suggested as a potentially effective means to remove reed canary grass and enhance soil conditions.

6.0 CONSTRUCTED REED BED

6.1 General Considerations

While the southwest wetland would appear to be a logical location for a constructed reed bed and interconnecting wetland to Maple Lake Creek, the east wetlands section provides greater opportunities for habitat enhancement and habitat value and does not have the inherent risk of impacting the eco-sensitive protected northwest wetlands section, as it is located on the far side of Maple Lake Creek. Controlled augmentation and habitat enhancement within the west wetlands section can still be considered as a secondary objective, but additional work is required to ensure augmentation will not impact the sensitive northwest wetlands section. Stored stormwater could be considered as a water source for future augmentation of the western wetlands areas.

Once the treated wastewater has passed though disinfection, it will be pumped to the constructed reed beds located within the east wetlands section. Fed at the surface, the reed bed would contain an underdrain connected to a discharge pipe which can be adjusted to regulate the liquid level within the reed bed. This would create a vertical flow configuration through the reed bed and also achieve a degree of filtration to improve water clarity.

The water released from the reed bed would then flow through the enhanced east wetland section to Maple Lake Creek. As recommended by Ecofish, the canary reed grass will be replaced with non-invasive emergent vegetation and the habitat conditions within the east wetlands section will be enhanced hydraulically using a series of ponds and connecting channels, with expected overland flow conditions during wet weather months.

6.2 Initial Pilot Program Findings

6.2.1 Water Quality Improvement

While the pilot reed bed program has yet to be concluded, the initial water quality data confirms the expected water quality benefits of adding biochar to the growing media. Group 2 with a media mix of 80% sand and 20% biochar had the most consistent treatment results with respect to the removal of target pharmaceuticals and water clarity. It was the only media mix that removed all of the analytes to less than detection levels and had similar turbidity levels to the other test Groups.

The reduction in phosphorus, ammonia and total nitrogen were less than for media mixes containing peat, but given the extensive natural wetlands and peat the reed bed will flow into, the absence of peat and related lower phosphorus and nitrogen removal within a Group 2 media reed bed is not considered to be of significance. However, the intent is not to rely on the wetlands to have any anticipated treatment function, and the water is being used for habitat enhancement purposes only and any further water quality benefits that might be achieved is a bonus.

6.2.2 Hydraulic Loading

The initial hydraulic draw-down tests done in October and those carried out in March both indicate the selected biochar used to create the four test groups contributes to the reduction of hydraulic conductivity. The media with the most rapid drawdown in October 2020 was Group 2 (80% sand and 20% biochar) with a draw-down rate of 14.5 mm/min, about 12% slower than for sand alone (16.5 mm/min). By March 2021

the rate in Group 2 had dropped to 10.2 mm per minute, about 25% slower than for sand alone (13.5 mm/min), noting the draw down rate for Tote 1 (100% sand) had also reduced over that period of time. In comparison, the draw down rate for Groups 3 and 4 were more than twice as slow as Group 2, and Group 5 was almost five times slower than Group 2.

6.2.3 Construction Considerations

Aside from Group 5, which involves placing a blanket layer of sand and biochar over natural peat, the simplest test unit to construct is likely Group 2, consisting of a mixture of 80% sand and 20% biochar and a simple vertical flow-through configuration. As noted, Group 2 also had the best treatment results with respect to the removal of target pharmaceuticals and water clarity.

6.2.4 Selection of Group 2 Media Mix (80% sand + 20% biochar)

Assuming the draw-down rate measured for Group 2 in March 2021 is indicative of the long-term flow rate through the Group 2 media mix, and applying a Factor of Safety of 2, the anticipated reed bed area is 700 m^2.

6.3 Hydraulic Profile

Under ideal conditions it would be desirable to have the water flow through the upgraded lagoon treatment system and then flow by gravity through the constructed reed bed and connecting wetlands to Maple Lake Creek. This would avoid pumping even under full wet weather flow conditions, and the entire wet weather flow could be processed through solids-liquid separation units and disinfection. The challenge is the liquid level in the two lagoons is already controlled by the lowest level discharge into Maple Lake Creek, which during wet weather is barely above the creek level. To increase the liquid level in the lagoons would require changes to the berm height surrounding the lagoons. Although consideration for modifying the lagoons has yet to be carried out, it seems unlikely that raising the berm height will be a practical option, particularly if it is agreed the reed bed and connecting enhanced wetlands should be located on the east side of Maple Lake Creek. While the water level within the reed bed may have to be elevated above the surrounding land using berm walls to establish sufficient head for flow through the enhanced wetlands, the desire is to pump only once. The highest point of the east wetland and the existing lagoon elevation are both about 135m (based on Lidar data), so there is not a lot of pumping head required.

6.4 Operating Considerations

Long-term operation can result in the accumulation of biomass and organic constituents within the reed beds that can impede hydraulic performance or adsorption performance. To mitigate this the reed beds can be divided into multiple units, such that the bed can be rested for a sufficiently long enough period of time to restore capacity. This is similar to the design of ground dispersal fields for wastewater effluent, where one field is allowed to go dry and not be used for a year, and the full hydraulic and load capacity is provided by the remaining dispersal fields.

To facilitate this operating strategy, the reed bed should be constructed in at least three parallel cells. Resting can be continued for a given cell for a full year, as is done for ground dispersal system, or for the summer, allowing the cell to be rested under low flow conditions and then re-activated for the high-flow winter wet weather. The decision on the number of cells will be made once the reed bed test program is complete as part of the detailed design.

The annual operating costs are expected to be minimal, consisting of inspections and monitoring. Typically, biomass removal is not practiced for constructed wetlands, and that is expected to be the case here.

7.0 CAPITAL COST ESTIMATE

The original project budget for the Cumberland High Performance Lagoon Upgrade wastewater project was developed in early 2018 and, at the time, the biochar enhanced reed bed and augmented wetlands were each given a budget allowance of $1M including design, construction and contingency. The following sections advances this allowance to prepare a Class D capital cost estimate based on the preliminary results of the reed bed pilot program described and discussed in this Feasibility Study report.

7.1 Biochar Sources

There are several sources of commercially available biochar that can be considered for a demonstration-scale or full-scale implementation of integrating biochar within constructed reed bed media. For this pilot project 1.5m3 of biochar (a standard "bulk bag") was sourced from Canadian Agri-Char Inc, a leading biochar producer based in Maple Ride, with their production facility in the BC interior. There are several other commercial biochar producers in BC, Alberta and Washington State. There are also two biochar enterprises being planned for Vancouver Island, but neither is operational as of 2021.

Canadian Agri-Char provided indicative project pricing for a full-scale project, where the biochar would be provided by 60m3 semi-trucks. The cost, including delivery to Cumberland, and excluding GST, is placed at $46,000 per truckload, which works out to $767 per m3. For project budgeting purposes, this has been rounded up to $800/m3.

All commercial producers in BC use wood waste from logging or sawmilling operations as their feedstock. But biochar can be made from many organic materials including yard waste, food waste, paper waste, animal manure, and – most significantly - wastewater biosolids. For a full-scale project where the value of biochar is in the order of $100-200,000 it may be possible to make biochar for the project from local (Cumberland) wood waste or possibly the lagoon biosolids. There are mobile rental units available that can process whole log wood waste into biochar. Processing of biosolids requires specialised, built to order equipment and would require constructing a permanent facility.

Local production of biochar, from any feedstock, is an additional process operation with its own engineering and economic aspects and would require a separate feasibility. This question can be re-visited in the conceptual planning stage of a full-scale project. For the purpose of Feasibility Study cost estimating, commercially produced biochar is readily available and was been used for both the trial and project budgeting purposes.

7.2 Reed Bed with 80% Sand and 20% Biochar

The reed bed pilot program preliminary results indicate a media mix of 80% sand and 20% biochar achieved the highest degree of constituent removal, including target pharmaceuticals and, aside from Test Unit 1 containing 100% sand, had the highest drainage rate, corresponding to the smallest required land area for a constructed reed bed.

For comparative purposes, the size and cost for all five Test Unit medias are presented in Table H.

Table H Estimated Areas and Media Quantities

	TEST UNIT	1	2	3	4	5
Hydraulic Loading Rate [1]	m/day	9.7	7.35	3.15	3.4	2
Reed Bed Area [2]	m^2	750	1,000	2,300	2,150	3,600
Sand Volume [3]	m^3	300	400	920	215	180
Biochar Volume [4]	m^3	0	100	230	215	180
Peat Volume [5]	m^3	0	0	0	645	1,440
Liner Area [6]	m^2	750	1,000	2,300	0	0
Perimeter Length [7]	m	140	160	250	240	300

Notes

1. *Assumes half the rate that was achieved in the March 2021 drawdown tests*
2. *Area is based on handling peak flow of 7200m3/day at the design loading rate*
3. *0.4m sand depth for Type 1,2,3 and 0.1m for Type 4 and 5*
4. *0.1m biochar depth for Type 2-5*
5. *0.4m peat depth for Type 4 and 5*
6. *Liner area is same as reed bed area. No liner is used for Types 4 and 5 as the peat for the reed bed is the naturally occurring in-situ peat*
7. *Perimeter length assumes a square shaped reed bed, and a central divider to make two half sized cells*

Table I presents a summary of the construction costs for the reed bed only for the five media mixtures evaluated through the pilot program.

Table J presents the total cost estimate including the reed bed construction and an allowance for conveyancing. Aside from a reed bed constructed of 100% sand, the lowest capital cost estimate is for a media mix of 80% sand and 20% biochar (Test Unit 2) with a vertical flow-through configuration, totaling $0.88M. Although the additional cost over a reed bed constructed of sand alone is 60% greater, the incremental amount of $0.33M to incorporate biochar results in significantly greater residual contaminant and pharmaceutical removal than for sand alone.

The proposed reed bed will be located 800m away from the lagoons at the point of highest elevation within the east wetland sector, to allow gravity flow to the rest of the wetland area from the reed bed.

An alternate location is the wetlands located immediately to the north of the lagoons; a flat area of reed canary grass with no habitat value at all. If habitat enhanced were not a key objective this would be the ideal location as it would avoid the conveyance costs. However, for the moment habitat enhancement and locating the reed bed in the east wetland sector is assumed, and the pump station will be located with the other mechanical equipment following disinfection.

Table I Estimated Project Costs – Reed Bed Only

Item	Unit Cost	TEST UNIT				
		1	2	3	4	5
Sand [1]	$15/m^3	$4,500	$6,000	$13,800	$3,225	$2,700
Biochar [2]	$800/m^3	-	$80,000	$184,000	$172,000	$144,000
Plants	$10/m^2	$7,500	$10,000	$23,000	$21,500	$36,000
Liner	$20/m^2	$15,000	$20,000	$46,000	0	0
Underdrain collection	$10/m^2	$7,500	$10,000	$23,000	$21,500	$36,000
Perimeter Containment	$100/m	$14,000	$16,000	$25,000	$24,000	$30,000
1st Subtotal		$48,500	$142,000	$314,800	$242,225	$248,700
Construction		$50,000	$142,000	$315,000	$245,000	$250,000
2nd Subtotal		$98,500	$284,000	$629,000	$489,225	$498,700
Engineering	20%	$20,000	$57,000	$125,000	$98,000	$100,000
3rd Subtotal		$118,500	$341,000	$754,000	$587,225	$598,700
Contingency	35%	$41,500	$49,700	$110,180	$84,779	$87,045
Class D Reed Bed		**$160,000**	**$390,000**	**$865,000**	**$700,000**	**$690,000**

Notes

1. *Sand cost is based on bedding sand from the local supplier, as used in the tote trial.*
2. *Biochar cost is based on 60 m3 semi-trucks from a leading commercial supplier in interior BC.*

The carbon sequestration potential of this reed bed can be estimated using the methodology outlined in section 2.8. The biochar has a bulk density of 260kg/m3 (from the supplier), and assuming half this weight for the carbon sequestration gives 130kg carbon per m3, and 477kgCO2. For the 100m3 biochar volume (based on configuration 2), the one –off carbon sequestration would be 48 tons of carbon dioxide equivalent.

7.3 Wetland Augmentation and Habitat Enhancement.

The performance of the reed bed allows a significant change in philosophy for the wetland augmentation component. There is no need to ensure uniform subsurface flow through the wetland soil for effluent polishing, as this will have already occurred in the reed bed. The augmented wetlands do not need to have a treatment function, and their primary functional purpose is as an alternate discharge location to a direct discharge to Maple Lake Creek. The water released to the wetland will be designed primarily for habitat enhancement.

The hydraulic design can be based on surface water distribution from the reed bed through the wetland by cascading surface swales (shallow channels), deep channels or chains of ponds. This freedom in the design of the wetland hydraulics also creates significant freedom in the design of the wetland habitat enhancement, where there can be different areas created with different water conditions and plant varieties, from tree groves between the channels to open water ponds with floating plants and fish habitat.

Table J Estimated Total Project Costs - Reed Bed and Conveyance

Item	Unit Cost	TEST UNIT				
		1	2	3	4	5
Connecting Pipeline [1]	Allowance	$200,000				
Pump Station [2]	Allowance	$100,000				
1st Subtotal		$300,000				
Engineering	20%	$60,000				
2nd Subtotal		$360,000				
Class D contingency	35%	$126,000				
Class D Conveyance		$486,000				
Class D Reed Bed		$160,000	$390,000	$865,000	$700,000	$690,000
Class D Project Total		**$0.55M**	**$0.88M**	**$1.35M**	**$1.19M**	**$1.17M**

Notes

1. Connecting pipeline is based on 800m of 300mm fused HDPE, using an up to date material and installation cost estimate from an experienced pipeline contractor
2. Pump station is an allowance for a simple low head pump station at the lagoons

Until a detailed habitat enhancement plan is developed by wetland/landscape designers, with public input on the both the habitat and amenity aspects it won't be possible to prepare a representative cost estimate for the work required and associated costs for habitat enhancement and improved public access. Additionally, there are ten hectares of area in the east wetland, but not all of it needs to be enhanced, and not all to the same extent.

The original budget of $1M can be used as a project cap for the purposes of setting the overall scope of work for habitat enhancement and improved public access and is consistent with other natural area restoration projects that have been done elsewhere.

Instead of being a wastewater treatment component, the wetland augmentation remains an aspirational goal for the Village of Cumberland, for habitat and human amenity, and it is up the community to decide how far they want to take it.

8.0 CLOSURE

We thank you for the opportunity of being able to assist the Village of Cumberland with this most interesting and progressive initiative to examine the implementation of the incorporation of natural wetlands into an integrated water management plan that explores the use of biochar to enhance constructed reed bed media and augment flows and enhance natural wetlands along Maple Lake Creek.

The water quality monitoring described in this Feasibility Report is part of an ongoing pilot-scale test program, and it is anticipated the results of this continued work will be reported through an addendum to this document, likely in the form of a Technical Memo.

We look forward to your comments.

TROY DAVID VASSOS INC.

Troy D. Vassos, Ph.D. FEC P.Eng.

President, Senior Environmental Engineer

Troy David Vassos Inc.
3332 Redfern Place
North Vancouver, British Columbia
Canada V7N 3W1
Tel: +01 (604) 657-6559



APPENDIX I
CAPITAL COST ESTIMATE - WWTF

COUNCIL REPORT

REPORT DATE: October 22, 2024

MEETING DATE: October 28, 2024

TO: Mayor and Councillors

FROM: Rob Crisfield, Director of Engineering and Public Works

SUBJECT: Wastewater Project Update Presentation from Colliers Project Leaders

RECOMMENDATION

THAT Council receive the presentation Wastewater Project Update presentation from Hans Seidemann, Senior Project Manager with Colliers Project Leaders.

THAT Council authorize construction activities to be resumed without exceeding the current Council approved project budget.

THAT Council approve the additional expenditure of $1,557,400 to increase the budget for the "Wastewater Upgrade Project Phase 1" from $16,060,000 to $17,617,400, with:

- $980,000 to be funded from borrowing approved earlier this year, and
- $577,400 to be funded through the Linear Asset Renewal Reserve.

THAT Council direct staff to bring forward an amendment to the adopted 2024-2028 Financial Plan Bylaw to reflect this expenditure.

PURPOSE

The purpose of this report is to provide Council with an update on the wastewater project upgrades and associated costs.

PREVIOUS COUNCIL DIRECTION

Date	Resolution
Feb 12, 2024	THAT Council approve the additional expenditure of $1,520,000 to increase the budget for the "Wastewater Upgrade Project Phase 1" from $14,550,000 to $16,070,000, with: a. $791,700 to be funded through Community Works Funds; and b. $406,000 to be funded through the Sewer and Water Infrastructure Asset Replacement Reserve; and c. $187,300 to be funded through the Sewer Stabilization Reserve; and d. $135,000 to be funded through Host Amenity Funds.

	III. THAT Council direct staff to bring forward an amendment to the adopted 2024-2028 Financial Plan Bylaw to reflect this expenditure. IV. THAT Council direct staff to bring forward an amendment to the adopted 2023-2027 Financial Plan Bylaw to reflect a change in funding for the Bevan Road Project with $560,000 coming from the Linear Asset Renewal Reserve. V. THAT Council direct staff to bring forward an amendment to the adopted 2024-2028 Financial Plan Bylaw to: a. Update the funding for the Sewer and Storm Master Plan with $151,500 coming from the Linear Asset Renewal Reserve. b. Remove the $135,000 contribution from the Host Amenity Funds towards the General Municipal Facility Asset Renewal Reserve. VI. THAT Council direct staff to prepare a loan authorization bylaw for the borrowing of an amount of $2,500,000 for the proposed budget increase to the "Wastewater Upgrade Project Phase 1" through the Municipal Financial Authority of British Columbia, with a term of 20 years.
Jun 12, 2023	THAT Council approve the additional expenditure of up to $2,140,000 to increase the budget for the "Phase 1 Wastewater Upgrade Project" from $12,410,000 to $14,550,000, with: • $1,840,000 to be funded through Growing Community Funds; and • $300,000 to be funded through Sewer and Water Infrastructure Asset Replacement Reserve; That Council approve an increase of $1,600,000 of the Maple Reinders contract to proceed with purchasing and construction of Phase 1 of the project, to the extent of the newly authorized budget; THAT Council approve the expenditure of up to $3,710,000 for the "Phase 2 Wastewater Upgrade Project, construction of "Phase 2A and 2B" and preconstruction and construction of "Phase 2C and 2D": • $2,500,000 to be funded through Strategic Priorities Fund; and • $855,000 to be funded through GMF (borrowing/grant); and • $355,000 to be funded through Sewer and Water Infrastructure Asset Replacement Reserve; THAT Council authorize staff to expand the scope of the Maple Reinders contract to include $1,515,000 to execute the first portion of "Phase 2A and 2B Wastewater Upgrade Project – Construction Program; and THAT Council direct staff to bring forward an amendment to the adopted 2023-2027 Financial Plan Bylaw to reflect these expenditures.
Mar 27, 2023	THAT Council receive the report "Wastewater Upgrade Project – Budget Update" for information.
Jan 23, 2023	THAT Council receive the report "Wastewater Upgrade Project – Project Update" for information.
Sep 21, 2022	THAT Council approve the additional expenditure of up to $2,710,000 for "Phase 1 Wastewater Upgrade Project" with: • $1,550,000 to be funded through Sewer and Water Infrastructure Asset Replacement Reserve; and

	$1,160,000 to be funded through GMF (borrowing/grant).
Sep 21, 2022	THAT Council approve the expenditure of up to $650,000 for "Phase 2 Wastewater Upgrade Project – Pre-Construction Program" with: • $195,000 to be funded through Sewer and Water Infrastructure Asset Replacement Reserve; and $455,000 to be funded through GMF (borrowing/grant).
June 27, 2022	That Council approve making the application to the Gas Tax Strategic Priorities Fund for funding of Phase 2 of the High Performance Wastewater Lagoon Upgrade Project, for a grant value of $2,500,000.
June 27, 2022	That Council commit to funding the municipal portion of project ($2,440,000) using a combination of existing, approved Green Municipal Fund funding and sewer reserves for a total project amount of $4,940,000.
Feb 14, 2022	THAT Council adopt Option 2 – the integrated project approach – as the preferred grant funding strategy for the Wastewater Upgrade Project; THAT Council approve applying for scope change to ICIP1 funding to remove the Reed Bed and Wetland components from the Phase 1 project scope;
Feb 14, 2022	That Council approve making the application to the Investing in Canada Infrastructure Program, Environmental Quality stream, intake 3, for funding of Phase 2 of the High Performance Wastewater Lagoon Upgrade Project, for a grant value of $2,260,000.
Feb 14, 2022	That Council commit to funding the municipal portion of project ($2,440,000) using a combination of existing, approved Green Municipal Fund funding and sewer reserves for a total project amount of $4,700,000
July 23, 2018	i. That Council authorize the application to the "*ICIP – Green Infrastructure: Environmental Quality Sub-stream*" for a Wastewater Capital Project for: a. The Project Scope of Phase 1, Phase 2A and the Biochar Media Reed Bed b. A funding amount of 73% of the estimated $9.7 million total cost, being $7,081,000 c. Submission for the August 29, 2018 intake ii. AND THAT Council supports the project and commits to its share ($2,619,000) of the project.

BACKGROUND

The Village of Cumberland's High-Performance Wastewater Lagoon Upgrade Project faces cost increases, now estimated at $17,617,357. The key factors for cost increases include schedule delays, unforeseen scope changes, and necessary contingency adjustments.

Recommended actions from the attached memorandum include:

- Resume construction within the current approved budget.
- Increase total project budget to $17,617,357, including $699,250 in contingency.
- Seek Council authorization for contracts to prevent further delays.

Staff are recommendations are to use the funding sources noted below in the financial section to cover these additional cost increases.

FINANCIAL IMPLICATIONS

The project is projected to exceed the current council-approved budget, necessitating an increase to $17,617,357. Cost increases are primarily due to schedule delays (42% of increases), unforeseen scope changes, and the need for contingency funds to address potential unforeseen challenges. Without additional funding, the project risks further delays and increased costs, impacting overall project completion and financial management.

The attached memo suggests that an additional budget increase of $1,557,400 is required to complete the wastewater treatment plant upgrade project for a total recommended budget of $17,617,360, which includes a $699,250 contingency.

After careful review of the Village reserves and available funding and while considering ongoing 2025-2029 budget discussions, Staff recommend the following combination of funding to support the proposed budget increase:

- $980,000 of additional borrowing, from the $2.5M approved earlier this year
- $577,400 from the Linear Asset Renewal Reserve

Additional Long-Term Borrowing

Approved borrowing for the Wastewater Treatment Plant

Loan Authorization Bylaw 1084

Borrowing for the wastewater treatment plant project in the amount of $4.4 M has been approved in 2018 by Council and supported by electoral approval, through Bylaw 1084. With a 20 year term and interest rate of 4.50%, this represents an estimated annual debt payment of $338,000 per year, including principal and interest.

The debt servicing cost represents approximately $199 per parcel for a period of 20 years.

Loan Authorization Bylaw 1207

Following the February 2024 budget increase request, borrowing for an additional amount of $2,500,000 has been approved by Council and supported by electoral assent. With a 20 year term and interest rate of 4.50%, this represents an estimated annual debt payment of $194,000 per year, including principal and interest.

Of this amount, only $1,520,000 has been committed by Council towards the February 2024 budget increase, leaving a borrowing amount of $980,000 available to fund this budget increase request.

The debt servicing costs on a $2.5 M borrowing represents an additional $113 per parcel, for a total of $312 per parcel for the next 20 years.

Liability servicing limit

The Province sets the local government liability service limit at 25% of specific municipal revenues. As specified on the Province's website: the limitation applies to the cost to service all borrowing, leases, loan guarantees and general capital commitments that are of a capital nature. Servicing, in this context, means principal and interest on debt, lease payments or other commitments to repay the liability and related financing charges.

The Village liability servicing limit calculated based on 2023 Financial Statements is $1,084,500. This means the Village can borrow additional funds, but cannot exceed more than $1.1 M in additional annual debt costs, which represents a maximum loan of $13 M with a 20 year term at an interest rate of 4.50%, currently available through MFA. With the recent approval of a $2.5 M borrowing, the Village liability servicing limit is now reduced to $10.5 M.

Internal Reserves

Linear Asset Renewal Reserve

The Linear Asset Renewal Reserve was established to fund linear infrastructure capital and replacement projects including roads, traffic signals, curb and gutters, sidewalks and streetlights, water, sewer and storm underground infrastructure. This reserve may be used to update master plans and provide capacity for the management of linear infrastructure assets. Annual frontage tax revenue is contributed to this reserve to replace the underground linear assets and property taxes, CWF and developer amenity funds is contributed to this reserve to replace the road assets.

The estimated available Linear Asset Renewal Reserve balance at the end of 2024 is $2,240,000.

Staff recommend using this source of funding towards the construction of linear assets included in Phase 1 of the project in the amount of $577,960:

- $177,000 Water linear assets
- $59,000 Storm drainage linear assets
- 341,960 Sewer linear assets

Details of other funds available for Council's information follows:

Growing Community Funds

In March 2023, the Province has announced a one-time grant, the Growing Community Funds (GCF), to provide up to $1 billion through direct grants to local governments to support communities with growth. These funds are to be incremental to currently planned investment with the intention to accelerate the delivery of capital projects.

The Province has communicated how the funds and related interest revenue can be used and wastewater conveyance and treatment facilities are eligible initiatives. One of the conditions of the grant is for recipient local governments to report annually how allocated funds are being used through their audited financial statements.

The Village of Cumberland has received an amount of $2,777,000, of which Council has already earmarked most it, including $1,840,000 to fund the $2,140,000 budget increase requested for the project in June 2023. An estimated amount of $180,000 remains unallocated.

Sewer and Water Infrastructure Asset Replacement Reserve

The Sewer and Water Infrastructure Asset Replacement Reserve is intended to fund major repairs, upgrades, replacement, and expansion of the sewer (wastewater) treatment and water supply assets. Council Reserve and Surplus Policy No. 3.5 includes a recommended minimum of $300,000 and maximum of $13,3M.

Funding from the Sewer and Water Infrastructure Asset Replacement Reserve in the amount of $2.4M (transferred from sewer DCCs in 2022) has already been allocated to the project and approved by Council:

- $1,745,000 for Phase 1, approved by Council on September 21, 2022
- $300,000 for Phase 1, approved by Council on June 12, 2023
- $355,000 for Phase 2, approved by Council on June 12, 2023

Staff estimate the Sewer and Water Infrastructure Asset Replacement Reserve available balance in 2024 to be around $591,000.

Sewer Fund Financial Stabilization Reserve

Stabilization reserves are for major emergent operating issues, one-time and intermittent projects, to smooth user fee and parcel tax increases over the financial planning period and to offset unrealized revenues. Council Reserve and Surplus Policy No. 3.5 includes a recommended minimum of $200,000 and maximum of $330,000 for the Sewer Fund Financial Stabilization Reserve.

The reserve estimated unallocated balance at the end of 2024 is $330,000. This doesn't include an amount of $437,000 accumulated in this reserve over the last few years to be used to smooth the impacts on user fees resulting from the operating expenses for the new wastewater plant.

Other Funding Options

Borrowing from internal reserve

Borrowing from interfund or internal reserves is permitted in the legislation. However, it is restricted to capital reserves only and:

- The money in the lending fund must not be currently required for the purpose of the fund.
- The borrowing fund must repay the lending fund with the interest that the amount would have earned if it had not been loaned.
- While elector approval is not required for short term interfund borrowing, the proposed interfund borrowing must be included in the financial plan, which requires public consultation.
- Long term interfund borrowing requires a loan authorization bylaw subject to electoral approval, as long term borrowing through debenture debt would.

Given the limitation to borrow from capital reserves, this option has not been considered by Staff.

Short Term Borrowing

Per section 178 of the Community Charter, short term borrowing is permitted and must:

- Be supported by bylaw adopted by Council with the approval of the inspector of Municipalities.

- Not cause the municipality to exceed the liability servicing limit prescribed by regulation.
- Must be payable no later than the lesser of:
    - 5 years from the date on which the securities were issued, and
    - the reasonable life expectancy of the capital asset for which the debt is contracted.

The limit prescribed for short term debt is the amount obtained by multiplying $50 by the population of the municipality, per the most recent census data, which represents $187,650 based on 2016 census (3,753).

Impact on Sewer Rates

A general increase in the new wastewater treatment plant operating costs has already been anticipated by staff and incorporated into the proposed 2025-2029 Financial Plan and projected sewer rates. Operating expenses were bumped to $470,000 in 2026.

Some of the Sewer Stabilization Reserve funding is earmarked to stabilize the sewer rate over the next seven years. The 2024 budget includes some budgeted operating costs for the new plant that are likely not to be required, due to the delay in construction. At year-end, this funding will be transferred to the stabilization reserve and used to smooth the sewer rates in the coming years.

Staff will undertake a review of the sewer utility fees and parcel tax in 2025 and analyze options available to Council to fund the debt servicing costs related to the wastewater treatment plant upgrade project. More information will be brought back to Council prior to the 2026-2030 budget discussions.

OPERATIONAL IMPLICATIONS

Under the provincial consent order, the Village has committed to completing the Phase 1 treatment works to bring the Village into compliance by the end of this year. The project delays to date have had an impact on timing and we will not be able to meet this deadline. As a result, staff have reached out to the Compliance and Enforcement Branch of the Ministry of Environment and Climate Change to seek a resolution to this matter.

CLIMATE CHANGE IMPLICATIONS

There are no direct climate change implications related to this report.

ALTERNATIVES

1. None

STRATEGIC OBJECTIVE

☐ Diverse and Healthy Community

☒ Sustainable Service Delivery and Asset Management

☐ Community Planning

ATTACHMENTS

1. Colliers Project Leaders - October 2024 Budget Update Memorandum.

CONCURRENCE

Annie Berard, Director of Corporate Services ***AB***

Respectfully submitted,

R. Crisfield

_____

Rob Crisfield
Director of Engineering and Public Works

M. Mason

_____

Michelle Mason
Chief Administrative Officer

Memorandum

To:	**Project Steering Committee**	For info of:	**Cumberland Mayor and Council**
From:	Hans Seidemann, Senior Project Manager	Doc Ref:	P0902-502768805-425 (1.0)
Project:	Village of Cumberland High Performance Wastewater Lagoon Upgrade Project	Date:	October 23, 2024
Subject:	**October 2024 Budget Update**		

Background

In the spring of 2021, the Village of Cumberland retained an engineering consultant to provide design services for the High-Performance Wastewater Lagoon Upgrade Project. Over the course of completing design and commencing construction of the project, contractual disputes arose between the design consultant and the Village's project delivery team. To resolve these disputes and allow the project to continue, the Village and its design consultant mutually agreed to terminate the contract for services in early 2024. At that time, a budget update was provided to Council and approval obtained for a total forecasted cost of completion for the project of $16,060,000. Following this, the Village retained the services of McElhanney Ltd. (McElhanney) to complete the detailed design for the project to allow construction to re-commence.

In carrying out their design work, McElhanney identified several opportunities to improve the design of the system and reduce both the estimated construction costs and long-term operational costs for the treatment system. While the design work to implement these changes was underway it was not possible to understand the total financial impact on the project, but the relative costs of the proposed improvements were estimated by both McElhanney and the Village's construction manager Maple Reinders (Maple) and found to cost less than the alternative of proceeding with the original designs. This redesign work is now approaching completion, which has allowed the project team to prepare a comprehensive update to the outcomes achieved and the impact on the estimated costs to complete the project, which are presented here below.

Current Budget and Cost Forecasts

Working with both Maple and McElhanney, a detailed estimate of costs committed to-date and forecasted costs to complete are shown below, along with the current Council-approved budget for the project.

Budget Category	Approved Budget	Committed Costs	Estimate to Complete	Estimate at Completion	Forecast Variance
01 – Owner's Costs	$1,374,192	$1,361,200	$157,992	$1,519,192	($145,000)
02 – Design	$2,022,965	$2,125,665	$430,289	$2,555,954	($532,989)
03 – Construction	$10,331,929	$6,565,594	$4,045,495	$10,611,089	($279,159)
04 – Construction Management	$2,330,317	$1,922,137	$1,008,986	$2,931,123	($600,806)
Total	**$16,059,403**	**$11,974,595**	**$5,642,762**	**$17,617,357**	**($1,557,954)**

Table 1 - Current Estimated Project Costs

As can be seen in Table 1 above, despite the best efforts of the project team to minimize costs, the current cost estimates for the project anticipate exceeding the current council-approved budget. For this reason, it's understood that approval will be required from Cumberland Village Council to authorize further project commitments that would cause the approved budget to be exceeded. The project team is currently working to ensure that construction within the approved budget can resume to avoid further delay and associated costs while approval is sought for the project budget needed to confidently complete the total scope of work.

Primary Sources of Project Cost Increases

The project team has worked diligently over the past several months to complete the project design in a way that minimizes the total project costs. Despite how it may appear given the overall forecasted deficit, those efforts have been successful, as the estimated base construction costs have decreased relative to the previous forecast. The cost increases shown in this budget update are primarily due to costs for schedule delay and unforeseen additional scope for the project consultants, and the re-establishing of contingency funds viewed as necessary to complete the project without the need for any further budget amendments.

The sources of the anticipated project cost increases are shown in the table below and will be detailed further in the following sections.

Budget Item	Forecast Variances	Schedule Delays	Scope Changes	Contingency Adjustments
01 – Owner's Costs	($145,000)	($135,000)	($10,000)	$0
02 – Design	($532,989)	($100,000)	($524,989)	$92,000
03 – Construction	($279,159)	($25,000)	$241,994	($496,153)
04 – Construction Management	($600,806)	($393,000)	(207,806)	$0
Total	**($1,557,954)**	**($653,000)**	**($500,801)**	**($404,153)**

Table 2 - Sources of Project Cost Increases

Schedule Delay Costs

As can be seen in Table 2 above, nearly half of the projected cost increases (~42%) results from the project's delays. Construction was originally suspended on the project in December of 2023, and construction anticipated to resume in March of 2024. This resumption has been delayed until this point for several reasons, including:

- Contractual delays due to the change in project engineers – 3 months
- Additional unforeseen design scope (HVAC requirements) – 1 month
- Additional value engineering scope (UV disinfection, Sludge Surveying) – 2 months

These delays, while necessary to ensure the project's eventual success, incurred costs to the Village for the ongoing project management and construction management services required during this time. It's for this reason we recommend that further delays be avoided as much as possible, to minimize the expenditure of the Village's limited resources on non-construction activities.

Scope Change Costs

Though the overall costs of the project have increased due to scope changes, the direct project cost impacts due to the voluntary changes approved by the Village Council have been positive. The overall cost increase shown due scope changes are entirely due to scope changes outside of the project team's control, necessitated by regulatory requirements that would not have been met if not for a change in the design approach.

The details of the unavoidable cost changes directly attributable to the change in scope are as follows:

Non-Discretionary Scope Changes	Committed	Forecast	Total
Unforeseen costs to conclude previous design engineering contracts	$164,385	$102,820	$267,204
Hydrographic sludge survey needed to complete design	$24,198	$0	$24,198
Unforeseen additional costs for electrical and SCADA design	$106,117	$203,808	$309,925
HVAC design for ventilation of process tents	$23,661	$0	$23,661
Supply and Installation of HVAC ventilation systems for process tents	$0	$300,000	$300,000
Center berm widening to meet stability requirements	$0	$207,000	$207,000
Projected construction management fee change due to scope increase	$0	$207,806	$207,806
Total	**$318,361**	**$1,021,434**	**$1,339,794**

Table 3 - Non-Discretionary Scope Change Costs

As you can see, these non-discretionary scope increases make up almost three times the total estimated direct cost impact due to scope changes. Thankfully these additional costs have been offset by the discretionary scope changes undertaken by the project team and approved by Village Council including the switch to UV disinfection and value engineering efforts. This discretionary work was completed within the existing allocated budget for design, and resulted in estimated construction cost savings of $935,641, resulting in an overall reduction for estimated construction costs of $241,994, despite construction now including the addition of unforeseen and non-discretionary scope to meet performance requirements.

Contingency Costs

The most recent Council-approved budget allowed for a total of $250,000 in contingency funding, distributed amongst all potential cost categories. The budget also included an additional allowance of $192,000 of contingency for the completion of design, which had been incorporated into the awarded design contract value.

With detailed design now nearing completion, the project milestone schedule and risk registers have also been updated. This has allowed a more accurate estimation of the contingency considered necessary to address unexpected conditions that may arise between now and project completion. Though the risk of further cost increases for owner's costs and design costs are now decreasing by $92,000, it's recommended that the contingency for construction be increased by $496,153.

The project team is of the opinion that this additional contingency funding is needed to allow unforeseen construction challenges to be addressed without the need for further budget increases which would introduce additional delays and further increase costs. This contingency would cover costs arising from items such as undiscovered geotechnical issues, extreme weather events, vandalism or theft, or new compliance requirements imposed by regulators. Should this contingency funding not be needed, it would result in a project surplus at project completion that could be returned to the Village.

Recommended Project Budget

Due to the cost increases described above, the project team now estimates that an increased budget will be required to bring the project to a successful conclusion. A breakdown of this budget, comprised of the expected costs to complete and the recommended contingency to be carried to address unforeseen circumstances, is provided here below:

Cost Category	Estimated Cost to Complete	Recommended Contingency	Recommended Budget
01 – Owner's Costs	$1,499,192	$20,000	$1,519,192
02 – Design	$2,455,954	$100,000	$2,555,954
03 – Construction	$10,061,839	$549,250	$10,611,089
04 – Construction Management	$2,901,123	$30,000	$2,931,123
Total	**$16,918,108**	**$699,250**	**$17,617,357**

Table 4 - Recommended Project Budget

The project team will continue working with the construction manager and design consultant to pursue all available opportunities to reduce these anticipated project costs. At this time, however, the project team is not able to confidently commit that further reductions can be achieved, and so is requesting this additional budget to ensure that the project can be successfully completed. Should further reductions be realized, it is recommended that the available budget be maintained as additional contingency until project completion with any final surplus returned to the Village.

Recommendations

Given the significant contribution of delays to cost increases throughout the project, the project team recommends the following:

1. That construction activities be resumed, and commitments continue to be made to all critical-path project elements that can be completed without exceeding the current Council-approved budget.
2. That the Steering Committee request that the total project budget be increased to $17,617,357, including $699,250 in contingency funding, to allow the project to complete without further delay.
3. That the Steering Committee request authorization from Council to enter into contracts with contractors and equipment suppliers up to the total budget value to minimize any further delays to the project's completion.

Client Name	VoC
Project Name	891378 - VoC HPL Phase 1
Version Name	891378 - VoC HPL Phase 1 CTL 2025 Feb 26 v9

1. Project Overview

Budget Category Number	Description	Budget ($)	Estimate at Completion ($)	Forecast Variance at Completion ($)	Benchmark Cost $ / sq. ft.
1	01 - Owner's Costs	1,519,191.77	1,499,191.77	20,000.00	
2	02 - Design Fees	2,555,933.69	2,455,953.74	99,979.95	
3	03 - Construction Costs	13,542,212.00	13,107,845.70	434,366.30	
		17,617,337.46	**17,062,991.21**	**554,346.25**	

2. Summary and taxes

Description	Budget ($)	Estimate at Completion ($)	Forecast Variance at Completion ($)
Pre-Tax Total	17,617,337.46	17,062,991.21	554,346.25
GST/HST/VAT %	0.00	0.00	0.00
PST %	0.00	0.00	0.00
Other Tax %	0.00	0.00	0.00
	17,617,337.46	**17,062,991.21**	**554,346.25**

3. Budget Log

Budget Item Number	Budget Item Description	Current Budget ($) as of 02/27/2025	Tax Rate (GST/PST/ Other) (%)	Budget Notes
1	01 - Owner's Costs	1,519,191.77		
1.01	Owner's Cost	1,499,191.77	0/0/0	
1.99	Owner's Contingency	20,000.00	0/0/0	
2	02 - Design Fees	2,555,933.69		
2.01	Integrated	1,200,232.69	0/0/0	
2.02	McElhanney Fees	1,255,701.00	0/0/0	Phase 1 McElhanney fees. Any Estimate to Complete Costs like change orders are added to the 'McElhanney Fee's actual amount and reduce from the 'ETC McElhanney' Planned amount to balance.
2.99	Design Contingency	100,000.00	0/0/0	
3	03 - Construction Costs	13,542,212.00		
3.01	Maple Reinders	12,439,224.20	0/0/0	
3.02	Muchalat	450,240.80	0/0/0	
3.03	BC Hydro	73,497.00	0/0/0	
3.99	Construction Contingency	579,250.00	0/0/0	

4. Cost Allocation Log

Budget Item Number	Budget Item Description	Current Budget ($) as of 02/27/2025	Original PO Commitment ($)	Estimate to Complete ($)	Estimate at Completion ($)	Forecast Variance at Completion ($) (Budget - Estimate at Completion)	Forecast Notes
1	01 - Owner's Costs	1,519,191.77	1,361,200.30	137,991.47	1,499,191.77	20,000.00	
1.01	Owner's Cost	1,499,191.77	1,361,200.30	137,991.47	1,499,191.77	0.00	
1.99	Owner's Contingency	20,000.00				20,000.00	
2	02 - Design Fees	2,555,933.69	2,303,767.99	152,185.75	2,455,953.74	99,979.95	
2.01	Integrated	1,200,232.69	1,200,232.69	0.00	1,200,232.69	0.00	Forecasted cost include costs for schedule extension, value engineering and additional costs related to Hedgehog
2.02	McElhanney Fees	1,255,701.00	1,103,535.30	152,185.75	1,255,721.05	-20.05	
2.99	Design Contingency	100,000.00				100,000.00	
3	03 - Construction Costs	13,542,212.00	9,739,484.26	3,368,361.44	13,107,845.70	434,366.30	
3.01	Maple Reinders	12,439,224.20	9,197,638.56	3,241,585.64	12,439,224.20	0.00	
3.02	Muchalat	450,240.80	450,240.80	0.00	450,240.80	0.00	
3.03	BC Hydro	73,497.00	73,497.00	0.00	73,497.00	0.00	
3.99	Construction Contingency	579,250.00	18,107.90	126,775.80	144,883.70	434,366.30	

5. Commitment Log

Actuals

Allocate Cost to:								
Budget Item	Budget Item Description	Vendor Name	Commitment Item Description	Transaction Number	Total Contract Amount ($)	Entry or Revision date	Contract Reference, Purchase Order	Commitment Notes
1.01	Owner's Cost	Ecofish	Environmental Consulting Services		219,119.90	02/20/2025		Feb 21/25 - Ecofish related costs as of Feb/2025
1.01	Owner's Cost	Various	Owner's Costs		289,954.20	02/20/2025		Feb 21/25
1.01	Owner's Cost	Alpine Water and Energy	Project Coordinator		193,228.70	02/20/2025		Feb 21/25 - Project coordinator fees to date, this also includes biochar reed bed trials
1.01	Owner's Cost	Colliers Project Leaders	Project Management & Procurement Support		581,100.00	02/20/2025		Feb 21/25 - Contract references include project management services and procurement services up to end of 2024.
1.01	Owner's Cost	Zinc	Public Engagement		77,797.50	02/20/2025		Feb 21/25 - Zinc contract to date
2.01	Integrated	Integrated	Integrated Costs		1,200,232.69	12/18/2024		
2.02	McElhanney Fees	McElhanney	McElhanney Fees		1,103,535.30	12/18/2024		Jan 24/25 - Incorporates changes order 01-06 (Phase 1 budget split) Jan 31/25 - Includes CO 07 Electrical Subconsultant Fees. Feb 20/25 - Includes CO 08 additional fee for Hedge hog
3.01	Maple Reinders	Maple Reinders	Construction Costs		9,215,746.46	02/25/2025		

Allocate Cost to:								
Budget Item	Budget Item Description	Vendor Name	Commitment Item Description	Transaction Number	Total Contract Amount ($)	Entry or Revision date	Contract Reference, Purchase Order	Commitment Notes
3.02	Muchalat	Muchalat	Muchalat Construction Costs		450,240.80	12/18/2024		
3.03	BC Hydro	BC Hydro	BC Hydro Costs		73,497.00	12/18/2024		
					13,404,452.55			

Forecasted

Allocate Cost to:								
Budget Item	Budget Item Description	Vendor Name	Commitment Item Description	Transaction Number	Total Contract Amount ($)	Entry or Revision date	Contract Reference, Purchase Order	Commitment Notes
1.01	Owner's Cost	TBD	ETC - Owner's Cost		137,991.47	02/20/2025		Feb 20/25 - ETC includes $127,000 for Colliers' fee into early 2026, as well as ~$10K for other miscellaneous Owner's costs
2.02	McElhanney Fees	McElhanney - ETC	ETC - McElhanney Fees		152,185.75	01/24/2025	N/A	Jan 1/25 Incorporates changes orders 01-06 Jan 31/25 Includes reduction in ETC due to CO 07 - Electrical Subconsultant Fees Feb 20/25 - Includes CO 08 additional fee for Hedge hog

Allocate Cost to:								
Budget Item	Budget Item Description	Vendor Name	Commitment Item Description	Transaction Number	Total Contract Amount ($)	Entry or Revision date	Contract Reference, Purchase Order	Commitment Notes
3.01	Maple Reinders	Maple Reinders	ETC - Maple Reinders		3,241,585.64	02/25/2025		Budget is from Council-Approved budget on October 28, 2024 Actual is amount remaining after change orders CO 15-CO 18 FEB 26/25 - Updated as of CO 21 for gravel placement under slabs
					3,531,762.86			

6. Change Log

Approved Changes

Commitment	Item Description		Situation Identified		Instruction		Pending Costs			Approved Changes		
		Change Status	Date Entered	Estimated Cost ($)	RFI #	Date Issued	CCN #	Date	Quoted Amt. ($)	CO #	Date Authorized	Approved Amt. ($)
Construction Costs	Construction Contingency	CO Approved	01/14/2025	3,068.37						CO 19	01/13/2025	3,068.37
Construction Costs	Construction Contingency	CO Approved	12/18/2024	24,542.53						CO 15	10/25/2024	15,039.53
				27,610.90								**18,107.90**

Forecasted Changes

Commitment	Item Description		Situation Identified		Instruction		Pending Costs			Comments
		Change Status	Date Entered	Est. Cost ($)	RFI #	Date Issued	CCN #	Date	Quoted Amt. ($)	
Construction Costs	Construction Contingency	RFI logged	12/18/2024	126,775.80						ETC Forecast
				126,775.80						

7. Responsibility Log

Code	Description	Total ($)	Budget Item Number	Notes
U	Construction Contingency		3.99	ETC Forecast
D	Construction Contingency	3,068.37	3.99	CO 19 - UV Basin concrete formwork cost delta per MR's updated budget 11.3 (as well as their follow up email with a correct to the delta Jan 13/25)
D	Construction Contingency	15,039.53	3.99	Maple Reinders cost for difference in UV disinfection (PST)
		18,107.90		

Responsibility Codes	
D	**Design Coordination**
O	**Owner Initiated Change**
R	**Regulatory Requirement (Bylaw, OBC)**
U	**Unforeseen Site Conditions**
C1	**Custom 1**
C2	**Custom 2**

8. Cash Allowance Summary

9. Cash Allowance Commitments

10. Invoicing

Budget Item	PO#	Vendor	Commitment	Initial PO	Total Approved Change Amt. ($)	Total Contract Amt. ($)	% Invoiced	Notes
1.01		Ecofish	Environmental Consulting Services	219,119.90		219,119.90	0.00	Feb 21/25 - Ecofish related costs as of Feb/2025
1.01		TBD	ETC - Owner's Cost			137,991.47	0.00	Feb 20/25 - ETC includes $127,000 for Colliers' fee into early 2026, as well as ~$10K for other miscellaneous Owner's costs
1.01		Various	Owner's Costs	289,954.20		289,954.20	0.00	Feb 21/25
1.01		Alpine Water and Energy	Project Coordinator	193,228.70		193,228.70	0.00	Feb 21/25 - Project coordinator fees to date, this also includes biochar reed bed trials
1.01		Colliers Project Leaders	Project Management & Procurement Support	581,100.00		581,100.00	0.00	Feb 21/25 - Contract references include project management services and procurement services up to end of 2024.
1.01		Zinc	Public Engagement	77,797.50		77,797.50	0.00	Feb 21/25 - Zinc contract to date
2.01		Integrated	Integrated Costs	1,200,232.69		1,200,232.69	0.00	
2.02	N/A	McElhanney - ETC	ETC - McElhanney Fees			152,185.75	0.00	Jan 1/25 Incorporates changes orders 01-06 Jan 31/25 Includes reduction in ETC due to CO 07 - Electrical Subconsultant Fees Feb 20/25 - Includes CO 08

Budget Item	PO#	Vendor	Commitment	Initial PO	Total Approved Change Amt. ($)	Total Contract Amt. ($)	% Invoiced	Notes
								additional fee for Hedge hog
2.02		McElhanney	McElhanney Fees	1,103,535.30		1,103,535.30	0.00	Jan 24/25 - Incorporates changes order 01-06 (Phase 1 budget split) Jan 31/25 - Includes CO 07 Electrical Subconsultant Fees. Feb 20/25 - Includes CO 08 additional fee for Hedge hog
3.01		Maple Reinders	Construction Costs	9,197,638.56	18,107.90	9,215,746.46	0.00	
3.01		Maple Reinders	ETC - Maple Reinders			3,241,585.64	0.00	Budget is from Council-Approved budget on October 28, 2024 Actual is amount remaining after change orders CO 15-CO 18 FEB 26/25 - Updated as of CO 21 for gravel placement under slabs
3.02		Muchalat	Muchalat Construction Costs	450,240.80		450,240.80	0.00	
3.03		BC Hydro	BC Hydro Costs	73,497.00		73,497.00	0.00	
				13,386,344.65	**18,107.90**	**16,936,215.41**		

Actuals

Forecasted

Client Name	High Performance Lagoon Project
Project Name	891378 - High Performance Lagoon Project - Phase 2
Version Name	891378 - High Performance Lagoon Project - Phase 2 CTL 2025 Feb 5 v3

1. Project Overview

Budget Category Number	Description	Budget ($)	Estimate at Completion ($)	Forecast Variance at Completion ($)	Benchmark Cost $ / sq. ft.
1	01 - Consultant Fees	837,227.10	675,902.10	161,325.00	
2	02 - Design Fees	822,711.00	657,711.00	165,000.00	
3	03 - Construction Costs	2,700,060.00	2,160,060.00	540,000.00	
		4,359,998.10	**3,493,673.10**	**866,325.00**	

2. Summary and taxes

Description	Budget ($)	Estimate at Completion ($)	Forecast Variance at Completion ($)
Pre-Tax Total	4,359,998.10	3,493,673.10	866,325.00
GST/HST/VAT %	0.00	0.00	0.00
PST %	0.00	0.00	0.00
Other Tax %	0.00	0.00	0.00
	4,359,998.10	**3,493,673.10**	**866,325.00**

3. Budget Log

Budget Item Number	Budget Item Description	Current Budget ($) as of 02/05/2025	Tax Rate (GST/PST/ Other) (%)	Budget Notes
1	01 - Consultant Fees	837,227.10		
1.01	Project Coordinator	100,000.00	0/0/0	Additional year of support. Estimate based on 2023 fees
1.02	Project Management	175,000.00	0/0/0	Additional year of support. Estimate based on 2023 fees
1.03	Communications	45,000.00	0/0/0	Additional year of support. Estimate based on 2023 fees
1.04	Environmental Permitting	310,902.10	0/0/0	Design Scoping for Phase 2C from proposal
1.05	Legal Fees	5,000.00	0/0/0	Estimate for filing fees for properties and permits
1.06	First Nations Engagement	40,000.00	0/0/0	Estimate based on Phase 1 consultation costs
1.99	Owner's Contingency	161,325.00	0/0/0	Feb 4/25 - Updated ~20% contingency, based on Paul Nash Phase 2 update
2	02 - Design Fees	822,711.00		
2.01	Phase 2A - Reed Bed & Conveyance	298,000.00	0/0/0	From Integrated Change Orders 2, 3, & 7
2.02	Phase 2B - Disc Filtration	47,711.00	0/0/0	From Integrated Change Order 3
2.04	Phase 2C - Maple Lake Creek Re-Routing	227,000.00	0/0/0	Costs from Ecofish Proposal
2.05	Phase 2D - Maple Lake Infill	85,000.00	0/0/0	Estimate based on August 2022 Proposal
2.06	Construction Inspections and Reviews (2C & 2D)	0.00	0/0/0	Estimate based on 20% of Design Fees Feb 4/25 - VOID
2.99	Design Contingency	165,000.00	0/0/0	Feb 4/25 - ~20% contingency
3	03 - Construction Costs	2,700,060.00		
3.01	Phase 2A & 2B Construction Management	54,060.00	0/0/0	From Maple Reinders contract formula and phase 2A and 2B construction cost estimates
3.02	Phase 2A - Reed Bed & Conveyance	670,000.00	0/0/0	From Maple Phase 2 Estimate at 50% of full size + 30% for electrical and other costs
3.03	Phase 2B - Disc Filtration	645,000.00	0/0/0	Pricing from proposal + 10% for labour
3.04	Phase 2C - Maple Lake Creek Re-Routing	325,000.00	0/0/0	Target costs for scope to achieve budget
3.05	Phase 2D - Maple Lake Infill	312,000.00	0/0/0	Estimate of $450k from PN Memo #27
3.06	Phase 2C & 2D Construction Management	154,000.00	0/0/0	10% of Construction Costs
3.99	Construction Contingency	540,000.00	0/0/0	Feb 4/25 - ~20% Contingency

Budget Item Number	Budget Item Description	Current Budget ($) as of 02/05/2025	Tax Rate (GST/PST/ Other) (%)	Budget Notes
				updated based on Paul Nash phase 2 update

4. Cost Allocation Log

Budget Item Number	Budget Item Description	Current Budget ($) as of 02/05/2025	Original PO Commitment ($)	Estimate to Complete ($)	Estimate at Completion ($)	Forecast Variance at Completion ($) (Budget - Estimate at Completion)	Forecast Notes
1	01 - Consultant Fees	837,227.10	239,608.37	436,293.73	675,902.10	161,325.00	
1.01	Project Coordinator	100,000.00	54,205.56	45,794.44	100,000.00	0.00	
1.02	Project Management	175,000.00	72,500.00	102,500.00	175,000.00	0.00	
1.03	Communications	45,000.00		45,000.00	45,000.00	0.00	
1.04	Environmental Permitting	310,902.10	112,902.81	197,999.29	310,902.10	0.00	
1.05	Legal Fees	5,000.00		5,000.00	5,000.00	0.00	
1.06	First Nations Engagement	40,000.00		40,000.00	40,000.00	0.00	
1.99	Owner's Contingency	161,325.00				161,325.00	
2	02 - Design Fees	822,711.00	267,102.00	390,609.00	657,711.00	165,000.00	
2.01	Phase 2A - Reed Bed & Conveyance	298,000.00	219,391.00	78,609.00	298,000.00	0.00	
2.02	Phase 2B - Disc Filtration	47,711.00	47,711.00	0.00	47,711.00	0.00	
2.04	Phase 2C - Maple Lake Creek Re-Routing	227,000.00		227,000.00	227,000.00	0.00	
2.05	Phase 2D - Maple Lake Infill	85,000.00		85,000.00	85,000.00	0.00	
2.06	Construction Inspections and Reviews (2C & 2D)	0.00				0.00	
2.99	Design Contingency	165,000.00				165,000.00	
3	03 - Construction Costs	2,700,060.00	640,060.00	1,520,000.00	2,160,060.00	540,000.00	
3.01	Phase 2A & 2B Construction Management	54,060.00	54,060.00	0.00	54,060.00	0.00	
3.02	Phase 2A - Reed Bed & Conveyance	670,000.00		670,000.00	670,000.00	0.00	
3.03	Phase 2B - Disc Filtration	645,000.00	586,000.00	59,000.00	645,000.00	0.00	
3.04	Phase 2C - Maple Lake Creek Re-Routing	325,000.00		325,000.00	325,000.00	0.00	

Budget Item Number	Budget Item Description	Current Budget ($) as of 02/05/2025	Original PO Commitment ($)	Estimate to Complete ($)	Estimate at Completion ($)	Forecast Variance at Completion ($) (Budget - Estimate at Completion)	Forecast Notes
3.05	Phase 2D - Maple Lake Infill	312,000.00		312,000.00	312,000.00	0.00	
3.06	Phase 2C & 2D Construction Management	154,000.00		154,000.00	154,000.00	0.00	
3.99	Construction Contingency	540,000.00				540,000.00	

5. Commitment Log

Actuals

Allocate Cost to:								
Budget Item	Budget Item Description	Vendor Name	Commitment Item Description	Transaction Number	Total Contract Amount ($)	Entry or Revision date	Contract Reference, Purchase Order	Commitment Notes
1.01	Project Coordinator	Alpine Water and Energy	Project Coordination	7	12,205.56	11/13/2024		Total Phase 2 Work pre-2023
1.01	Project Coordinator	Alpine Water and Energy	Project Coordination	8	42,000.00	03/06/2023	PO 581229	2023 Phase 2 Work
1.02	Project Management	Colliers Project	Project	5	72,500.00	11/13/2024	PO 581230	Phase 2 Design Support

Allocate Cost to:								
Budget Item	Budget Item Description	Vendor Name	Commitment Item Description	Transaction Number	Total Contract Amount ($)	Entry or Revision date	Contract Reference, Purchase Order	Commitment Notes
		Leader	Management					
1.04	Environmental Permitting	Ecofish Research	Phase 2C Design	1	112,902.81	11/30/2022	PO 581224	Design & Permitting Scoping
2.01	Phase 2A - Reed Bed & Conveyance	Integrated Sustainability	Contract Termination	12	-230,727.00	07/09/2024		Contract value remaining unpaid at execution of mutual release.
2.01	Phase 2A - Reed Bed & Conveyance	McElhanney	Phase 2 Portion of Initial Contract	13	92,290.00	07/09/2024		Task 3 and item 5.1 from initial contract
2.01	Phase 2A - Reed Bed & Conveyance	Integrated Sustainability	Phase 2A - Reed Bed & Conveyance	10	4,026.00	11/13/2024	CO 07	Change Order for Reed Bed Optimization Workshop
2.01	Phase 2A - Reed Bed & Conveyance	Integrated Sustainability	Phase 2A Design	3	129,880.00	01/04/2023	CO 02	Change for Disinfection Basin Relocation
2.01	Phase 2A - Reed Bed & Conveyance	Integrated Sustainability	Phase 2A Design	2	252,222.00	01/04/2023	CO 03	Change Order for Phase 2A
2.01	Phase 2A - Reed Bed & Conveyance	McElhanney	Transfer of Unused Budget to Phase 1	14	-28,300.00	09/03/2024	CO 02	Budget transfer to Phase 1 for conveyance to reedbed scope not pursued
2.02	Phase 2B - Disc Filtration	Integrated Sustainability	Phase 2B Design	4	47,711.00	11/06/2024	CO 03	Change Order for Phase 2B
3.01	Phase 2A & 2B Construction Management	Maple Reinders	Phase 2A & 2B Construction Management	6	41,340.00	02/07/2023		Included in CO 4
3.01	Phase 2A & 2B Construction	Maple Reinders	Phase 2A & 2B	9	12,720.00	05/15/2023		Included in CO 5

Allocate Cost to:								
Budget Item	Budget Item Description	Vendor Name	Commitment Item Description	Transaction Number	Total Contract Amount ($)	Entry or Revision date	Contract Reference, Purchase Order	Commitment Notes
	Management		Construction Management					
3.03	Phase 2B - Disc Filtration	TBD	Phase 2B - Disc Filtration		586,000.00	02/04/2025		Feb 4/25 - Commitment updated based on Paul Nash phase 2 budget update
					1,146,770.37			

Forecasted

Allocate Cost to:								
Budget Item	Budget Item Description	Vendor Name	Commitment Item Description	Transaction Number	Total Contract Amount ($)	Entry or Revision date	Contract Reference, Purchase Order	Commitment Notes
1.01	Project Coordinator	TBD	ETC - Project Coordinator		45,794.44	02/04/2025		Feb 4/25 - Phase 2 budget update based on Paul Nash's budget update
1.02	Project Management	Colliers Project Leaders	ETC - Project Management		102,500.00	02/04/2025		Colliers ETC for Phase 2 PM services
1.03	Communications	TBD	ETC - Communications		45,000.00	02/04/2025		Feb 4/25 - Phase 2 budget update based on Paul Nash's budget update
1.04	Environmental Permitting	TBD	ETC - Environmental Permitting		197,999.29	02/04/2025		Feb 4/25 - Updated based on Paul Nash phase 2 budget proposal
1.05	Legal Fees	TBD	ETC - Legal Fees		5,000.00	02/04/2025		Feb 4/25 - Updated based on Paul Nash Phase 2 budget
1.06	First Nations	TBD	ETC - First		40,000.00	02/04/2025		Feb 4/25 - Updated based on

Allocate Cost to:								
Budget Item	Budget Item Description	Vendor Name	Commitment Item Description	Transaction Number	Total Contract Amount ($)	Entry or Revision date	Contract Reference, Purchase Order	Commitment Notes
	Engagement		Nations Engagement					Paul Nash Phase 2 budget
2.01	Phase 2A - Reed Bed & Conveyance	TBD	ETC - Phase 2A - Reed Bed & Conveyance		78,609.00	02/04/2025		Feb 4/25 - Updated based on Paul Nash Phase 2 budget
2.04	Phase 2C - Maple Lake Creek Re-Routing	TBD	ETC - Phase 2C - Maple Lake Creek Re-Routing		227,000.00	02/04/2025		Feb 4/25 - Updated based on Paul Nash Phase 2 budget
2.05	Phase 2D - Maple Lake Infill	TBD	ETC - Phase 2D - Maple Lake Infill		85,000.00	02/04/2025		Feb 4/25 - Updated based on Paul Nash Phase 2 budget
3.02	Phase 2A - Reed Bed & Conveyance	TBD	ETC - Phase 2A - Reed Bed & Conveyance		670,000.00	02/04/2025		Feb 4/25 - ETC updated based on Paul Nash phase 2 update
3.03	Phase 2B - Disc Filtration	Nexom	Tertiary Filtration Equipment	11	59,000.00	11/13/2024	PO 1176-014	Includes, Limited Notice to Proceed for shop drawing prep, shipping to site and commissioning Feb 4/25 - ETC updated based on Paul Nash phase 2 update
3.04	Phase 2C - Maple Lake Creek Re-Routing	TBD	ETC - Phase 2C - Maple Lake Creek Re-Routing		325,000.00	02/04/2025		Feb 4/25 - ETC updated based on Paul Nash phase 2 update
3.05	Phase 2D - Maple Lake Infill	TBD	ETC - Phase 2D - Maple Lake Infill		312,000.00	02/04/2025		Feb 4/25 - ETC updated based on Paul Nash phase 2 update
3.06	Phase 2C & 2D	TBD	ETC - Phase		154,000.00	02/04/2025		Feb 4/25 - ETC updated based

Allocate Cost to:								
Budget Item	Budget Item Description	Vendor Name	Commitment Item Description	Transaction Number	Total Contract Amount ($)	Entry or Revision date	Contract Reference, Purchase Order	Commitment Notes
	Construction Management		2C & 2D Construction Management					on Paul Nash phase 2 update
					2,346,902.73			

6. Change Log

Approved Changes

Forecasted Changes

7. Responsibility Log

Responsibility Codes	
D	Design Coordination
O	Owner Initiated Change
R	Regulatory Requirement (Bylaw, OBC)
U	Unforeseen Site Conditions
C1	Custom 1
C2	Custom 2

8. Cash Allowance Summary

9. Cash Allowance Commitments

10. Invoicing

Budget Item	PO#	Vendor	Commitment	Initial PO	Total Approved Change Amt. ($)	Total Contract Amt. ($)	% Invoiced	Notes
1.01		TBD	ETC - Project Coordinator			45,794.44	0.00	Feb 4/25 - Phase 2 budget update based on Paul Nash's budget update
1.01		Alpine Water and Energy	Project Coordination	12,205.56		12,205.56	0.00	Total Phase 2 Work pre-2023
1.01	PO 581229	Alpine Water and Energy	Project Coordination	42,000.00		42,000.00	0.00	2023 Phase 2 Work
1.02		Colliers Project Leaders	ETC - Project Management			102,500.00	0.00	Colliers ETC for Phase 2 PM services
1.02	PO 581230	Colliers Project Leader	Project Management	72,500.00		72,500.00	0.00	Phase 2 Design Support
1.03		TBD	ETC - Communications			45,000.00	0.00	Feb 4/25 - Phase 2 budget update based on Paul Nash's budget update
1.04		TBD	ETC - Environmental Permitting			197,999.29	0.00	Feb 4/25 - Updated based on Paul Nash phase 2 budget proposal
1.04	PO 581224	Ecofish Research	Phase 2C Design	112,902.81		112,902.81	0.00	Design & Permitting Scoping
1.05		TBD	ETC - Legal Fees			5,000.00	0.00	Feb 4/25 - Updated based on Paul Nash Phase 2 budget
1.06		TBD	ETC - First Nations Engagement			40,000.00	0.00	Feb 4/25 - Updated based on Paul Nash Phase 2 budget
2.01		Integrated Sustainability	Contract Termination	-230,727.00		-230,727.00	0.00	Contract value remaining unpaid at execution of mutual release.
2.01		TBD	ETC - Phase 2A - Reed Bed &			78,609.00	0.00	Feb 4/25 - Updated based on Paul Nash Phase 2

Budget Item	PO#	Vendor	Commitment	Initial PO	Total Approved Change Amt. ($)	Total Contract Amt. ($)	% Invoiced	Notes
			Conveyance					budget
2.01		McElhanney	Phase 2 Portion of Initial Contract	92,290.00		92,290.00	0.00	Task 3 and item 5.1 from initial contract
2.01	CO 07	Integrated Sustainability	Phase 2A - Reed Bed & Conveyance	4,026.00		4,026.00	0.00	Change Order for Reed Bed Optimization Workshop
2.01	CO 02	Integrated Sustainability	Phase 2A Design	129,880.00		129,880.00	0.00	Change for Disinfection Basin Relocation
2.01	CO 03	Integrated Sustainability	Phase 2A Design	252,222.00		252,222.00	0.00	Change Order for Phase 2A
2.01	CO 02	McElhanney	Transfer of Unused Budget to Phase 1	-28,300.00		-28,300.00	0.00	Budget transfer to Phase 1 for conveyance to reedbed scope not pursued
2.02	CO 03	Integrated Sustainability	Phase 2B Design	47,711.00		47,711.00	0.00	Change Order for Phase 2B
2.04		TBD	ETC - Phase 2C - Maple Lake Creek Re-Routing			227,000.00	0.00	Feb 4/25 - Updated based on Paul Nash Phase 2 budget
2.05		TBD	ETC - Phase 2D - Maple Lake Infill			85,000.00	0.00	Feb 4/25 - Updated based on Paul Nash Phase 2 budget
3.01		Maple Reinders	Phase 2A & 2B Construction Management	12,720.00		12,720.00	0.00	Included in CO 5
3.01		Maple Reinders	Phase 2A & 2B Construction Management	41,340.00		41,340.00	0.00	Included in CO 4
3.02		TBD	ETC - Phase 2A - Reed Bed & Conveyance			670,000.00	0.00	Feb 4/25 - ETC updated based on Paul Nash phase 2 update

Budget Item	PO#	Vendor	Commitment	Initial PO	Total Approved Change Amt. ($)	Total Contract Amt. ($)	% Invoiced	Notes
3.03		TBD	Phase 2B - Disc Filtration	586,000.00		586,000.00	0.00	Feb 4/25 - Commitment updated based on Paul Nash phase 2 budget update
3.03	PO 1176-014	Nexom	Tertiary Filtration Equipment			59,000.00	0.00	Includes, Limited Notice to Proceed for shop drawing prep, shipping to site and commissioning Feb 4/25 - ETC updated based on Paul Nash phase 2 update
3.04		TBD	ETC - Phase 2C - Maple Lake Creek Re-Routing			325,000.00	0.00	Feb 4/25 - ETC updated based on Paul Nash phase 2 update
3.05		TBD	ETC - Phase 2D - Maple Lake Infill			312,000.00	0.00	Feb 4/25 - ETC updated based on Paul Nash phase 2 update
3.06		TBD	ETC - Phase 2C & 2D Construction Management			154,000.00	0.00	Feb 4/25 - ETC updated based on Paul Nash phase 2 update
				1,146,770.37		**3,493,673.10**		

Actuals

Forecasted

APPENDIX J
DEVELOPMENT COST CHARGES

Calculation of Wastewater Treatment Development Cost Charges

The use of DCC's (Development Cost Charges) is normally to fund projects that are yet to be done, rather than ones that have already been done. However, the provincial regulations allow DCC's to be used to pay off costs and loans for already completed projects in certain cases where infrastructure must be expanded before development can occur and this specifically includes wastewater treatment plants. In these cases, the DCC's can also cover the interest cost in addition to the project capital costs. Application must be made to the Province for such case.

For Cumberland, the simplified cost and capacity breakdown of the treatment upgrade project is as follows, with a parcel being designated as a Single Family Equivalent Unit (SFEU).

Item	Quantity/Cost
2026 Population*	5,130
Plant Design Capacity (Population)	8,500
Proportion for Growth	40%
Total Project Cost	$21.977M
Proportion Allocated to Growth	$8.71M
Loan Interest on $6.9M	$3.740M
Total Cost	$12.45M
Municipal Assist Factor**	1%
Net Portion Allocated to Growth	$12.329M
Nominal Population per SFEU*** Household	2.4
Nominal New SFEU's	1,196
Nominal DCC per SFEU	**$10,308**

Notes:

*Population and household figures from 2024 Housing Needs Report.

** As per the BC DCC regulations, the Municipal Assist Factor must be a minimum of 1%.

***SFEU = Single Family Equivalent Unit (i.e. a "house"). Population of 2.4 per household is from 2024 Housing Needs Report.

Since no further treatment capacity expansions are expected for the twenty-year LWMP period, this DCC represents the entirety of the wastewater *treatment* portion of the wastewater DCC. A separate calculation is still needed for the collection portion, based on anticipated collection system expansion projects. The DCC would be recalculated when the DCC bylaw is renewed, typically at five-year intervals.

An example of this strategy is the City of Kelowna in 2011, which had just completed a wastewater expansion and listed that as $54M of a $66M wastewater treatment DCC program (extract attached to this memo).

The rate of population and household growth to year 2041 has been modelled in the 2024 Housing Needs Report. This has been extrapolated to 2046 for this LWMP – note that the projected 2046 population of 7,000 is less than the WWTF design capacity of 8,500 people.

Year	Population	Households (SFEU)	Average SFEU added per year	Average DCC Revenue per year
2026	5130	2138		
2031	5770	2404	53	$546k
2036	6300	2625	44	$454k
2041	6660	2775	30	$309k
2046	7000	2916	28	$289k
Total for 20 years	**1870**	**778**	**38.9**	**$401k/yr, $8.019M total**

At the projected growth rates, the DCC's will pay off 75% of the total loan cost of $10.64M and 65% of the $12.45M allocated to growth over the 20-year period. It does not pay it all off as the projected growth as the projected 778 units, does not use up all the treatment plant spare capacity (1196 units). Since DCC's are dependent on the rate of growth, the revenue stream fluctuates and is not guaranteed. So similarly to infrastructure grants, the DCC revenues in this case should be viewed as a bonus, rather than as a guaranteed stream that would allow an immediate reduction of the loan parcel taxes. With DCC's covering most of the loan cost, excess from user parcel taxes can go towards asset replacement reserves.

APPENDIX K
MUNICIPAL SANITARY SYSTEM REGULATION AND FEES BYLAW NO. 1025, 2015

STATUS

TITLE:	Municipal Sanitary System Regulation and Fees Bylaw No. 1025, 2015
APPLICANT:	Village of Cumberland
PURPOSE:	A Bylaw to regulate the connection, use, and extension to the municipal sanitary system and to impose fees for associated services.

COUNCIL:	**Date:**	August 10, 2015
	Decision:	1st, 2nd, and 3rd readings
COUNCIL:	**Date:**	September 14, 2015
	Decision:	Adoption

CORPORATION OF THE VILLAGE OF CUMBERLAND

BYLAW NO. 1025

A Bylaw to regulate the connection, use, and extension of the municipal sanitary sewer system and to impose fees for associated services.

The Council of the Corporation of the Village of Cumberland enacts as follows:

Part A GENERAL PROVISIONS

1. Title

This Bylaw may be cited as the 'Municipal Sanitary System Regulation and Fees Bylaw No. 1025, 2015.'

2. Administration

The Chief Administrative Officer, Corporate Officer, Protective Services Manager, MoO or his designate, Municipal Engineer, and Building Official, are appointed by Council to administer this Bylaw.

3. Applicability

a) This Bylaw shall be applicable to all land within the municipal boundaries of the Corporation of the Village of Cumberland.

b) For the purpose of this Bylaw the Schedule A referred to herein is attached to and forms an integral part of this Bylaw.

4. Definitions

For the purpose of this Bylaw, the following definitions apply. The context meaning of terms contained in this Bylaw and not defined herein, are to be determined in accordance with firstly, the *British Columbia Building Code 2012*, secondly, this Bylaw, thirdly in the 'Corporation of the Zoning Bylaw No. 717, 1997, and then in the Canadian Oxford dictionary.

BUILDING INSPECTOR means a person employed or contracted by the Village to administer the *Corporation of the* Building Bylaw No. 949, 2012 and the *BC Building Code*.

BCBC means the *British Columbia Building Code 2012* as adopted by the Minister pursuant to the *Local Government Act,* which includes the BCBC.

BOD means Biological Oxygen Demand, the amount of dissolved oxygen needed by aerobic biological organisms in a body of water to break down organic material present in a given water sample at certain temperature over a specific time period.

ENGINEER	means a person who is adequately experienced in civil engineering to provide the report and is a member *in good standing* with the Association of Professional Engineers and Geoscientists of British Columbia.
FLAMMABLE LIQUID	means any liquid having a flash point at or above 38°Celcius and below 93°Celcius.
FOOD SECTOR ESTABLISHMENT	means: a) a retail establishment or institutional facility where food is prepared and made ready for retail sale or sold to the public b) a business or institutional eating or drinking establishment where food is prepared or made ready for eating and is sold or served to the public (or with respect to institutions, sold or served to persons employed at, served by or attending those institutions) whether or not consumed on the premises.
IMPROVED PROPERTY	means real property on which one or more structures have been built for either residential or business use, or a combination of both.
MoO	means the Manager of Operations, the person appointed by Council to carry out the duties of this position, this may include his designate.
MMCD	means the Master Municipal Construction Documents prepared under the auspices of the Master Municipal Construction Document Association which is an association of the BC municipalities, regional districts, contractors and consultants.
OWNER	means a person registered in the land registry records as Owner of land or of a charge on land, whether entitled to it in his own right or in a representative capacity or otherwise.
PRIVATE CONNECTION	means all the fittings and appurtenances (i.e an inspection chamber or clean out) in the area between the building that is served by and where it is linked to the Municipal System.
MUNICIPAL SYSTEM	means, for the purposes of this Bylaw, a network of collection and conveyance facilities in a separate underground system specifically for transporting stormwater from the source point to treatment or disposal.
STORMWATER SYSTEM	means a network of collection and conveyance facilities in a separate underground system specifically for transporting uncontaminated stormwater from the source point to treatment or disposal and is not intended for wastewater.

STORMWATER	means water resulting from or following rainfall or snowfall but not containing wastewater.
TSS	means the Total Suspended Solids being the measure of insoluble matter obtained by separating particles from a water sample using a filter.
WASTEWATER	means the water-borne wastes containing fecal matter and urine from domestic or industrial sources but does not include rainwater, groundwater, or drainage of uncontaminated water.
WORKING HOURS	means those hours between 7:30am to 3:30pm, Monday through Friday except for statutory holidays.

5. Offences & Penalties

a) Every person who violates any of the provisions of this Bylaw or who suffers or permits any act or thing to be done in contravention or in violation of any of the provisions of this Bylaw, or who neglects to do or refrains from doing anything required to be done by any of the provisions of this Bylaw or who does any act which violates any of the provisions of this Bylaw is guilty of an offence against this Bylaw and liable to the penalties hereby imposed.

b) Each day that a violation is permitted to exist shall constitute a separate offence.

c) Every person who commits an offence of a continuing nature is liable to a fine not exceeding $10,000 for each day such offence is continued.

d) Offences and penalties shall not contravene the *Environmental Management Act*.

e) **Recovery of Costs for Damage to the Municipal System**

i) Where any person contravenes any provision of this Bylaw and thereby causes damage to the municipal system, such person shall be liable to the Village for all costs incurred in making repairs or taking remedial action.

ii) If such costs are not paid forthwith after demand, the Village may recover the same by action in any court of competent jurisdiction.

6. Repeal

The following Bylaws are hereby repealed upon adoption of this Bylaw:

a) The 'Corporation of the Village of Cumberland Private Connection and Fees Bylaw No. 848, 2007' and all amendments thereto; and

b) The 'Corporation of the Village of Cumberland Sanitary Sewer Use, Extension and Connection Bylaw No. 849, 2007.'

PART B PRIVATE CONNECTIONS

1. Application for Private Connections

a) The MoO is authorized to prescribe the form of application for:

i) the connection to the Municipal System;

ii) to alter or repair a Private Connection;

iii) to abandon a Private Connection.

b) Prior to connection to the Municipal System, the Owner must:

i) make application for a connection on the prescribed form; and

ii) make full payment of fees as prescribed in the Schedule A attached hereto and forming part of this Bylaw. The fees do not include any required works on private property.

c) If an application for a Private Connection is denied, the Owner shall be so informed, the reasons for denial given, and the applicable refund in accordance with Schedule A, shall be made.

d) Outstanding fees in relation to this Bylaw not paid on or before December 31st in any year must be deemed to be taxes in arrears on the lot served by the Private Connection.

e) The Private Connection will be installed at the location requested by the Owner wherever possible. In the event the Owner's preferred location is not practicable as determined by the MoO, the MoO will determine the location of the Private Connection.

f) No person, other than the Village, its employees or its contractors shall install, alter or remove or cause to be installed, altered or removed, any part of a Private Connection without written approval from the MoO.

g) There shall be only one Private Connection provided for each legal lot[1], however where a parcel of land can be subdivided as permitted by Bylaw or a hardship exists as determined by the MoO, an Owner may be granted a second Private Connection. The cost of each Private Connection and associated use fees will be payable by the Owner as set out in Schedule A of this Bylaw.

h) Except as provided elsewhere in this Bylaw, the standards for any Private Connection to the Municipal System, and for the repair or alteration of any Private Connection shall be as required by the BCBC.

[1] Lot refers to those subdivided in fee simple only. Connections to those properties subdivided under the Strata Property Act or Residential Tenancy Act will be required and made to the edge of the parent lot.

2. Compulsory Private Connections

a) Where an Improved Property abuts a street newly serviced by the Municipal System, a Private Connection must be installed and the property must utilize the Municipal System within one year of the Municipal System being made available and the applicable fees shall be payable by the Owner as set out in Schedule A of this Bylaw.

b) Where street surface improvements are scheduled by the Village, a Private Connection will be installed to any property abutting said street not already serviced, regardless of whether the lot is improved. The applicable fees for the Private Connection shall be payable by the Owner as set out in Schedule A of this Bylaw.

3. Standards for Private Connections

a) The standards for installation, repair, or alteration of any Private Connection are as required by the BCBC, except as provided elsewhere in this Bylaw.

b) The minimum size of the Private Connection that supplies any building or parcel shall be determined by the BCBC and approved by the Village.

c) The Village undertakes no duty of care to ensure that the capacity of a connection is sufficient for the future development potential of a lot by approving a Private Connection under this Bylaw.

d) All works must be designed and built in accordance with the BCBC. The Private Connection must be installed with sufficient depth to provide natural drainage from the lowest floor of any building or structure except where natural drainage is impractical due to the relative elevation of the Private Connection at the connection to the Municipal System and the lowest floor of the building or structure. Where the elevation cannot be met, the required lift station/equipment must be installed at the Owner's expense.

e) All requirements of this Bylaw for the installation of a Private Connection must be met before the MoO will connect the Private Connection to the Municipal Service.

4. Upgrading to a Private Connection

If an Owner is increasing the capacity, altering, modifying, relocating, or repairing an existing Private Connection or internal system and upgrades to current standards are required, the Owner must pay for the required works (materials, labour, and equipment), at the time of the Plumbing Permit application.

5. Private Connection Disconnection

a) Council may, within 48hours of a sending a written notice to the Owner, disconnect a Private Connection where the discharge is or has the potential to:

i) be hazardous or creates an immediate danger to any person, or

ii) endanger or interfere with the operation of the Municipal System; or

iii) be a risk to public health and safety.

b) The costs incurred in section 5(a) above shall be in addition to and not in substitution for any fine or other penalty to which the Owner of the building may be subject pursuant to the provisions in this Bylaw or any other statute or regulation.

c) The Private Connection must not be reconnected until the applicable costs, charges and fines have paid.

6. Notice Given

Notice in writing required to be given by the Village shall be considered as sufficiently given if sent by registered mail or hand delivered to the Owner at the address shown on the last revised Assessment Roll of the Village.

7. Appeal to Council

An Owner who has received disconnection notice under section 5 of this Bylaw may, by written notice delivered to the Village within 14days of receipt of the notice of disconnection, request that Council reconsider the implementation of the notice.

8. Private Connection Restoration

a) Where a Private Connection has been disconnected in accordance with this Bylaw, such service must not be reconnected until the Owner has:

i) paid to the Village outstanding fees or charges owing relating to the provision of the connection pursuant to the Bylaws of the Village; and

ii) paid to the Village any additional costs incurred by the Village in order to prevent the continued discharge after the connection was disconnected; and

iii) installed, repaired, rectified any outstanding issues leading to the disconnection to the satisfaction of the MoO.

b) The costs incurred in section 8(a) above shall be in addition to and not in substitution for any fine or other penalty to which the Owner of the premises in question may be subject pursuant to the provisions in this Bylaw or any other statute or regulation.

9. Decommissioning of an On-Site Wastewater Treatment System

a) Where an application to install a Private Connection to a property that has been previously serviced by an on-site wastewater treatment system, the Private Connection fees and Onsite Wastewater Treatment System decommissioning security must be paid in accordance with Schedule A of this Bylaw.

b) The on-site wastewater treatment system must be decommissioned by qualified professionals in accordance with current Ministry of Health requirements.

c) When proof of the decommissioning has been received by the MoO, the security shall be returned to the person who paid it. Acceptable proof includes original copies of receipts or reports which confirm that the works required to decommission the on-site wastewater treatment system have been completed.

d) If the on-site wastewater treatment system is not decommissioned within one year of receiving the new Private Connection to the Municipal System:

i) The MoO may ensure that the works are completed using the performance security as payment.

ii) Should the works cost more than the security received, the additional amount shall be invoiced to the Owner of the subject property. The amount invoiced shall be paid upon demand and if unpaid on December 31st of the year in which said work is done, shall be deemed to be taxes in arrears on the property concerned and shall be dealt with in the same manner as ordinary municipal taxes upon land in accordance with the applicable provisions of the *Community Charter.*

10. Abandonment

When a building on a lot serviced by the Municipal System is abandoned or demolished, the MoO may require the disconnection of the Private Connection and the cost shall be recovered from the Owner as set out in Schedule A of this Bylaw.

PART D USE OF MUNICIPAL SERVICE

1. Prohibitions

a) No person must connect or attempt to connect, or allow to be connected, or allow to remain connected to the Municipal System of any property or premises, otherwise than in accordance with the provisions of this Bylaw.

b) Unless authorized by this Bylaw or the MoO, or a person must not:

i) use, change, tamper, connect to, obstruct, destroy damage or in any manner interfere with the Municipal System or any part thereof;

ii) obstruct, at any time or in any manner, the Village access to the Municipal System.

c) Without first obtaining written approval from the MoO, a person must not repair or alter, or cause any repairs or alteration to any Private Connection that is part of the Municipal System;

d) The prohibitions under sections Part D(1)(a), (b) & (c) do not apply to the employees, agents or contractors of the Village when carrying out necessary works on the Municipal System;

2. Unpolluted Discharges

Industrial cooling water shall be pre-treated for removal of the pollutants and the resultant unpolluted water and water from air conditioning, cooling or condensing systems may be discharged into the Municipal Stormwater System, ditch or approved natural outlet or watercourse.

3. Swimming Pools and Hot Tubs

Any and all waters discharged from a swimming pool or hot tub, as well as any effluent from pool filters, back washing, and skimmers, must be discharged into the Municipal System.

4. Prohibited Discharges

No person must place or discharge or cause to be placed or discharged into the Municipal System any of the following:

a) stormwater;

b) untreated and treated industrial cooling water;

c) water from air conditioning, cooling or condensing systems;

d) **Explosives and Flammable Substances**

i) any flammable or explosive liquid, solid, or gas; and

ii) any substance that is water reactive or by interaction with other wastes will cause an explosion, generate flammable gases, or support combustion;

e) **Poisonous and Infectious Substances**

i) any water or waste containing a toxic, poisonous, or infectious substance in sufficient quantity to injure or constitute a hazard to humans or animals, or to create any hazard to the receiving waters of the Municipal System;

ii) any pesticides, herbicides or fungicides;

iii) without limiting the generality of this section, the concentration of the following toxic substances at the point of discharge to the Municipal System shall not exceed:

Matter Toxic Substances	Expressed As	Concentrations in Milligrams/Litre
Aluminum	Al	50.0
Arsenic	As	1.0
Barium	Ba	5.0
Boron	B	50.0
Cadmium	Cd	0.2
Chlorides		1500.0
Chlorinated Phenols*		0.05
Chromium	Cr	4.0
Cobalt	Co	5.0
Copper	Cu	2.0
Cyanide	CN	1.0
Fluorides		10.0
Iron	Fe	10.0
Lead	Pb	1.0
Manganese	Mn	5.0
Mercury	Hg	0.05
Molybdenum	Mo	1.0
Nickel	Ni	2.0
Phenolic Compounds		1.0
Silver	Ag	1.0
Sulphates		1500.0
Sulphides		1.0
Tin	Sn	5.0
Zinc	Zn	3.0

**Chlorinated Phenols are the total of 2, 3, 4, 5 and 2, 3, 4, 6 tetrachlorophenols and pentachlorophenols.*

f) **Corrosive and Noxious Substances**

Any gases, liquids, or solids such as corrosive, noxious or malodorous materials which either by themselves or by interaction with other wastes are capable of creating a public nuisance, or hazard to life or preventing entry into a municipal sanitary sewer or sewage treatment system. This includes waters, sewage or wastes having a pH factor lower than 5.0 or higher than 9.5, or having any other corrosive property capable of causing damage or hazard to structures, equipment, biological sewage treatment processes, or personnel engaged in the operation or maintenance of the Municipal System.

g) **Radioactive Substances**

Any radioactive material except as permitted by the license issued by the Atomic Energy Control Board of Canada.

h) **Special Wastes**

Any special waste as defined in the BC *Environmental Management Act*.

i) **High Temperature Wastes**

Any materials that, when reacting with water, will create heat which will interfere with the operation and maintenance of the Municipal System or exceed a temperature of 65°Celsius.

j) **Trucked Wastes**

Any material from a cesspool, septic tank, or sewage holding tank, including those in recreational vehicles, or any trucked wastes, except those as approved by the MoO.

k) **Dyes**

Any dyes except those approved by Public Works or where permission has been granted by the MoO.

l) **Obstructive Wastes**

i) any substance which may solidify or become discernibly viscous at temperatures above 0°Celsius;

ii) any substance which will solidify or become discernibly viscous when it reacts with water;

iii) any garbage except comminuted foodstuffs having particles no greater than 7.0mm in any dimension, such as handled by kitchen garbage disposals;

iv) any solid or viscous substance capable of obstructing sanitary sewage flow or interfering with the proper operation of the Municipal System;

v) any waters, sewage or wastes containing dissolved suspended solids of more than 500parts per million by weight of TSS, so that any abnormal attention or expense would be required in the treatment of such sewage;

vi) any waters, sewage or wastes having BOD count greater than 500parts per million by weight; and

vii) any sludge or deposit contained in septic system tanks.

5. Accidental Discharges from Private Connections

Every person responsible for the accidental discharge of prohibited substances into a Private Connection or the Municipal System must immediately report the discharge to the MoO in order that the necessary precautions can be taken to minimize the deleterious effects of the discharge.

6. Blockages

a) The Private Connection shall be maintained by the Owner at his sole expense. Where any Private Connection or the Municipal System becomes stopped or otherwise fails to function, the Owner shall contact the MoO who shall determine where the stoppage or blockage is located:

i) If the stoppage or failure is found on private property, the Owner is responsible for the repair; or

ii) If the stoppage or failure is located outside Private Connection, the MoO will, as soon as practicable, arrange to the Municipal System restored to serviceable condition.

b) Where any stoppage or failure is found to exist within the Municipal System and the stoppage or other failure is found to have been caused by the act or neglect of the an Owner, all costs incurred by the Village in restoring service to the Municipal System shall be paid by said Owner. The amount invoiced shall be paid upon demand and if unpaid on December 31st of December of the year in which such work is done, shall be deemed to be taxes in arrears on the property concerned and shall be dealt with in the same manner as ordinary municipal taxes upon land in accordance with the applicable provisions of the *Community Charter*.

7. Right of Entry to Private Property

a) Access to private property, at all reasonable times, must be permitted to any person authorized to administer this Bylaw, to enter into and inspect the Private Connection. Where possible, 24hours notice shall be given in accordance with the *Community Charter.*

b) Any person interfering with or obstructing the entry of the authorized person after that person has identified himself, must be deemed to be guilty of an infraction of this Bylaw and is liable to the penalties in this Bylaw.

c) Any person authorized to administer this Bylaw may remove any material or thing that obstructs or impedes access to the Municipal System and the expense of such removal must be charged to and paid by the person responsible for the obstruction or the Owner of the property serviced.

PART C <u>INDUSTRIAL and COMMERCIAL WASTEWATER</u>

1. Standards for Industrial and Commercial Wastewater

a) Where an Owner wishes to:

i) connect an industrial or commercial premises to the Municipal System; or

ii) alter or expand an industrial or commercial premises which is connected to the Municipal System; or

iii) intends to expand an industrial or commercial activity so that the quantity, biochemical oxygen demand, total suspended solids, or grease concentration in the wastewater will be increased;

he shall supply to the MoO, plans and reports certified by an Engineer indicating:

iv) the proposed or existing development or addition;

v) the daily volumes and peak discharges;

vi) the type of waste to be processed or discharged;

vii) the anticipated increased BOD, TSS, and/or grease;

viii) the pH factor and temperature of the wastewater;

ix) toxic chemicals contained in the wastewater;

x) the proposed pretreatment;

xi) flow equalizing or mixing facilities;

xii) the location of sampling manhole;

xiii) the monitoring equipment; and

xiv) any other information deemed necessary by the Village.

b) An Engineer may recommend to the Village to waive the requirement for any or all of the information required in Part C 1(iv)to(xiv), if it is believed that due to the nature of the application, a decision can be made on the proposed works without any of the above information.

2. Volume Control

a) Where wastewater is discharged into the Municipal System in volumes which are highly variable or unusual, the Owner shall ensure that discharges do not exceed the limits on flow volumes set by the Engineer or the Village at installation of the connection.

b) Equipment necessary to comply with Part C 2(a) above shall be provided, maintained and operated by the Owner of such premises in a manner satisfactory to the MoO.

c) If the MoO believes that the Municipal System or any portion thereof has insufficient capacity to handle existing or proposed wastewater from a Private Connection, an Engineer shall be required to determine and certify that the amount of flow which can be discharged into the Municipal System, can be limited by satisfactory means.

3. Rate of Discharge

The rate or rates of discharge for various times of a 24hour period for any industry connected to the Municipal System shall not exceed the extra capacity of the Municipal System after all the other regular users have been accommodated. Such industries shall install and maintain on their own properties, such holding facilities, pumps, valves, flow regulating, and measuring devices as may be required by their Engineer and the MoO to ensure that the specified flow rates shall not be exceeded.

4. Special Control Manholes

a) Any property discharging industrial wastewater to the Municipal System shall have installed a control manhole suitable for the inspection and sampling of the discharged wastes.

b) Any design and location of the control manhole shall be carried out by an Engineer and approved by the MoO.

c) The control manhole shall be installed and maintained at the sole expense of the Owner of the property for which is serves and shall be accessible at all times to the MoO.

d) All industrial wastewater to be discharged to Municipal System shall first pass through the control manholes.

e) Where installation of a control manhole is not possible, an alternative device or facility may be substituted if approved by the MoO.

5. Monitoring of Wastewater

a) Should any testing of wastewater show that it is not in compliance with this Bylaw, the MoO may direct the Owner to so comply with the Bylaw and may, in addition, direct the Owner at his expense to install such automatic monitoring and recording equipment as the MoO deems necessary and shall supply the results of such monitoring to him.

b) All tests, measurements, analysis and examination of wastewater, its characteristics or contents shall be carried out in accordance with "Standard Methods"[2].

6. Control of Waste Disposal

a) The MoO may require a person who intends to dispose of wastes of liquid, semi-liquid or solid nature to show proof that these wastes are being stored and subsequently disposed of in a place and manner which is acceptable to him. The information must also include method of packaging, storing and transporting.

b) The MoO may require a person to provide an analysis, prepared by an Engineer, of the waste referred to in Part C section 6(a) above.

7. Pre-Treatment of Wastewater

a) Any wastewater from an industrial and commercial property which may damage or increase maintenance costs or detrimentally affect the Municipal System, or contaminate surface or subsurface waters, shall be pre-treated to render them innocuous prior to discharge into the Municipal System.

---

[2] **Standard Methods for the Examination of Water and Wastewater** prepared and published jointly by the American Public Health Association (APHA); American Water Works Association (AWWA), and the Water Environment Federation (WEF).

b) Discharges of liquid wastes exceeding the strength, nature, quantity or quality permitted by this Bylaw, shall be treated in a facility designed, constructed and operated by an Engineer so as to fulfill all of the requirements of this Bylaw and any other agency having jurisdiction.

c) All details of the facility design pertaining to the treatment process(es), capacity, location, materials, equipment, methods of construction and all operational procedures and methods of process control of treatment facilities shall be approved by the MoO before any portion of such facilities is installed.

d) All treatment facilities must be kept clear of obstructions so as to provide immediate access for inspection by the MoO.

PART D MUNICIPAL SYSTEM EXTENSIONS

1. Application for Extension

Where an application for a Private Connection has been made and cannot be provided unless the Municipal System is extension, that extension works must be installed under the following conditions:

a) Payment of fees as required in Schedule A;

b) Where two or more applications are received, the total cost applicable shall be divided pro rata among the applicants;

c) Where the extension is to be constructed in a public road right-of-way by a contractor shall apply for a *Permit to do Works within a Public Right-of-Way* in accordance with the Subdivision and Development Bylaw No. 948, 2012.

2. Design Guidelines and Construction Specifications

All works built in the Village right-of-ways shall be designed and built in accordance with the MMCD design guidelines.

PART F ENACTMENT

READ A FIRST TIME THIS	**10TH**	**DAY OF**	**AUGUST,**	**2015.**
READ A SECOND TIME THIS	**10TH**	**DAY OF**	**AUGUST,**	**2015.**
READ A THIRD TIME THIS	**10TH**	**DAY OF**	**AUGUST,**	**2015.**
ADOPTED THIS	**14TH**	**DAY OF**	**SEPTEMBER,**	**2015.**

Mayor

Corporate Officer

Schedule A

1. Private Connections

The fee for any Private Connections is as follows:

Connection Size	Private Connection Fee[3]		
	Base Rate	Plus Administration Fee	Total
100mm (4inch)	$1,500*	$100	$1,600
150mm (6inch)	$1,700*	$100	$1,800
200mm(8inch)	$1,900*	$100	$2,100
*This rate includes the inspection chamber, service pipe, equipment and labour to install.			
Larger than 200mm(8inch)	The Greater Amount of:		
	the estimated cost of the works[4] times 125%, plus $100 administration fee.		
	OR		
	$1,500 plus a $100 administration fee.		
Refund	If an application for a private connection has been made which includes the fees and the private connection cannot be completed, a refund of the amount paid less the Administration Fee shall be reimbursed to the person who paid it		

2. Extension Fee

The fee for extending the municipal service will be as follows:

Connection Size	Extension Fee
All	The Greater Amount of:
	the estimated cost of the works[4] times 125%, plus $100 administration fee.
	OR
	$1,500 plus a $100 administration fee

[3] Where the municipal system has been extended or improved by a GRANT which includes connections the fee would not be applicable.

[4] The Owners will be required to pay in advance, the estimated cost which is calculated to be the estimated cost of the works. The estimate will be established considering the rates uniform with those charged to other projects with the Village and includes labour, equipment, materials, and any other cost of any probable service arising during the course of construction. The fee paid will form the account for the works project. Staff will maintain an accounting of charges for these works (all be consistent with municipal accounting procedures) which will be provided to the Owner upon completion/termination of the project. Any surplus funds less the minimum charge of $1,500 will be returned to the Owner.

Schedule A

4. Inspection Fee

One inspection by the MoO is required prior to connection to the Municipal System and the cost of this inspection is included in the connection fee paid pursuant to section (1) above however, if subsequent additional inspections are required, the following fee will be paid prior to the each inspection being carried out:

	During Normal Working Hours	Outside Normal Working Hours
Each additional inspection	$50	$173

5. Decommissioning of On-site Septic System Performance Security

The Security that shall be given to the Village for the decommissioning of an On-site Wastewater Treatment System will be $2,500.

7. Upgrade Fee

If an Owner is upgrading, altering, modifying, relocating, or repairing an existing Private Connection or internal system and upgrades to current standards are required, the Owner must pay for the required works (materials, labour, and equipment), at the time of the Plumbing Permit application. The fee for will be the greater amount of: the estimated cost of the works[4] times 125%, plus $100 administration fee; OR $1,500 plus a $100 administration fee.

8. Abandonment Fee

The fee for disconnection of an abandoned Private Connection will be as follows:

Connection Size	Connection Fee
All sizes	The Greater Amount of:
	the estimated cost of the works[4] times 125%, plus $100 administration fee. [I]
	OR
	$1,500 which is the minimum fee for all works and plus a $100 administration fee

APPENDIX L
MUNICIPAL STORMWATER SYSTEM REGULATION AND FEES BYLAW NO. 1024, 2015

STATUS

TITLE:	Municipal Stormwater System Regulation and Fees Bylaw No. 1024, 2015
APPLICANT:	Village of Cumberland
PURPOSE:	A Bylaw to regulate the connection, use, and extension to the municipal stormwater system and to impose fees for associated services.

COUNCIL:	**Date:**	August 10, 2015
	Decision:	1st, 2nd, and 3rd readings
COUNCIL:	**Date:**	September 14, 2015
	Decision:	Adoption

CORPORATION OF THE VILLAGE OF CUMBERLAND

BYLAW NO. 1024

A Bylaw to regulate the connection, use, and extension of the Municipal Stormwater System and to impose fees for those and associated services.

The Council of the Corporation of the Village of Cumberland, enacts as follows:

PART A ADMINISTRATION

1. Title

This Bylaw may be cited as the 'Municipal Stormwater System Regulation and Fees Bylaw No. 1024, 2015.'

2. Administration

The Chief Administrative Officer, Corporate Officer, Protective Services Manager, Manager of Operations or his designate, Municipal Engineer, and Building Official, are appointed by Council to administer this Bylaw.

3. Applicability

a) This Bylaw must be applicable to all land within the municipal boundaries of the Corporation of the Village of Cumberland.

b) For the purpose of this Bylaw, the attached Schedule A referred to herein is attached to and forms an integral part of this Bylaw.

4. Definitions

For the purpose of this Bylaw, the following definitions apply. The context meaning of terms contained in this Bylaw and not defined herein, are to be determined in accordance with firstly, the *British Columbia Building Code 2012*, secondly, this Bylaw, thirdly in the Corporation of the *Zoning Bylaw No. 717, 1997*, and then in the Canadian Oxford dictionary.

BUILDING OFFICIAL	means the person employed or contracted by the Village to administer the Corporation of the Building Bylaw No. 949, 2011 and the BC Building Code.
BCBC	means the *British Columbia Building Code 2012* as adopted by the Minister pursuant to the *Local Government Act* which includes the BCBC.
CISTERN	means for the purpose of this Bylaw, a rainwater storage tank with 1,200litre minimum capacity that allows rainwater to be used for outside irrigation purposes only, connected to an infiltration gallery with an overflow into the Municipal System. A cistern can be above ground, elevated above ground, or below ground.

IMPROVED PROPERTY	means real property on which one or more structures have been built for either residential or business use, or a combination of both.
MoO	the person appointed by Council to carry out the duties of this position, this may include his designate.
MMCD	means the Master Municipal Construction Documents prepared under the auspices of the Master Municipal Construction Document Association which is an association of the BC municipalities, regional districts, contractors and consultants.
MUNICIPAL SYSTEM	means, for the purposes of this Bylaw, a network of collection and conveyance facilities in a separate underground system specifically for transporting stormwater from the source point to treatment or disposal.
OWNER	means a person registered in the land registry records as Owner of land or of a charge on land, whether entitled to it in his own right or in a representative capacity.
PRIVATE CONNECTION	means all the fittings and appurtenances (i.e an inspection chamber or clean out) in the area between the building that is served by and where it is linked to the Municipal System.
INFILTRATION GALLERY	means a covered trench or hole filled with rocks that is fed directly from the rainwater leaders with an overflow into the Municipal System.
STORMWATER	means water resulting from or following rainfall or snowfall but not containing wastewater.
WASTEWATER	means the water-borne wastes containing fecal matter and urine from domestic or industrial sources but does not include rainwater, groundwater, or drainage of uncontaminated water.
WORKING HOURS	means those hours between 7:30am to 3:30pm, Monday through Friday except for statutory holidays.

5. Offences & Penalties

a) Every person who violates any of the provisions of this Bylaw or who suffers or permits any act or thing to be done in contravention or in violation of any of the provisions of this Bylaw, or who neglects to do or refrains from doing anything required to be done by any of the provisions of this Bylaw or who does any act which violates any of the provisions of this Bylaw is guilty of an offence against this Bylaw and liable to the penalties hereby imposed.

b) Each day that a violation is permitted to exist must constitute a separate offence.

c) Every person who commits an offence of a continuing nature is liable to a fine not exceeding $10,000 for each day such offence is continued.

d) Offences and penalties shall not contravene the *Environmental Management Act*.

e) **Recovery of Costs for Damage to the Municipal System**

i) Where any person contravenes any provision of this Bylaw and thereby causes damage to the municipal system, such person shall be liable to the Village for all costs incurred in making repairs or taking remedial action.

ii) If such costs are not paid forthwith after demand, the Village may recover the same by action in any court of competent jurisdiction.

6. Repeal

The 'Corporation of the Village of Cumberland Service Connection and Fees Bylaw No. 848, 2007' is hereby repealed upon adoption of this Bylaw.

PART B PRIVATE CONNECTION

1. Application for Private Connections

a) The MoO is authorized to prescribe the form of application for:

i) the connection to the Municipal System;

ii) to alter or repair a Private Connection;

iii) to abandon a Private Connection.

b) Prior to connection to the Municipal System, the Owner must:

i) make application for a connection on the prescribed form; and

ii) make full payment of fees as prescribed in the Schedule A attached hereto and forming part of this Bylaw. The fees do not include any required works on private property.

c) If an application for a Private Connection is denied, the Owner shall be so informed, the reasons for denial given, and the applicable refund in accordance with Schedule A shall be made.

d) Outstanding fees in relation to this Bylaw not paid on or before December 31st in any year must be deemed to be taxes in arrears on the lot served by the Private Connection.

e) The Private Connection will be installed at the location requested by the Owner wherever possible. In the event the Owner's preferred location is not practicable as determined by the MoO, the MoO will determine the location of the Private Connection.

f) No person, other than the Village, its employees or its contractors shall install, alter or remove or cause to be installed, altered or removed, any part of a Private Connection without written approval from the MoO.

g) There shall be only one Private Connection provided for each legal lot[11], however where a parcel of land can be subdivided as permitted by Bylaw or a hardship exists as determined by the MoO, an Owner may be granted a second Private Connection. The cost of each Private Connection will be payable by the Owner as set out in Schedule A of this Bylaw.

h) Except as provided elsewhere in this Bylaw, the standards for any Private Connection to the Municipal System, and for the repair or alteration of any Private Connection shall be as required by the BCBC.

2. Compulsory Private Connections

a) Where an improved property abuts a street newly serviced by the Municipal System, a Private Connection must be installed and the property must utilize the Municipal System within one year of the Municipal System being made available. The applicable fee must be recovered from the Owner as set out in Schedule A of this Bylaw.

b) Where a development has been designed by an Engineer to retain and manage as much stormwater on site as possible, the overflow or outlet must be connected to the Municipal System where available.

c) Where street surface improvements are scheduled by the Village, a Private Connection will be installed to any property abutting said street not already serviced, regardless of whether the lot is improved. The applicable fees for the Private Connection shall be payable by the Owner as set out in Schedule A of this Bylaw.

3. Standards for Private Connections

a) The standards for installation, repair, or alteration of any Private Connection are as required by the BCBC, except as provided elsewhere in this Bylaw.

b) The minimum size of the Private Connection that supplies any building or parcel shall be determined by the BCBC and approved by the Village.

c) The Village undertakes no duty of care to ensure that the capacity of that connection is sufficient for the current uses or future development of a lot, by approving a Private Connection under this Bylaw.

d) All works must be designed and built in accordance with the BCBC. The Private Connection must be installed with sufficient depth to provide natural drainage from the lowest floor of any building or structure except where natural drainage is impractical due to the relative elevation of the Private Connection at the

[1] Lot refers to those subdivided in fee simple only. Connections to those properties subdivided under the *Strata Property Act* or *Residential Tenancy Act* will be required and made to the edge of the parent lot

connection to the Municipal System and the lowest floor of the building or structure. Where the elevation cannot be met, the required lift station/equipment must be installed at the Owner's expense.

e) All requirements of this Bylaw for the installation of a Private Connection must be met before MoO completes the connection to the Municipal System.

4. Abandonment

When a building on a lot serviced by the Municipal System is abandoned or demolished, the MoO may require the disconnection of the Private Connection and the cost shall be recovered from the Owner as set out in Schedule A of this Bylaw.

PART C GREEN ALTERNATIVES

1. Infiltration Gallery

In an effort to maintain pre-development groundwater flow regimes, stormwater should be infiltrated as close as practicable to the initial source.

a) New Development

i) The Village requires infiltration galleries (where feasible) to be constructed and connected to roof leaders and perimeter drains in new subdivision and new building development.

ii) The design of the infiltration gallery shall be designed and certified by an Engineer.

iii) Overflows from the infiltration galleries will be connected to the municipal stormwater system (where available) or if unavailable to an adjacent ditch. If no ditch is available, the Engineer will design a suitable overflow scheme.

iv) The Building Inspector will consider other methods of rainwater harvesting provided that the design and installation are certified by an Engineer.

b) Upgrading Existing Development

i) The Village encourages infiltration galleries to be connected to roof leaders and perimeter drains where possible where significant re-development of a property is taking place.

ii) The design of the infiltration gallery shall be designed and certified by an Engineer.

iii) Overflows from the infiltration galleries will be connected to the municipal stormwater system (where available) or if unavailable to an adjacent ditch. If no ditch is available, the Engineer will design a suitable overflow scheme.

iv) The Village encourages other methods of rainwater harvesting where the design and installation are certified by an Engineer.

2. Cisterns

The Village encourages the use of cisterns or other methods of rainwater harvesting to be used for collection of rainwater for use for outdoor watering only.

a) Cisterns used as Part of Stormwater System as required by the BCBC:

i) The cistern system will include an infiltration gallery (rock pit or trench) in order to ensure that unused rainwater is returned to groundwater regime.

ii) The overflow from the cistern will be connected to infiltration gallery and the infiltration gallery overflow is connected to the municipal stormwater system (where available) or if unavailable to an adjacent ditch. If no ditch is available, the Engineer will design a suitable overflow scheme.

iii) The design of the cistern, infiltration gallery, and system to use the water shall be designed and certified by an Engineer.

b) Cisterns to be connected to Secondary Rainwater Capture System:

The Village encourages that these systems be designed by an Engineer.

PART D USE OF MUNICIPAL SYSTEM

1. Prohibitions

a) No person must connect or attempt to connect, or allow to be connected, or allow to remain connected to the Municipal System of any property or premises, otherwise than in accordance with the provisions of this Bylaw.

b) Unless authorized by the Village, a person must not:

i) use, change, tamper, connect to, obstruct, destroy damage or in any manner interfere with the Municipal System or any part of thereof;

ii) obstruct, at any time or in any manner, the access to the Municipal System;

iii) connect, cause to be connected, or allow to remain connected to the Municipal System any piping, fixture, fitting, container or appliance which may cause disturbance which may, in the opinion of the Village, result in annoyance to any other customer, damage to any Private Connection or to the Municipal System;

iv) permit the introduction of any contaminant or foreign matter whatsoever into the Municipal System.

c) The prohibitions under sections Part C(1)(a) & (b) do not apply to:

i) the employees, agents or contractors of the Village when carrying out approved works on the Municipal System; and

ii) the use of the Municipal System for emergency purposes.

2. Prohibited Discharges

a) No person must place or discharge or cause to be placed or discharged into the Municipal System any of the following:

i) Waters discharged from a swimming pool or hot tub, as well as any effluent from pool filters, back washing, and skimmers.

ii) Explosive and Flammable Substances

1) any flammable or explosive liquid, solid or gas including but not limited to gasoline, benzene, naphtha, alcohol and propane;

2) any substance that is water reactive or by interaction with other wastes will cause an explosion, generate flammable gases or support combustion.

iii) Poisonous and Infectious Substances

1) any water or waste containing a toxic, poisonous or infectious substance in sufficient quantity to injure or constitute a hazard to humans or animals, or to create any hazard to the receiving waters of the storm drainage system;

2) any pesticides, herbicides or fungicides.

iv) Corrosive and Noxious Substances

any gases, liquids, or solids including but not limited to corrosive, noxious or malodorous materials which either by themselves or by interaction with other wastes are capable of:

1) creating a public nuisance;

2) causing a hazard to life or damage to property or the environment;

3) any radioactive material except within such limits as are permitted by the license issued by the Atomic Energy Control Board of Canada;

4) any special waste as defined in the British Columbia *Environmental Management Act*.

v) High Temperature Wastes

any material that will react with water that will create heat at a temperature at or higher than 65°Celsius.

vii) Trucked Wastes

any material from a cesspool, septic tank or sewage holding tank, including those in recreational vehicles, or any trucked wastes.

viii) Dyes

any dyes except those approved by the MoO or where permission has been granted by the Village.

ix) Obstructive Wastes

1) any substance which may solidify or become discernibly viscous at temperatures above 0°Celsius;

2) any substance which will solidify or become discernibly viscous when it reacts with water.

3. Oil & Grit Interceptors for Stormwater from Multi-family, Commercial, and Institutional, & Industrial Properties

a) Oil and grit interceptors are required for the removal of sediment and oils contained in stormwater discharged from parking areas, driveways for all multi-family, commercial, institutional, and industrial properties.

c) All oil and grit interceptors must be designed and certified for their intended purpose by an Engineer and installed, inspected, and maintained according to his instructions at the Owner's expense. Records of installation, annual inspection, and all maintenance must be made available to the MoO upon request.

b) Oil and grit interceptors must be so located as to be readily and easily accessible for cleaning and inspection.

d) Discharges from certified functioning oil and grit interceptors may be discharged into the Municipal System, ditch or approved natural outlet or watercourse.

4. Accidental Discharges from Private Connections

Every person responsible for the accidental discharge of prohibited substances into a Private Connection or the Municipal System must immediately report the discharge to the MoO in order that the necessary precautions can be taken to minimize the deleterious effects of the discharge.

5. Private Connection Disconnection

a) Council may, within 48hours of a sending a written notice to the Owner, disconnect a Private Connection where the discharge is or has the potential to:

i) be hazardous or creates an immediate danger to any person, or

ii) endanger or interfere with the operation of the Municipal System; or

iii) be a risk to public health and safety.

b) The costs incurred in section 5(a) above shall be in addition to and not in substitution for any fine or other penalty to which the Owner of the building may be subject pursuant to the provisions in this Bylaw or any other statute or regulation.

c) The Private Connection must not be reconnected until the applicable costs, charges and fines have paid.

6. Notice Given

Notice in writing required to be given by the Village shall be considered as sufficiently given if sent by registered mail or hand delivered to the Owner at the address shown on the last revised Assessment Roll of the Village.

7. Appeal to Council

An Owner who has received disconnection notice under section 5 of this Bylaw may, by written notice delivered to the Village within 14days of receipt of the notice of disconnection, request that Council reconsider the implementation of the notice.

8. Private Connection Restoration

a) Where a Private Connection has been disconnected in accordance with this Bylaw, such service must not be reconnected until the Owner has:

i) paid to the Village outstanding fees or charges owing relating to the provision of the connection pursuant to the Bylaws of the Village; and

ii) paid to the Village any additional costs incurred by the Village in order to prevent the continued discharge after the connection was disconnected; and

iii) installed, repaired, rectified any outstanding issues leading to the disconnection to the satisfaction of the MoO.

b) The costs incurred in section 8(a) above shall be in addition to and not in substitution for any fine or other penalty to which the Owner of the premises in question may be subject pursuant to the provisions in this Bylaw or any other statute or regulation.

7. Right of Entry to Private Property

a) Access to private property, at all reasonable times, must be permitted to any person authorized to administer this Bylaw, to enter into and inspect the Private Connection. Where possible, 24hours notice shall be given in accordance with the *Community Charter.*

b) Any person interfering with or obstructing the entry of the authorized person after that person has identified himself, must be deemed to be guilty of an infraction of this Bylaw and is liable to the penalties in this Bylaw.

c) Any person authorized to administer this Bylaw may remove any material or thing that obstructs or impedes access to the Municipal System and the expense of such removal must be charged to and paid by the person responsible for the obstruction or the Owner of the property serviced.

PART D – MUNICIPAL SYSTEM EXTENSIONS

1. Application for Extension

Where an application for a Private Connection has been made and cannot be provided unless the Municipal System is extension, that extension works must be installed under the following conditions:

a) Payment of fees as required in Schedule A;

b) Where two or more applications are received, the total cost applicable shall be divided pro rata among the applicants;

c) Where the extension is to be constructed in a public road right-of-way by a contractor shall apply for a *Permit to do Works within a Public Right-of-Way* in accordance with the Subdivision and Development Bylaw No. 948, 2012.

2. Design Guidelines and Construction Specifications

All works built in the Village right-of-ways shall be designed and built in accordance with the MMCD design guidelines.

PART D – ENACTMENT

READ A FIRST TIME THIS	**10TH**	**DAY OF**	**AUGUST,**	**2015.**
READ A SECOND TIME THIS	**10TH**	**DAY OF**	**AUGUST,**	**2015.**
READ A THIRD TIME THIS	**10TH**	**DAY OF**	**AUGUST,**	**2015.**
ADOPTED THIS	**14TH**	**DAY OF**	**SEPTEMBER,**	**2015.**

Mayor

Corporate Officer

Schedule A

1. Private Connections

The fee for any Private Connection is as follows:

Connection Size	Private Connection Fee[22]		
	Base Rate	Plus Administration Fee	Total
100mm (4inch)	$1,500*	$100	$1,600
150mm (6inch)	$1,700*	$100	$1,800
200mm(8inch)	$1,900*	$100	$2,000
*This rate includes the inspection chamber, service pipe, equipment and labour to install.			
Larger than 50mm (2inch)	The Greater Amount of:		
	the estimated cost of the works[3] times 125%, plus $100 administration fee.		
	OR		
	$1,500 plus a $100 administration fee.		
Refund	If an application for a private connection has been made which includes the fees and the private connection cannot be completed, a refund of the amount paid less the Administration Fee shall be reimbursed to the person who paid it.		

2. Extension Fee

The fee for extending the Municipal System will be as follows:

Connection Size	Extension Fee
All	The Greater Amount of:
	the estimated cost of the works[3] times 125%, plus $100 administration fee.
	OR
	$1,500 plus a $100 administration fee

2 Where the municipal system has been extended or improved by a GRANT which includes connections the fee would not be applicable.

3 *The Owners will be required to pay in advance, the estimated cost which is calculated to be the estimated cost of the works. The estimate will be established considering the rates uniform with those charged to other projects with the Village and includes labour, equipment, materials, and any other cost of any probable service arising during the course of construction. The fee paid will form the account for the works project. Staff will maintain an accounting of charges for these works (all be consistent with municipal accounting procedures) which will be provided to the Owner upon completion/termination of the project. Any surplus funds less the minimum charge of $1,500 will be returned to the Owner*

3. Inspection Fee

One inspection by the MoO is required prior to connection to the Municipal System and the cost of this inspection is included in the connection fee paid pursuant to section (1) above however, if subsequent additional inspections are required, the following fee will be paid prior to the each inspection being carried out:

	During Normal Working Hours	Outside Normal Working Hours
Each additional inspection	$50	$173

4. Upgrade Fee

If an Owner is upgrading, altering, modifying, relocating, or repairing an existing Private Connection or internal system and upgrades to current standards are required, the Owner must pay for the required works (materials, labour, and equipment), at the time of the Plumbing Permit application. The fee for will be the greater amount of: the estimated cost of the works[3] times 125%, plus $100 administration fee; OR $1,500 plus a $100 administration fee.

5. Abandonment Fee

The fee for disconnection of an abandoned Private Connection will be as follows:

Connection Size	Connection Fee
All sizes	The Greater Amount of:
	the estimated cost of the works[3] times 1.25%, plus a $100 administration fee.
	OR
	$1,500 which is the minimum fee for all works plus a $100 administration fee.

APPENDIX M
WATER CONSERVATION BYLAW NO. 807

CORPORATION OF THE VILLAGE OF CUMBERLAND

BYLAW NO. 807

WATER CONSERVATION BYLAW

WHEREAS under Section 8 of the Community Charter a municipality may regulate in relation to a service;

NOW, THEREFORE, the Council of the Village of Cumberland follows:

1. **Definitions**

In this bylaw:

"Appliance" means a device or mechanism, other than that owned and operated by the Municipality in or through which Water is piped or used for a domestic or commercial purpose.

"Council" means Council of the Village of Cumberland.

"Boat" means a vessel propelled on water by an engine, oars or sails.

"Boulevard" means that portion of any highway other than the paved, improved or main traveled roadway, driveway or sidewalk and includes any landscaped median.

"Bylaw Enforcement Officer" means a person appointed or contracted by the Council to enforce this bylaw.

"Council" means the Council of the Village of Cumberland.

"CAO" means the Chief Administrative Officer of the Village of Cumberland.

"Exempted Person" means an Owner or Occupier of property identified in Schedule "A" as exempt from one or more of the regulations under this bylaw.

"Farm" means a parcel of land classified as farmland for assessment and taxation purposes.

"Fill" means to fill completely with Water.

"Micro-irrigation or Drip-irrigation System" means a system using irrigation components which consume less than 20 gallons per hour and operate at less than 25 psi to deliver Water to the root zone of the plant material being irrigated, and includes spray emitter systems (Micro-Sprays), point source emitters and linear tape systems as defined in the BC Trickle Manual prepared and published by the BC Ministry of Agriculture and Food, Resource Management Branch (issue 1999), but does not include weeper or soaker hoses.

"Municipality" means the Village of Cumberland.

"Newspaper" has the same meaning as in the *Local Government Act.*

"Notice" means a Notice given under Section 6 of this bylaw.

"Nursery" means a business in which flowers, plants, trees or shrubs are grown or displayed for sale.

" Occupier" has the same meaning as in the *Local Government Act.*

"Over-Watering" means to Water in a manner that saturates the lawn, Boulevard or landscaped area being watered and results in Water spreading onto areas beyond them.

"Owner" has the same meaning as in the *Local Government Act.*

"Permit" means a Permit issued under Section 9(1) of this bylaw.

"Public Authority" has the same meaning as defined in the *Local Government Act*.

"Restricted Hours" means those time periods during which watering is permitted in Schedule "A" of this bylaw.

"Sprinkler" means a hose connected or other sprinkler system but excludes a Micro-irrigation or Drip-irrigation system.

"Stage" means the Stages 1, 2 and 3 of Water Use Restrictions prescribed in Schedule "A" of this bylaw.

"Vehicle" means a device in, on or by which a person or thing is or may be transported or drawn on a highway.

"Village" means the Village of Cumberland.

"Water" means Water supplied by the Village directly or indirectly to an Owner or Occupier or the act of using or applying such Water.

"Water Use Restrictions" means the restrictions prescribed in Schedule "A" of this bylaw.

"Watering Days" means those days during which Watering is permitted in Schedule "A" of this bylaw.

2. Application

The restrictions and regulations in this bylaw are applicable in the Village.

3. Prohibitions

(1) The prohibitions in subsections 3(2) and 3(3) are in force at all times of the year.

(2) No person shall damage or allow the deterioration of any Appliance so as to result in a waste of Water.

(3) No person shall waste Water by using more Water than is required to provide a service, produce a product or complete a task, including but not limited to

(a) allowing a tap or hose to run Water unnecessarily, and

(b) the Over-Watering of plants or lawns.

(4) No person, being an Owner or Occupier of property in the Municipality, shall use Water or cause Water to be used contrary to the provisions of this bylaw in effect at the time of use.

4. Inspection

A Bylaw Enforcement Officer has the authority to enter at all reasonable times on any property that is subject to this bylaw to ascertain whether the requirements of this bylaw are being met or the regulations in this bylaw are being observed.

5. Effective Dates of Stages and Restrictions

(1) Stage 1 and the Water Use Restrictions for Stage 1 prescribed in Schedule "A" are in effect in each year from May 1st to September 30th both inclusive, except as provided under subsection (2).

(2) The Council, by resolution, may

(a) amend the effective period of time for Stage 1, or

(b) terminate or bring into effect a Stage more restrictive than Stage 1 at any time of the year for any period of time.

(3) The Stage determined under subsection (2) and the Water Use Restrictions prescribed under Schedule "A" for that Stage take effect on the commencement date stated in this bylaw or the Notice for that Stage and remain in effect until that Stage is terminated.

(4) A Stage will remain in effect until it is terminated by resolution or otherwise under this bylaw, or until the a commencement of another Stage.

6 Notice

(1) The CAO must give Notice or cause Notice to be given to persons within the Municipality of the applicable Stage determined under Section 5(2) and its effective dates of commencement and termination when determined by the Council.

(2) The Notice under subsection (1) must be given at least once

(a) before the commencement of the applicable Stage, and

(b) within a reasonable time after the resolution of the Council to terminate the Stage.

(3) The Notice under this section must be published in a Newspaper and broadcast from a radio station, and may also be broadcast from a television station or cable television channel serving Cumberland and posted on the municipal web site.

7 Determination Factors

In making a determination under Section 5(2), the Council may consider, but shall not be bound by, the recommendation of the CAO. The CAO's recommendation will be upon consultation with the Public Works Foreman and in consideration of estimated water usage for the remainder of the effective dates of this bylaw.

8 Water Use Restrictions

The Water Use Restrictions for each Stage are prescribed in Schedule "A" to this bylaw and must be obeyed during the period that the applicable Stage is in effect under this bylaw.

9 Permits, Exemptions and Special Cases

(1) The Village may issue Permits in the special cases and manner prescribed in Schedule "B"

(2) Exemptions and special cases to the regulations in this bylaw are prescribed in Schedule "A"

(3) Exempted Persons and Permit holders are exempted from Section 3 to the extent permitted by Schedule "A" and the conditions of the Permit where applicable.

10 Schedules

Schedules "A" and "B" of this bylaw form part of and are enforceable in the same manner as this bylaw.

11 Penalty

(1) A person who contravenes this bylaw commits an offence, is punishable in accordance with the Offence Act, and on conviction, in addition to the penalties prescribed under the Offence Act, is subject to the following minimum fines;

(a) for an offence under section 3(3) of this bylaw, a minimum fine of $100 plus costs if the offence is committed during Stage 1, $200 plus costs if the offence is committed during Stage 2, $300 plus costs if the offence is committed during Stage 3, and $100 plus costs if the offence is committed when no Stage is in effect; and

(b) for an offence under section 3(4) of this bylaw, a minimum fine of $50 plus costs for each offence under Stage 1, $75 plus costs for each offence under Stage 2, and $100 plus costs for each offence under Stage 3.

12 Effective Date

This bylaw shall take effect upon the date of its adoption.

13 Bylaw Citation

This Bylaw may be cited as "The Corporation of the Village of Cumberland Water Conservation Bylaw No. 807"

READ A FIRST TIME, this 16th day of May, 2005

READ A SECOND TIME, this 16th day of May, 2005.

READ A THIRD TIME, this 16th day of May, 2005.

ADOPTED this 6th day of June, 2005.

_____ _____

MAYOR CORPORATE ADMINISTRATOR

I hereby certify the foregoing to be a true and correct copy of Bylaw No. 807 of the Village of Cumberland, cited as the "Corporation of the Village of Cumberland Water Conservation Bylaw No. 807, 2005", as adopted by the Village Council on the 6th day of June, 2005.

_____

CORPORATE ADMINISTRATOR

SCHEDULE "A"
to Bylaw No. 807

OUTDOOR WATER USE RESTRICTION STAGES

1. STAGE 1 - TWO DAYS PER WEEK LAWN WATERING

(1) During Stage 1,

(a) no person shall use a Sprinkler to water a lawn growing on a property with

(i) an even numbered address, except on Wednesday and Saturday between the hours of 4:00 a.m. to 10:00 a.m. and 7:00 p.m. to 10:00 p.m.; and

(ii) an odd numbered address, except on Thursday and Sunday between the hours of 4:00 a.m. to 10:00 a.m. and 7:00 p.m. to 10:00 p.m.; and

(b) a person may

(i) water trees, shrubs, flowers and vegetables on any day with a Sprinkler during the prescribed hours for Stage 1 lawn watering and on any day at any time if watering is done by hand-held container or a hose equipped with a shut-off nozzle;

(ii) water newly planted trees, shrubs, flowers and vegetables by any method during installation and for the following 24 hours;

(iii) use Micro-irrigation or Drip-irrigation systems to Water trees, shrubs, flowers and vegetables at any time on any day;

(iv) under the authority of a Permit, water new sod on installation and during the first 21 days after installation, and water newly seeded lawns until growth is established or for 49 days after installation, whichever is less, but only during the prescribed Stage 1 lawn Watering hours;

(v) water all weather playing fields at any time if failure to do so will result in a permanent loss of plant material: and

(vi) wash a vehicle with Water using a hand held container or hose equipped with a shut-off nozzle and at car dealerships or commercial car washes.

(2) As exceptions to the Stage 1 restrictions,

(a) Owners or Occupiers of property who, by reason of physical or mental incapacity, are unable to water their property within the restricted days and times, may water their property on any two days of the week for a maximum of 9 hours per day;

(b) Nurseries, Farms, turf farms and tree farms are exempted from the restrictions'

(c) Public Authorities may water lawns and Boulevards on any day but no more than two days per week; and

2 STAGE 2 - ONE DAY PER WEEK LAWN WATERING

(1) During Stage 2,

(a) no person shall use a Sprinkler to water a lawn growing on a property with

(i) an even numbered address, except on Wednesday between the hours of 4:00 a.m. to 10:00 am. and 7:00 p.m. to 10:00 p.m.;

(ii) an odd numbered address, except on Thursday between the hours of 4:00 a.m. to 10:00 a.m. and 7:00 p.m. to 10:00 p.m.;

(b) no person shall use Water to wash sidewalks, driveways or parking lots, exterior windows or exterior building surfaces, except as necessary for applying a product such as paint, preservative and stucco, preparing a surface prior to paving or repointing bricks, or if required by law to comply with health or safety regulations; and

(c) a person may

(i) water trees, shrubs, flowers and vegetables on any day with a Sprinkler during the prescribed hours for Stage 2 lawn watering and on any day at any time if watering is done by hand-held container or a hose equipped with a shut-off nozzle;

(ii) water newly planted trees, shrubs, flowers and vegetables by any method during installation and for the following 24 hours;

(iii) use Micro-irrigation or Drip-irrigation systems to water trees, shrubs, flowers and vegetables at any time on any day;

(iv) water all weather playing fields at any time if failure to do so will result in a permanent loss of plant material; and

(v) wash a vehicle with using a hand held container or hose equipped with a shut-off nozzle and at car dealerships and commercial car washes.

(2) As exceptions to Stage 2 restrictions,

(a) Owners or Occupiers of property who, by reason of physical or mental incapacity, are unable to water their property within the restricted days and times, may water their property on one day per week for a maximum of 9 hours per day;

(b) Nurseries, Farms, turf farms and tree farms are exempted from the restrictions;

(c) Public Authorities may water lawns and Boulevards on any day but no more than one day per week; and

3 STAGE 3 - NO LAWN WATERING

(1) During Stage 3,

(a) no person shall

(i) water a lawn or Boulevard;

(ii) Fill a swimming pool, hot tub or garden pond;

(iii) Fill or operate a non re-circulating fountain at any time; or

(iv) wash a Vehicle or a Boat with water.

(b) a person may

(i) water trees, shrubs, flowers and vegetables on any day between the hours of 4:00 a.m. to 10:00 a.m. and 7:00 p.m. to 10:00 p.m. if watering is done by hand-held container or a hose equipped with a shut-off nozzle;

(ii) water newly planted trees, shrubs, flowers and vegetables between the hours of 4:00 a.m. to 10:00 a.m. and 7:00 p.m. to 10:00 p.m. only by hand-held container or a hose equipped with a shut-off nozzle during installation and during the following 24 hours after installation is completed;

(iii) use Micro-irrigation or Drip-irrigation systems to water trees, shrubs, flowers and vegetables on any day between the hours of 4:00 a.m. to 10:00 a.m. and 7:00 p.m. to 10:00 p.m.'

(iv) water all weather playing fields at any time, but only if failure to do so will result in a permanent loss of plant material; and

(v) use Water to wash sidewalks, driveways or parking lots, exterior windows or exterior building surfaces, but only if necessary for applying a product such as paint, preservative and stucco, preparing a surface prior to paving or repointing bricks, or if required by law to comply with health or safety regulations.

(2) As exceptions to the Stage 3 restrictions,

(a) Nurseries, Farms, turf farms and tree farms are exempted from the restrictions;

(b) wading pools may be Filled with Water; and

(c) Vehicles and Boats may be washed with Water only at car dealerships and commercial car washes using less than 57 litres of Water per Vehicle wash or 50% recirculated Water as long as the total amount of Water, excluding recirculated Water, does not exceed 57 litres per Vehicle wash.

SCHEDULE "B"
to Bylaw No. 807

PERMITS

1 During Stage 1, a person who has installed a new lawn, either newly seeded or new sod, may apply to the Village of Cumberland Municipal Office for a Permit, which will allow the new lawn to be Sprinkled with Water outside of permitted days, but within Restricted Hours. The Permit shall be conspicuously displayed at the premises for which it was issued.

2. The Village of Cumberland Municipal Office shall issue a Permit to an applicant pursuant to Section 1 upon payment to the Village of Cumberland of a fee in an amount determined by the Council.

3. New sod may be watered for 21 days after installation and newly seeded lawn may be watered until growth is established or for 49 days after installation, whichever is less, provided a Permit pursuant to Section 1 has been issued for the premises at which the new lawn has been installed.

4. Permits will not be issued or be valid during Stages 2 or 3 restrictions.

APPENDIX N
STORM WATER SYSTEM SUMMARY

Memorandum

4015 7 Street SE, Calgary AB T2G 2Y9, T: 403.254.0544 F: 403.254.9186

To:	**Village of Cumberland**	Date:	**March 20, 2025**
Attention:	**Jason Wallace**	Project No.:	**34053**
Cc:	**Paul Nash, Rob Crisfield, and Joel Clarkston**		
Reference:	**Village of Cumberland Stormwater System Summary - DRAFT**		
From:	**Joel Grieco, EIT, Sarah Barbosa, P.Eng. ENV SP**		

The 2.5 km² Village of Cumberland stormwater catchments are split over a watershed divide that traverses the center of the Village. In the north, runoff is directed through 7 catchments to outfalls that discharge into wetlands in the Maple Creek Watershed. In the south, 15 catchments drain to the South Cumberland Watershed. Eventually, all runoff from the Village discharges into the Trent River via tributary watersheds.

1.0 Existing Stormwater System

The existing drainage system in Cumberland is responsible for road drainage, conveyance of stormwater away from residences, and foundation drainage. The infrastructure comprising the drainage system is shown in **Figure 1.1 and Figure 1.2.** It contains 25 km of gravity mains, as well as 23 culverts, and ditches and swales that convey surface drainage.

Runoff is directed toward 22 main discharge points, shown in **Figure 1.3**. Mapping of the existing stormwater system catchments was conducted using a combination of GIS analysis and review of existing drainage records. Catchments were estimated by evaluating elevation data, storm sewer infrastructure, and known flow directions to illustrate flow patterns and drainage coverage. Based on the identified catchments, it is shown that the drainage system in Cumberland consists of a series of smaller piped networks, ranging from small catchments with few pipes to larger catchments with significant underground stormwater systems. The largest subcatchment carries drainage from the neighbourhood in the north of the village and discharges into the wetlands north of Cumberland sewage treatment lagoons.

Some areas within Cumberland currently lack stormwater infrastructure, leading to localized drainage issues. These gaps should be identified and addressed through infrastructure improvements. The primary areas in the village lacking stormwater systems are areas with combined sewers, where road and foundation drainage is directed to the sanitary system. The combined sewer areas are shown in red.

Figure 1.4 illustrates the broader hydrologic context of the village, including nearby watersheds, watercourses, and wetlands. The stormwater system's outfalls are indicated on this map to highlight their connection to receiving waters.

2.0 Future Drainage Considerations

Recent development has expanded the stormwater system and begun to separate combined sewers that have been historically used in Cumberland. Several developments in the last 10 years have added dedicated stormwater systems, and stormwater system development along Dunsmuir Drive in downtown Cumberland has improved local drainage capacity in the most urbanized areas of Cumberland.

In the next 20 years, the stormwater system in Cumberland will develop in two primary ways, influenced by the types of development anticipated. According to Cumberland's Official Community Plan (OCP), stormwater

management should prioritize environmental protection, flood prevention, and use integrated stormwater management practices where appropriate.

Growth in Cumberland is expected to be a combination of infill development directed at the Village Center (increasing density and impervious areas within the village boundaries) and greenfield development on the Village's western periphery, requiring new stormwater infrastructure.

As Cumberland continues to redevelop and expand, stormwater infrastructure investments should prioritize improving combined sewer separation, addressing service gaps, and integrating new development into the stormwater network. Future development in Cumberland will expand the stormwater system by continuing combined sewer separation and integrating new infrastructure. Infill development within the Village Center will introduce localized stormwater collection systems to address areas lacking adequate drainage. Meanwhile, developments on the village's periphery will be designed to tie into existing catchments, ensuring proper drainage without overwhelming the system.

The guiding principles for stormwater development in Cumberland should be as follows:

1. **Remediate combined sewer areas** by installing a minor storm system. Cumberland has a plan for separation and remediation of combined sewers. The combined sewer separation plan will connect existing weeping tiles, roof leaders and catch basins to new storm sewers to reduce inflow and infiltration (I-I) and improve overall sanitary system performance. In areas previously connected to the sewer system, the new storm sewers will extend the existing stormwater system and further develop Cumberland's stormwater system.

2. **Identify and address gaps in stormwater service,** particularly in areas lacking minor system storm infrastructure. These areas are primarily in areas serviced by combined sewers, as well as areas that primarily rely on surface drainage. For larger storm events, the major system must provide safe overland flow paths to receiving water bodies. Currently, the major overland drainage system in Cumberland is not fully mapped, and there may be areas where storm flows leave designated rights-of-way. Conducting an overland drainage analysis will help define safe flow pathways and guide roadway modifications to improve major flow conveyance—particularly in response to extreme events, such as recent atmospheric river storms.

3. **Ensure downstream stormwater system capacity is evaluated and upgraded as required** when development occurs on brownfield sites within Cumberland. The village has 4-5 primary trunk storm sewers that bring drainage from wider areas to singe outfalls. These trunks must be assessed to ensure they can accommodate future development without causing localized flooding or infrastructure failures.

4. **Development on the periphery of the village** is mainly on the west side of the catchment. Based on the topography, this will necessitate an expansion of the catchments on the north side of the village that carry drainage into the Maple Creek Watershed. The existing stormwater system has been designed to accommodate future connections in this area, which will be leveraged to extend this catchment.

To further support effective stormwater management and long-term infrastructure resilience, Cumberland is in the process of updating its 2010 Stormwater Drainage Management Plan. The updated master plan will outline the expansion of the future system to accommodate combined sewer remediation and planned development to ensure that stormwater is managed effectively to minimize flood risk and environmental impacts. By incorporating stormwater modelling and analysing various scenarios, the plan will help guide investments in stormwater capital projects, ensuring a coordinated and sustainable approach to growth and drainage management. The updated master plan will include:

- **A detailed hydraulic analysis of the stormwater system** to identify capacity constraints, potential bottlenecks, and opportunities for improvement.
- **Sizing of and further definition of combined sewer separation projects** to support more detailed cost estimates and support implementation of the proposed projects.
- **Climate change adaptation strategies** to account for increasing rainfall intensity and extreme weather events.
- **A phased implementation plan for infrastructure upgrades and expansions** based on priority areas for development and drainage improvements.

Updating the stormwater master plan will ensure that Cumberland's stormwater system evolves to support future growth while minimizing flood risk and environmental impacts.



LEGEND

- Culvert
- Outlet
- Manhole
- Open Drainage Channel

Storm Main Diameter

- 100 mm
- 150 mm
- 200 mm
- 250 mm
- 300 mm
- 375 mm
- 400 mm
- 450 mm
- 500 mm
- 525 mm
- 600 mm
- 660 mm
- 750 mm
- 900 mm
- Unknown

TITLE

STORM MAIN DIAMETER

PROJECT

LWMP PLANNING

CLIENT

VILLAGE OF CUMBERLAND

DATA SOURCES

- Topographic Map: World Imagery: Maxar

PROJECTION

NAD 1983 UTM Zone 10N

0 0.05 0.1 0.2

1:10,000 KM

FIGURE	1.1
DATE	2025-03-20
PROJECT NO.	34053
AUTHOR	

ISL

Document Path: Q:\Projects\34053_VCU_LWMP_Planning\34053_VCU_LWMP_Planning_ProProject\34053_VCU_LWMP_Planning_ProProject.aprx



LEGEND

- Outlet
- Manhole
- Open Drainage Channel

Storm Main Pipe Material

- PVC
- Asbestos Concrete
- Concrete
- Polypropylene Resin (Ultrarib)
- Steel
- Vitrified Clay
- Corrugated Metal Pipe
- HDPE
- Unknown

Culvert Material

- Corrugated Metal Pipe
- HDPE
- Steel
- Unknown

TITLE

STORM MAIN PIPE MATERIAL

PROJECT

LWMP PLANNING

CLIENT

VILLAGE OF CUMBERLAND

DATA SOURCES

- Topographic Map: World Imagery: Maxar

PROJECTION

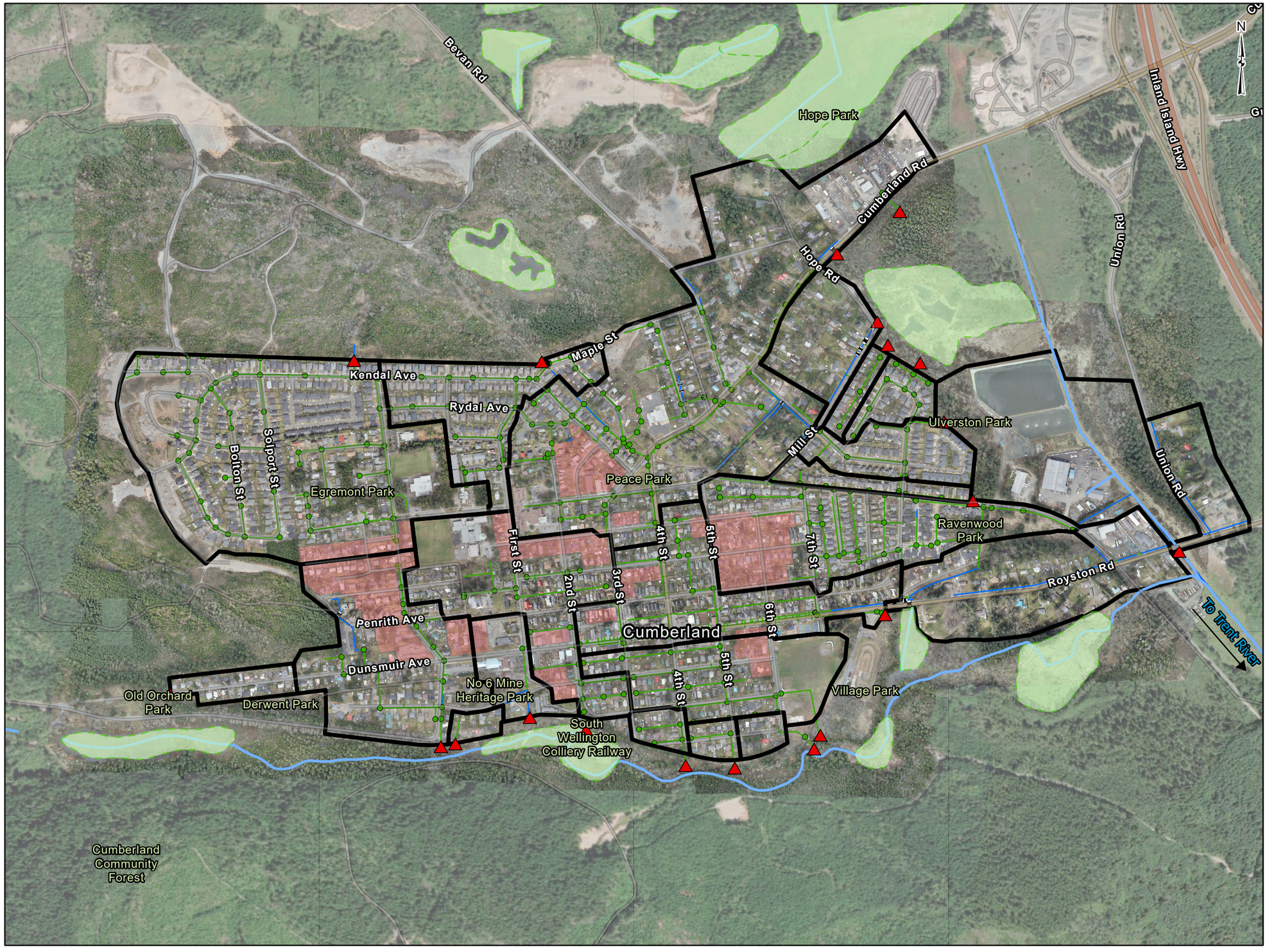
NAD 1983 UTM Zone 10N

0 0.05 0.1 0.2

1:10,000 KM

FIGURE	1.2
DATE	2025-03-20
PROJECT NO.	34053
AUTHOR	

Document Path: Q:\Projects\34053_VCU_LWMP_Planning\34053_VCU_LWMP_Planning_ProProject\34053_VCU_LWMP_Planning_ProProject.aprx



LEGEND

- Stormwater System Catchments
- Combined Sewer Areas
- Cumberland Stormwater System Outfalls
- Open Drainage Channel
- Gravity Main
- Culvert
- Storm Manhole
- Watercourse
- Wetland

TITLE

STORMWATER SYSTEM CATCHMENTS

PROJECT

LWMP PLANNING

CLIENT

VILLAGE OF CUMBERLAND

DATA SOURCES

- Topographic Map: Hybrid Reference Layer: Esri Community Maps Contributors, Esri Canada, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, US Census Bureau, USDA, NRCan, Parks Canada

PROJECTION

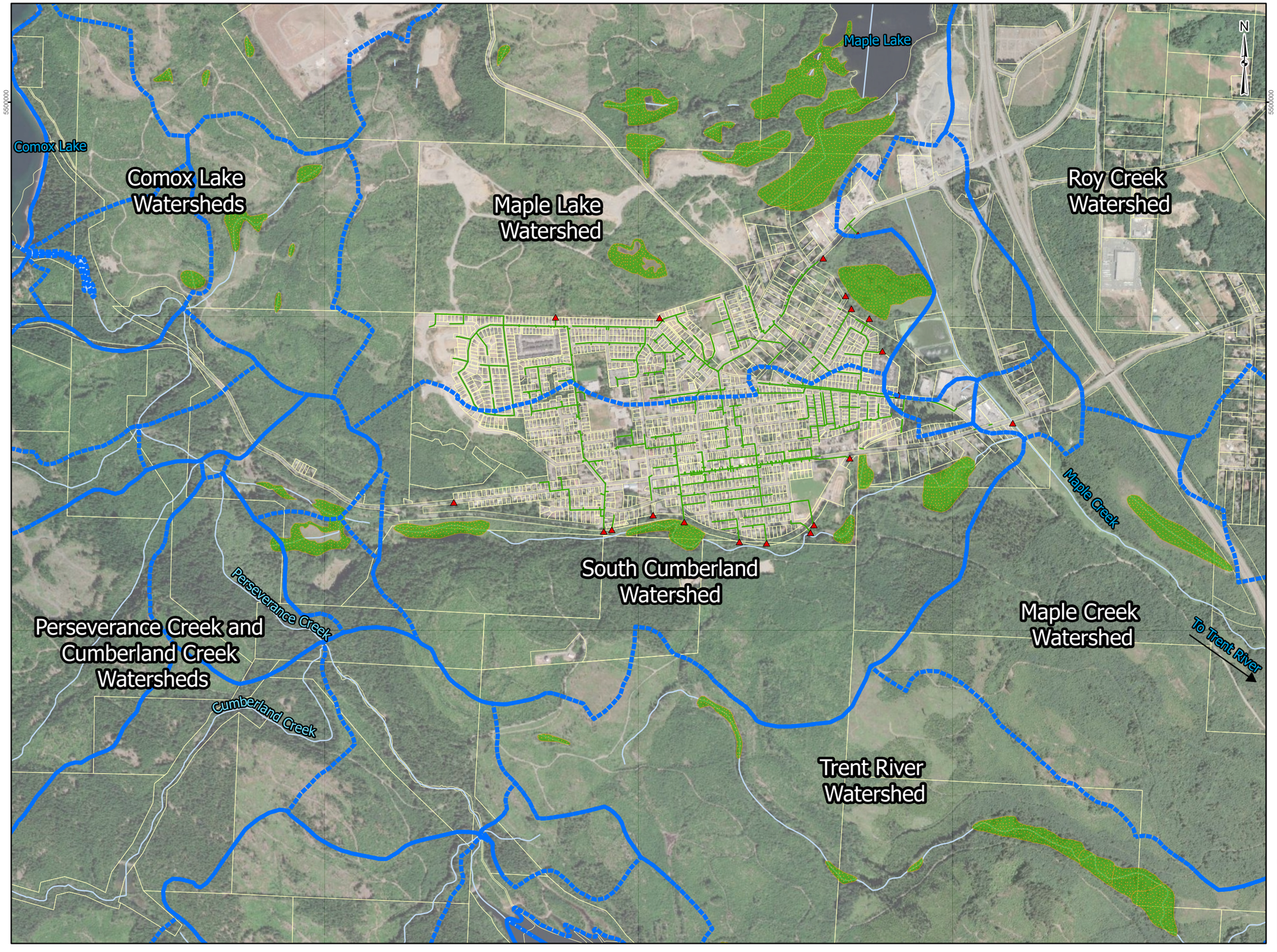
NAD 1983 UTM Zone 10N

0 0.05 0.1 0.2

1:10,000 KM

FIGURE	1.3
DATE	2025-03-20
PROJECT NO.	34053
AUTHOR	

Document Path: Q:\Projects\34053_VCU_LWMP_Planning\34053_VCU_LWMP_Planning_ProProject\34053_VCU_LWMP_Planning_ProProject.aprx



LEGEND

- Provincially Designated Watersheds
- Wetlands
- Watercourse
- Cadastre
- Cumberland Stormwater System
- Cumberland Stormwater System Outfalls

TITLE

CUMBERLAND WATERSHEDS

PROJECT

LWMP PLANNING

CLIENT

VILLAGE OF CUMBERLAND

DATA SOURCES

- Topographic Map: World Imagery: Earthstar Geographics

PROJECTION

NAD 1983 UTM Zone 10N

0 0.13 0.25 0.5

1:18,000 KM

FIGURE	1.4
DATE	2025-03-20
PROJECT NO.	34053
AUTHOR	

Document Path: Q:\Projects\34053_VCU_LWMP_Planning\34053_VCU_LWMP_Planning_ProProject\34053_VCU_LWMP_Planning_ProProject.aprx

APPENDIX O
RECEIVING ENVIRONMENT MONITORING PROGRAM

Liquid Waste Management Plan

Addendum to Enhanced Environmental Impact Study



Prepared for:

The Corporation of the Village of Cumberland
2673 Dunsmuir Avenue
Box 340 Cumberland, BC, V0R1S0

July 31, 2025

Prepared by:

Ecofish Research Ltd.

Trinity Consultants

ECOFISH RESEARCH

CANADA

1. RECEIVING ENVIRONMENT MONITORING PROGRAM

The Village of Cumberland (VOC) operates a sewer system and wastewater treatment plant (WWTP) with treated effluent discharged into Maple Lake Creek (MLC). The VOC proposes to use WWTP discharge as beneficial stream flow augmentation. An enhanced Environmental Impact Study (EIS) was developed to assess the potential associated benefits and adverse effects to surrounding wetlands, MLC, and the Trent River from effluent discharge from the upgraded WWTP (Dinn *et al.* 2025). Per the Terms of Reference (TOR) provided by the British Columbia Ministry of Environment and Parks, as part of the permitting process under the *Environmental Management Act*, the proponent is responsible for developing and implementing a science-based Receiving Environment Monitoring Program (REMP) capable of evaluating treatment performance, receiving environment condition, and potential adverse effects to the environment. This report describes the proposed REMP sampling design, methods, and reporting.

The REMP was informed by the enhanced EIS, which assessed the predicted impacts to the receiving environment after proposed upgrades are made (Dinn *et al.* 2025). The REMP will assess potential effects of WWTP effluent discharge to aquatic life and monitor the effectiveness of mitigation. This REMP is designed to evaluate effects in the receiving environment only; efficacy of the wastewater treatment on effluent quality will require end of pipe monitoring as part of the Liquid Waste Management Plan or Operations Certificate.

This REMP was developed consistent with guidance provided in the following technical documents, per the TOR:

- Guidelines for designing and implementing a water quality monitoring program in British Columbia (BC MELP 1998).
- BC Field Sampling Manual (Government of BC 2013) and the updated BC Field Sampling Manual for surface water sampling (BC ENV 2024).
- Marine Monitoring Guidance (LGL Limited and BC ENV 2019), consulted for general guidance on receiving environment monitoring.
- Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators (BC MOE 2016), for discussions of statistical power, relevant methods, and other general considerations.

1.1. Goals and Objectives

Water quality monitoring is proposed to assess the potential effects of WWTP effluent discharge on aquatic life and monitor the effectiveness of mitigation. As described in the enhanced EIS (Dinn *et al.* 2025), the combination of the WWTP upgrades, biochar media reed bed (BMRB) and natural wetland complex is anticipated to reduce concentrations of key water quality parameters of potential concern (e.g., nutrients, metals, temperature). However, there is uncertainty regarding the efficacy of wetland treatment to remove nutrients and certain parameters. This uncertainty will be

managed via adaptive management and will involve monitoring water quality, reviewing data regularly, and applying additional monitoring and/or mitigation (e.g., enhanced treatment systems, wetland restoration) if deemed necessary based on evaluating monitoring results and in consultation with regulators.

Thus, the goals of the REMP are to:

1. Verify the conclusions of the enhanced EIS that the future VOC WWTP effluent discharge is not predicted to adversely affect human health or the aquatic environment following the application of mitigation measures.
2. Monitor the effectiveness of the WWTP upgrades and constructed BMRB at removing nutrients and metals.

The monitoring questions are:

1. Does water quality meet guidelines to protect aquatic life and human health? If not, does water quality differ between the control and impact sites in the natural wetlands, MLC, and the Trent River? If so, do such differences indicate adverse effects of the WWTP effluent discharge on the receiving environment?
2. Does mitigation improve water quality between the end of pipe and downstream of the BMRB and the natural wetlands?

The monitoring objectives are:

1. Assess if measurements of the key parameters (physical, bacteriological, metals, nutrients, and chlorophyll-*a*) meet water quality guidelines and/or differ between the control sites (upstream MLC, Trent River, and natural wetlands) and impact sites (downstream MLC, Trent River, and natural wetlands).
2. Assess if the measurements of the parameters (physical, bacteriological, metals, nutrients, and chlorophyll-*a*) differ between the end of pipe and downstream end of the BMRB, and between the control site (natural wetlands) and mitigation site (at the downstream end of the BMRB and the reed canary grass wetland represented by CWC-03).

Monitoring objectives are designed to be addressed by making comparisons to water quality guidelines bi-annually, and evaluating differences between control and impact or mitigation sites after two years (as described in Section 1.7). Water quality parameters will be compared to guidelines developed to protect aquatic life, wildlife, and drinking water sources. If water quality measurements are found to exceed guidelines, then additional sampling such as biological monitoring (e.g., sediment sampling) will be considered. An assessment report will be prepared after five years that will provide a synthesis of all monitoring results to date and include recommendations regarding future monitoring.

The below subsections describe the following components of the REMP: 1) sampling design, 2) sampling methods, 3) sample handling, 4) analytical methods, 5) quality assurance/quality control (QA/QC) processes, and 6) data reporting.

1.2. Sampling Design

1.2.1. Approach

To evaluate potential effects on the wetlands, MLC, and the Trent River, a control-impact study design is prescribed, where an "impact" is assessed by statistically comparing measurements between upstream control and downstream impact sites. Mitigation efficacy will be evaluated by comparing measurements for sites at the downstream end of the BMRB and natural wetlands receiving environment with end of pipe water quality.

The REMP will involve sampling at 11 sites, comprising the four compliance monitoring sites required by Permit 197, three additional stream sites including two upstream control sites (one each on MLC and the Trent River), and four new wetland sites including two mitigation monitoring sites and one control site (Map 1).

The REMP sampling design is summarized by water quality parameter category in Table 1 and by sampling sites in Table 2.

1.2.2. Site Selection

The rationale for selecting each sampling site is described in Table 2. Site selection was informed by previous work: the enhanced EIS, which well characterizes wetlands and streams (Dinn *et al.* 2025); baseline studies (Hull *et al.* 2022); and 20 years of permit sampling (Appendix A of Dinn *et al.* 2025).

Stream sample sites are selected to ensure coverage of different ecological areas in each stream. Upper MLC (MLC-DSWQ01) represents a stream reach where less sensitive species are present (e.g., Threespine Stickleback) and therefore less sampling effort is recommended. Lower MLC (MLC-DSWQ03; permit Site 6) represents a stream reach that supports more sensitive species such as anadromous salmonids, and therefore long-term compliance monitoring is recommended at this site. The Trent River supports sensitive aquatic species and is a recreational use area. For this reason, sampling in the Trent River is designed to monitor potential impacts to both human health and aquatic life (described in detail in Table 2). Water quality at the most downstream Trent River site (TRT-DSWQ03) tends to be similar to that at TRT-DSWQ02 (permit Site 13) and therefore only two years of monitoring in the dry season are recommended at TRT-DSWQ03 to confirm that this area of the stream is represented by water quality measurements at TRT-USWQ02 (permit Site 8).

In wetlands, site locations were selected to monitor potential effects on wetlands by selecting a control site located upgradient of WWTP discharge (CWC-01), an impact site located approximately 100 m downstream of the discharge point within the assumed main flow path of WWTP discharge (CWC-03), and a second potential impact site at the edge of the sensitive bog ecosystem (CWC-05). If two years of monitoring confirms that the enhanced EIS conclusions that there will be no effects from WWTP operations on water quality or vegetation communities are accurate, then no additional sampling effort will be required. Mitigation efficacy will be monitored throughout the operational period at the end of the constructed BMRB (CWC-BMRB-01) and the reed canary grass wetland (CWC-03).

1.2.3. Parameter Selection

Based on the results of the enhanced EIS (Dinn *et al.* 2025), the water quality parameters proposed to be sampled comprise the following parameter categories: physical (e.g., pH, temperature), microbial (fecal coliforms and *E. coli*), metals, nutrients (forms of phosphorus and nitrogen), explanatory (chloride and dissolved organic carbon) and chlorophyll-*a*. The complete list and rationale for selecting water quality parameters included in the REMP are presented in Table 1. Not all parameters will be monitored at all sites during all sample events (Table 1). Other parameters of potential concern evaluated in the enhanced EIS, such as total suspended solids, turbidity, aggregate organics, total residual chlorine, legacy and emerging contaminants of concern, and hydrocarbons, are not proposed to be sampled as part of the REMP because they were either predicted with sufficiently high confidence to meet relevant guidelines or be below method detection limits in future effluent at end of pipe.

The monitoring will focus on parameters of most concern to each ecological area. Bacteriological parameters (fecal coliforms and *E. coli*) are anticipated to meet relevant guidelines at end of pipe but will be sampled at permit compliance sites only (MLC-DSWQ03, TRT-USWQ01, TRT-DSWQ01 and TRT-DSWQ02) because these parameters are indicators of potential human health hazard, and these four sites are considered representative of the most sensitive ecological areas. In addition, chlorophyll-*a* will be sampled at Trent River sites only, because the Trent River is considered most sensitive to phosphorus inputs which may increase periphyton biomass, which is measured indirectly by chlorophyll-*a*. Physical measurements, metals, and nutrients will be sampled at all sites.

At the wetland monitoring sites (CWC-01, CWC-03, and CWC-05), both water quality sampling and vegetation surveys will be completed in year one and year two of WWTP operations, at minimum. Vegetation surveys will be completed once per year during the growing season, concurrent with water quality sampling. This monitoring will evaluate if there have been any changes to the vegetation communities that could be attributed to changes in water quality and/or hydrologic conditions at the sites, and determine whether adaptive management strategies (e.g., water containment, change to flow pathways, targeted vegetation planting, etc.) are required to maintain the health of vegetation communities upstream (CWC-01) and adjacent to (CWC-05) the expected receiving environment of WWTP discharge, and/or improve water quality functioning of the BMRB and receiving wetland (CWC-01).

Only water quality sampling is proposed for the BRMB (at CWC-BMRB-01). If the water at CWC-BMRB-01 and/or CWC-03 does not meet the water quality improvements predicted in the enhanced EIS, additional sampling may be conducted at these sites and adaptive management strategies identified to improve water quality.

1.2.4. Sample Timing and Frequency

Water quality sampling will occur during both dry (May to September) and wet (October to April) weather months to account for seasonal variability. Sampling is proposed to occur monthly from May to September (during the most critical period to aquatic life and time of greater potential variability in

wetland water levels) and twice in winter (when conditions are expected to be less variable). The higher frequency of sampling proposed in May to September will ensure good temporal coverage during the growing season and ensure results can be compared to guidelines for Phosphorus Management in Vancouver Island Streams (BC MOE 2014).

The proposed frequency of monitoring varies by site and by parameter. Sites will be sampled either for two years (unless a potential effect is detected) or throughout the Operational Period. The sampling sites that can be discontinued from the REMP after two years are the sites 500 m downstream MLC (MLC-DSWQ01), 2.5 km downstream Trent River (TRT-DSWQ03), the natural wetlands control site (CWC-01), and the site at the edge of the bog (CWC-05) (Table 2). Only two years of monitoring are proposed to confirm no effect at these sites; if adverse effects are detected, additional monitoring will commence to further evaluate effects to biological receptors.

It is important to note that changes to vegetation communities can take time. If water quality data collected at the wetland control site (CWC-01) or potential impact site (CWC-05) shows no negative trend and there have been no negative changes to vegetation community after two years of monitoring, monitoring at these sites may be discontinued; however, it would be prudent to complete a water sampling and vegetation survey data collection program in year five of operations to confirm WWTP discharge is still having no impact to these sites.

Water quality parameters at each site will be sampled either throughout the Operational Period, or for five years; updates to the monitoring frequency after the first five years will be confirmed based on the outcomes of the five-year analysis. The sampling frequency of parameters that will be re-assessed after five years include metals, nutrients, and chlorophyll-*a*. Physical and bacteriological parameters are proposed to be sampled throughout the Operational Period (Table 1).

The sampling design incorporates regular review and reporting of annual results, as described in Section 1.7. The decision to discontinue sites/parameters from the REMP will be based on the interim evaluation of potential effects after two years of data collection (Section 1.7).

Table 1. Proposed water quality parameters and monitoring requirements for the VOC WWTP Receiving Environment Monitoring Program.

Parameter Category	Parameter[1]	Sites	Frequency	Duration	Type of Sampling	Rationale
Physical[2]	pH Temperature Dissolved oxygen Specific conductance	All	Monthly during dry period (May-Sept), twice in winter (except TRT-DSWQ03)[3]	Throughout Operational Period	Meter	Physical parameters to assess changes in water quality. Potential residual effects of temperature were assessed in the enhanced EIS and further monitoring was recommended. BC water quality guidelines are available for temperature, pH, and dissolved oxygen. Temperature, pH, and dissolved hardness are required to calculate BC water quality guidelines for various parameters.
	Dissolved hardness				Grab	
Bacteriological	Fecal coliforms *E.coli*	Permit sites (MLC-USWQ01, TRT-USWQ01, TRT-DSWQ01, TRT-DSWQ02)		Throughout Operational Period	Grab	Indicators of potential human health hazard. Guidelines are available for fecal coliforms under the Municipal Wastewater Regulation for reclaimed water and for *E.coli* under BC drinking water quality. Bacteriological parameters will be sampled at permit sites only.
Metals	Total and dissolved metals	All		5 years, then to be determined after 5 year analysis	Grab	Metals are present at various concentrations in municipal wastewater. Several metals are potentially deleterious to aquatic organisms. Potential residual effects of metals were assessed in the enhanced EIS and further monitoring was recommended. BC water quality guidelines are available for several metals parameters.
Nutrients	Ammonia nitrogen Nitrate Nitrite Total nitrogen Total phosphorus Orthophosphate	All		5 years, then to be determined after 5 year analysis	Grab	Phosphorus and nitrogen are present in municipal wastewater under various forms. High levels of phosphorus and nitrogen may cause eutrophication and harmful algal blooms. Potential residual effects of some nutrients were assessed in the enhanced EIS and further monitoring was recommended. Water quality guidelines are available for ammonia nitrogen, nitrate, nitrite, and total phosphorus.
Other	Chloride Dissolved organic carbon	All		Throughout Operational Period	Grab	Chloride and dissolved organic carbon are explanatory parameters required to calculate BC water quality guidelines for various parameters.
Chlorophyll-*a*		TRT-USWQ01, TRT-DSWQ01, TRT-DSWQ02, TRT-DSWQ03	Dry period (May-Sept)	5 years, then to be determined after 5 year analysis	Grab	Chlorophyll-*a* will be sampled at Trent River sites only. The Trent River is sensitive to phosphorus inputs which may increase the magnitude of periphyton biomass accumulation which is measured indirectly by chlorophyll-*a*.

[1]Vegetation surveys will occur during the growing season at CWC-01, CWC-03, and CWC-05 in year one and year two to evaluate whether WWTP discharge is negatively impacting the composition and health of wetland vegetation communities.

[2] Discharge from the WWTP will be monitored at end-of-pipe. The enhanced EIS study confirmed that the majority of flow to MLC in summer months is from the WWTP. Thus, no hydrometric monitoring is recommended to further prove this augmentation.

[3]TRT-DSWQ03 will be sampled in the dry period (May-Sept) only as this is the period of concern at this site.

Table 2. Existing compliance sites (Permit 197) and proposed additional sample sites for Cumberland WWTP Receiving Environment Monitoring Program.

Habitat	Site Name	Site Description/Location	Sampling Duration	Rationale
Stream	MLC-USWQ03	MLC, upstream control	Throughout Operational Period	The upstream control site representing background for the EIS (MLC-USWQ02) will be impacted by effluent discharge from the wetlands under Operating conditions. Therefore, a site further upstream in MLC is recommended to act as a control. Although the channel is split upstream, the east channel has been observed to more consistently maintain flow than the east channel and is therefore recommended.
	MLC-DSWQ01	MLC, 500 m downstream of the existing point of discharge	Two years unless potential effects from WWTP operations are detected[1]	Represents a stream reach where less sensitive species were identified (i.e., Stickleback). Therefore, only two years of monitoring are recommended to confirm no effect.
	MLC-DSWQ03/Site 6	5 km downstream of the lagoons at the end of MLC/ 100 m upstream from the confluence with the Trent River	Throughout Operational Period	Compliance site (Permit 197). Represents a stream reach that supports more sensitive species, such as anadromous salmon.
	TRT-USWQ01/Site 8	Control site on the Trent River, located 100 m upstream of the confluence with MLC		Compliance site (Permit 197). Represents background conditions in the Trent River and therefore provides an upstream control for comparison of impact sites to background.
	TRT-DSWQ01/Site 7	Trent River, 100 m downstream of the confluence with MLC		Compliance site (Permit 197). Representative of conditions in the Trent River potentially impacted by WWTP effluent because it is downstream of the confluence with MLC.
	TRT-DSWQ02/Site 13	Trent River, 400 m downstream from the confluence with MLC		Compliance site (Permit 197). Represents fully mixed conditions in the Trent River downstream of the confluence with MLC.
	TRT-DSWQ03	Trent River, ~2.5 km downstream of the confluence with MLC	Two years unless potential effects from WWTP operations are detected[1]	Represents the most downstream reach of the Trent River prior to discharge to Baynes Sound. Measurements tend to be similar to TRT-DSWQ02 and therefore only two years of monitoring to confirm this site is represented by TRT-USWQ02 are recommended.
Wetland	CWC-BMRB-01	At end of biochar media reed bed	Throughout Operational Period	Short- and long-term effectiveness monitoring of the biochar media reed bed to polish WWTP effluent discharge. Monitoring will inform any requirements for adaptive management to meet WWTP water quality objectives.
	CWC-03	Natural wetlands receiving environment		Short- and long-term effectiveness monitoring of the receiving reed canary grass wetland to perform the water quality functions anticipated in the enhanced EIS. Monitoring will inform any requirements for adaptive management or restoration to improve water quality functions.
	CWC-01	Natural wetlands control site	Two years unless potential effects from WWTP operations are detected[1]	To confirm enhanced EIS conclusions that there will be no effects from WWTP operations on water quality or vegetation communities. Monitoring will inform any requirements for adaptive management or restoration, including to prevent future impacts.
	CWC-05	Edge of bog		

[1] If potential effects are detected, additional monitoring will commence to evaluate any effects to biological receptors.

MLC = Maple Lake Creek
WWTP = wastewater treatment plant
Enhanced EIS = enhanced Environmental Impact Study

1.3. Sampling Methods

Sampling methods will be consistent with those used for previous water quality sampling as described in the enhanced EIS (Dinn *et al.* 2025) and Aquatic Assessment Report (Hull *et al.* 2022).

Water quality data will be collected using two methods: (1) *in situ* sampling at each site, and (2) collection of water samples for laboratory analysis. Sampling procedures and selection of method detection limits will be determined following the British Columbia Field Sampling Manual (Part E1: Surface Water; BC ENV 2024).

In streams, water quality samples will be collected in the main flow of the channel away from watercourse banks, avoiding areas with unusual flow characteristics (e.g., eddies or backwater areas) or floating debris. Sample sites are accessible by wading and the sampler will collect samples from upstream of where they are wading. *In situ* samples will be collected at 0.2 m below the surface with a meter (such as YSI meter) that has been bench calibrated prior to field sampling. Laboratory samples will be collected at 0.2 m depth at all sites. Field crews will ensure that the inner portion of the sample bottle and cap are not contaminated (touched) by anything other than sample water and preservative (if applicable).

In wetlands, water quality samples will be collected from monitoring wells in the BMRB and existing wetlands. A monitoring well will be installed in the BMRB (CWC-BMRB-01) once constructed, and the monitoring wells at the edge of the bog (CWC-05), control site (CWC-01), and reed canary grass meadow impact site (CWC-03) will be replaced with deeper monitoring wells following standard techniques (Government of BC 2013) (Map 1). Prior to water sampling, wells will be purged using a hand-held pump (e.g., Waterra SS-19). *In situ* sampling will occur prior to and after purging the well with a meter (e.g., YSI) that has been bench calibrated prior to field sampling. Water levels will also be measured and recorded prior to and after purging the wells, and after water sampling, using a water level meter (such as a Solinst Model 101; 1 mm accuracy). Due to the relatively small diameter and shallow depth of these wells, the equivalent of one well volume is typically needed to stabilize water level, temperature, pH, and electrical conductivity to pre-purge levels. Water will be pumped from the well directly into sample bottles for laboratory analysis. To avoid contamination between sites, the pump hose will be changed prior to purging and sampling each site (i.e., it will not be reused). There are conditions when there may be insufficient water in the well(s) to collect water samples, particularly during the driest summer months. Installation of deeper wells may remedy this issue, but if this situation occurs, a soil pit will be dug to the water table near the well site to collect *in situ* and laboratory water samples and to record water levels in relation to the ground surface.

In addition to water quality sampling in the wetlands, a vegetation survey will be conducted at the wetland monitoring sites (CWC-01, CWC-03, and CWC-05) during the growing season. Plants have specific tolerances to water quantity and quality conditions. Changes in vegetation communities (species present, abundance, health) can reflect shifts in water quality parameters like pH, nutrient levels (e.g., nitrogen, phosphorus), or water table depth. The vegetation surveys, along with the repeated collection of water quality and water table data over time and the analysis of these data will

meet the objective of evaluating whether WWTP discharge is having a negative effect on wetland function at CWC-01 and CWC-05, and whether the CWC-03 mitigation site is effectively improving water quality as predicted in the enhanced EIS.

Monitoring methods will follow a qualitative approach to assess whether WWTP discharge is impacting wetland vegetation communities outside of the expected receiving environment (i.e., at CWC-01 and CWC-05). Sites will be monitored by establishing permanent plots to record vegetation and hydrologic condition, and by comparing these data to data recorded at the mitigation sites (CWC-03 and CWC-BMRB-01), as well as baseline conditions at these plots.

Vegetation surveys will consist of evaluating plant species composition, abundance, or and health following provincial field data collection standards (MacKenzie and Moran 2004; BC MOFR 2010). Prior to WWTP discharge, a permanent plot will be established in each of the three sites. Plot data will be recorded prior to WWTP discharge. Plot locations will be selected to capture the variability of vegetation communities and microsite positions, such as shallow open water. Plots will be 100 m^2 in size with a radius of 5.54 m. Plot centers will be permanently marked with a wooden stake and the perimeter will be marked with temporary bright-coloured flagging tape or pin flags. String will be placed from plot center to the perimeter at each cardinal direction: north, east, south, and west. Within each plot, photos will be taken to capture the vegetation cover and site conditions within each quarter of the plot viewing northeast, southeast, southwest, and northwest.

At each plot, the following biophysical conditions will be monitored once during each monitoring year, at the same time each year (within one month and under the same conditions, i.e., considering whether the monitoring year is drier or wetter than in previous years of monitoring), and during a water quality sampling trip, recording:

- Vegetation species composition and structure;
- Mortality percent cover;
- Vegetation species percent cover;
- Notes on water flow and water direction (if applicable); and
- Measurements of surface water level and water table depth.

Corrective (adaptive) management actions will be implemented immediately if the QEP and/or the Ministry advises it is necessary based on monitoring results, i.e., to address any criteria that are not trending towards success (i.e., meeting the objectives of this REMP and the predictions of the enhanced EIS). Field data will be analyzed to evaluate whether success criteria have been met. The recommended success criteria for evaluating impacts of the WWTP discharge to the wetland control site (CWC-01) and potential impact site (CWC-05) are as follows:

- Water quality is comparable to (i.e., within the range of) baseline conditions and has not deteriorated;

- Water depths are typical or within the range needed to maintain the existing vegetation community, considering sampling conditions (i.e., whether it is a drought or non-drought year); and
- No more than a 5% change in vegetation community composition and abundance (a range of 1-5% annual change is often considered typical for many ecosystems undergoing natural succession or experiencing moderate environmental fluctuations, e.g., Moseley 2018; Franklin *et al.* 2016; Zweig and Kitchens 2009).

Where monitoring results show signs of conditions that do not meet the objectives, such as vegetation mortality, decreasing vegetation cover, increasing invasive plant infestations, poor water quality (e.g., extreme pH values), adaptive management strategies will be implemented.

The success criteria for evaluating mitigation effectiveness and the need for adaptive management actions at CWC-BMRB-01 and CWC-03 are as follows:

- Water quality at CWC-BMRB-01 is improved from end of pipe water quality; and
- Water quality at CWC-03 is improved from the water quality at CWC-BMRB-01.

1.4. Sample Handling

Field crews will take due care in sampling, storing, and transporting the samples to control temperature and avoid contamination, breakage, and any other factor or influence that may compromise the integrity of the samples. Field crews will ensure that sample hold-times are strictly adhered to by ensuring that samples are received by the laboratory within their designated hold-time.

Laboratory sample analysis will be completed by an accredited analytical laboratory with an ISO/IEC 17025:2017 and Canadian Association for Laboratory Accreditation certification. *In situ* and laboratory sampling procedures, chain of custody procedures, and QA/QC procedures will adhere to the guidelines of the BC Field Sampling Manual (Government of BC 2013; BC ENV 2024). Site photos will be collected and archived for all sites, and detailed information (e.g., location, date and time, persons involved) will be recorded for all data collected. In addition, data screening and management will follow the QA/QC procedures outlined below in Section 1.6.

1.5. Analytical Methods

Water quality measurements will be compared to short-term maximum BC water quality guidelines for the protection of aquatic life (BC WLRS 2025) and BC drinking water guidelines (BC ENV 2020). Several water quality parameters have BC water quality guidelines that are calculated based on an equation that depends on the value of another parameter (e.g., pH, dissolved hardness (as $CaCO_3$), dissolved organic carbon, chloride). These guidelines are calculated based on the water chemistry associated with each sampling site/date. Where applicable, triplicate *in situ* measurements of pH and water temperature will be averaged for the calculation of the guidelines.

If water quality guidelines are exceeded at the impact sites, an analysis will be conducted to assess if there are statistical differences between upstream control and downstream impact sites. It is assumed

that this analysis will use the same statistical method as used in the enhanced EIS, i.e., Wilcoxon-Mann-Whitney rank sum test (or parametric equivalent if assumptions are met) where differences are considered statistically significant if the p-value is less than or equal to 0.05 (Dinn *et al.* 2025). This statistical analysis will be conducted after two years of data collection and presented in the preliminary assessment report, described below in Section 1.7. After two years of data collection, ten samples will have been collected at each site during the dry period (monthly sampling from May to September); Conine *et al.* (2021) conducted a power analysis to determine how many samples are needed to evaluate exceedances of water quality criteria in flowing waters and found that eight samples are needed to obtain at least 80% power, which is considered sufficient at detecting effects.

1.6. QA/QC Processes

In situ water quality meters will be maintained and operated following the manufacturer's recommendations. Maintenance will include calibration, cleaning, periodic replacement of components, and proper storage. Triplicate readings will be collected for *in situ* data at each site. For grab samples, one duplicate sample and one field blank will be collected during each sampling event, consistent with the BC Field Sampling Manual (Government of BC 2013; BC ENV 2024), which suggests that one replicate sample should be collected for every ten samples and one field blank should be collected once per day.

Water quality samples for laboratory analysis will be collected in appropriate bottles provided by an accredited laboratory and filtered and preserved as required. Sample containers and preservatives will be provided by an accredited laboratory. Samples will be packaged in clean coolers filled with ice packs and couriered to an accredited laboratory within 24 hours of collection. Standard Chain of Custody procedure will be strictly adhered to. An accredited laboratory will be selected that maintains a Quality Management System that adheres to the requirements of the ISO: IEC 17025:2005 standards. Laboratory QC procedures will include replicate analysis of a subset of samples, analysis of standard reference materials, and method blanks. Samples will be analyzed to the lowest method detection limit to ensure the reliability and quality of analytical results.

Data will be entered into a database, where comprehensive QA/QC procedures are implemented. Detailed information (e.g., collection date, persons involved, analytical methods, techniques, or procedures employed) is recorded for all analyses. Sample data and QA/QC results (e.g., hold time exceedances, precision among replicates, field blank detections) will be evaluated based on the BC Guidelines for Interpreting Water Quality Data (RISC 1998) and British Columbia Field Sampling Manual (Government of BC 2013).

1.7. Data Reporting

The reporting schedule will involve bi-annual summary reports of dry weather months (May to September) and wet weather Months (October to April). These reports will present seasonal summary statistics (average, minimum, maximum, and standard deviation) calculated for each sampling location. Values below the method detection limit will be set as the method detection limit for these

calculations. The results will be compared to water quality guidelines to protect aquatic life, and to drinking water guidelines where applicable. Recommendations to modify the monitoring plan based on monitoring results will be evaluated in each bi-annual summary report as part of the adaptive management strategy. Laboratory reports will be provided in an appendix.

After two years, a preliminary assessment report will be developed that compares summary statistics at the impact sites to upstream control sites. A statistical comparison between control and impact sites will only be conducted if water quality guidelines are exceeded at the impact sites. Prior to drawing conclusions, any statistical differences will be carefully evaluated in the context of potential confounding factors and biological significance. This two-year preliminary report will evaluate the need for additional sampling at wetland sites and additional sampling at TRT-DSWQ03. If this report indicates that there is no effect (i.e., all water quality guidelines are met and/or water quality and vegetation communities at wetland sites CWC-01 and CWC-05 have not deteriorated), then select sampling sites and parameters can be discontinued from the REMP, as described in Table 1 and Table 2.

After five years, a five-year assessment report will be prepared. This assessment will evaluate whether the findings and assumptions of the enhanced EIS are accurate (i.e., do field measurements meet predictive assumptions, is mitigation performing as expected) (Dinn *et al.* 2025). The report will compare summary statistics at the control sites to those at the impact sites. Results will be compared to applicable water quality guidelines. The potential effects of WWTP discharge in the receiving environment will be evaluated and compared to the assumptions in the enhanced EIS (Dinn *et al.* 2025). In addition, the efficacy of mitigation (reed bed, natural wetlands) and WWTP upgrade efficacy will be evaluated. The REMP sample design and mitigation measures will be evaluated by a QEP and changes for improvement will be recommended if monitoring indicates effects to receptors of concern are possible or whether monitoring of some parameters can be discontinued.

Reports will include the following:

- Executive summary and introduction (with rationale and objectives clearly defined);
- Program methodology (including sampling sites, field and analysis methods, and QA/QC details);
- Summaries of results and analyses (e.g., summary statistics, comparison to applicable water quality guidelines, spatial/temporal trends, and statistical analysis);
- Conclusions of analysis;
- Recommendations; and
- Laboratory results, e.g., as appendices.

REFERENCES

BC ENV (British Columbia Ministry of Environment and Climate Change Strategy). 2019. Permit 197 Under the Provisions of the *Environmental Management Act*. Issued: August 25, 1967. Amended: September 16, 2019.

BC ENV (British Columbia Ministry of Environment and Climate Change Strategy). 2020. B.C. Source Drinking Water Quality Guidelines: Guideline Summary. Water Quality Guideline Series, WQG-01. Prov. B.C., Victoria B.C.

BC ENV (British Columbia Ministry of Environment and Climate Change Strategy). 2024. The British Columbia Field Sampling Manual. Part E1 Surface Water. Available online at: https://www2.gov.bc.ca/assets/gov/environment/research-monitoring-and-reporting/monitoring/emre/manuals/field-sampling-manual/bc-field-sampling-manual-part-e1-surface-water-2024-03-08.pdf. Accessed on February 5, 2025.

BC MELP (British Columbia Ministry of Environment, Lands and Parks). 1998. Guidelines for Designing and Implementing a Water Quality Monitoring Program in British Columbia. Available online at: https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/nr-laws-policy/risc/guidelines_for_designing_and_implementing_a_water_quality_monitoring_program_in_british_columbia.pdf. Accessed on February 5, 2025.

BC MOE (British Columbia Ministry of Environment). 2014. Coast Region Environmental Protection Division. Environmental Sustainability and Strategic Policy Division. Ministry of Environment. Phosphorus Management in Vancouver Island Streams. April 2014. Available online at: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-reference-documents/phosphorous_management_vi_streams_guidance_2014.pdf. Accessed on June 14, 2024.

BC MOE (British Columbia Ministry of Environment). 2016. Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators. Available online at: https://www2.gov.bc.ca/assets/gov/environment/waste-management/industrial-waste/industrial-waste/water_air_baseline_monitoring.pdf. Accessed on February 5, 2025.

BC MOFR (British Columbia Ministry of Forests and Range). 2010. Field Manual for Describing Terrestrial Ecosystems 2nd Edition. Land Management Handbook 25. Victoria BC. Available online at: http://www.for.gov.bc.ca/hfd/pubs/Docs/Lmh/Lmh25/Lmh25_ed2_(2010).pdf. Accessed on February 5, 2025.

BC WLRS (British Columbia Ministry of Water, Land and Resource Stewardship). 2025. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture - Guideline Summary. Water Quality Guideline Series, WQG-20. Prov. B.C., Victoria B.C. Available online at: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/wqg_summary_aquaticlife_wildlife_agri.pdf. Accessed on February 18, 2025.

Conine, A.L., S.E. Rickard, A.M. Onion, E.J. Wiegert, and A.J. Smith. 2021. Use of power analysis to determine the number of samples needed to assess water quality in lakes and flowing waters. Integrated Environmental Assessment and Management, 18: 1621–1628.

Dinn, P., N. Wright, C. Suzanne, J. Terry, L. Burns, L. Ballin, C. Whelan, and J. Abell. 2025. Village of Cumberland Liquid Waste Management Plan: Enhanced Environmental Impact Study. Draft V2. Consultant's report prepared for the Corporation of the Village of Cumberland by Ecofish Research Ltd., February 3, 2025.

Franklin, J., Serra-Díaz, J. M., Syphard, A. D., and Regan, H. M. 2016. Global change and terrestrial plant community dynamics. *Proceedings of the National Academy of Sciences USA, 113*(14), 3725-3734.

Government of BC (British Columbia). 2013. B.C. Field Sampling Manual. Part A Quality Control and Assurance and Part E Water and Wastewater Sampling. Available online at: https://www2.gov.bc.ca/assets/gov/environment/research-monitoring-and-reporting/monitoring/emre/manuals/field-sampling-manual/bc_field_sampling_manual_part_e.pdf. Accessed on February 5, 2025.

Hull, L., C. Suzanne, K. Chin, and J. Abell. 2022. Maple Lake Creek and Trent River Aquatic Assessment Report. Draft V1. Consultant's report prepared for the Corporation of the Village of Cumberland by Ecofish Research Ltd., September 2, 2022.

LGL Limited and BC ENV (LGL Limited Environmental Research Associates and British Columbia Ministry of Environment and Climate Change Strategy). 2019. Marine Monitoring Guidance Document. Available online at: https://www2.gov.bc.ca/assets/gov/environment/waste-management/waste-discharge-authorization/guides/forms/2021-01-05-marine_monitoring_guidance.pdf. Accessed on February 13, 2025.

MacKenzie, W.H. and J.R. Moran. 2004. Wetlands of British Columbia: a guide to identification. Res. Br., B.C. Min. For., Victoria, B.C. Land Management. Handbook. No. 52. 295 p.

Moseley, K. 2018. Wetland Ecology- Basic Principles. Regional ESS bulletin. National Research Conservation Servies, United States Department of Agriculture. Available online at: nrcs.usda.com Accessed on July 10, 2025.

RISC (Resource Inventory Standards Committee). 1998. Guidelines for Interpreting Water Quality Data. Prepared by the BC Ministry of Environment, Lands and Parks for the Resource Inventory Commission.

Zweig, C.L. and W.M Kitchens. 2009. Multi-state succession in wetlands: a novel use of state and transition models. *Ecology*. **90** (7): 1900–1909.

PROJECT MAPS

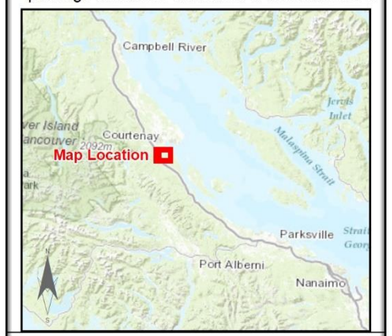
VILLAGE OF CUMBERLAND

REMP Sampling Sites

Legend

- Discharge Point
- Fish Barrier [1]
- Water Quality Site
- Biochar Reed Bed
- Streams
- Watersheds
- Wetland Complex
- Freshwater Atlas Wetland
- SEI Wetland

[1] Approximate location of the complete fish passage barrier as described in Mimulus 2001.



MAP SHOULD NOT BE USED FOR LEGAL OR NAVIGATIONAL PURPOSES

0 250 500 1,000 m

Scale: 1:18,000

NO.	DATE	REVISION	BY
1	2/24/2025	1345_VOC_REMPSampling_7112_20250224	KCP
2			
3			
4			
5			

Date Saved: 2/24/2025
Coordinate System: NAD 1983 UTM Zone 10N

ECOFISH RESEARCH

Map 1

Path: M:\Projects-Active\1345 Village of Cumberland\MXD\1345_VOC_REMPSampling_7112_20250224.mxd

APPENDIX P
COUNCIL RESOLUTIONS

APPROVAL OF THE STAGE 3 LWMP REPORT

LWMP AMENDMENT - ADAPTIVE STRATEGY; LWMP MONITORING COMMITTEE COMMITMENT

LWMP AMENDMENT - RECOMMENDATIONS FOR IMPLMENTATION COMMITMENT

7.3 Approval of Stage 3 LWMP Report for Submission to Ministry of Environment

Motion 25-113

Moved by: Therrien
Seconded by: Sullivan

THAT Council confirms the municipal fund method of payment plan for the storm-sanitary sewer separation program in the Stage 3 Liquid Waste Management Plan; and

THAT Council, acting as the Liquid Waste Management Plan Steering Committee, approves the Stage 3 Liquid Waste Management Plan Report for submission to the BC Ministry of Environment and Parks.

Carried Unanimously

This copy or extract is certified a true copy or extract of the original document or public record.

Deputy Corporate Officer
The Corporation of the Village of Cumberland

The Corporation of the Village of Cumberland
P.O. Box 340 - 2673 Dunsmuir Ave.
Cumberland , B.C V0R 1S0

7.2 Update to Stage 3 LWMP Report for Submission to Ministry of Environment and Parks

Motion 25-156

Moved by: Therrien
Seconded by: Borecky

THAT Council confirms that the Village of Cumberland has reviewed and formally adopt the commitments with timelines or triggers that have been brought forward within the Stage 3 Liquid Waste Management Plan that is outlined in the July 28, 2025 staff report "Update to Stage 3 LWMP Report for Submission to Ministry of Environment and Parks".

Carried Unanimously

This copy or extract is certified a true copy or extract of the original document or public record.

Deputy Corporate Officer
The Corporation of the Village of Cumberland

The Corporation of the Village of Cumberland
P.O. Box 340 - 2673 Dunsmuir Ave.
Cumberland , B.C V0R 1S0

Corporation of the
Village of Cumberland

2673 Dunsmuir Avenue
P.O. Box 340
Cumberland, BC V0R 1S0
Telephone: 250-336-2291
Fax: 250-336-2321
cumberland.ca

Liz Archibald, P.Ag.
Section Head - Communities, IPM, & Agrifood| Environmental Protection Division
BC Ministry of Environment and Climate Change Strategy
205 Industrial Rd G | Cranbrook BC | V1C 7G5 | Tel: 250-420-6384

RE: Village of Cumberland – Liquid Wastewater Management Plan (LWMP)
LWMP Amendment - Adaptive Mitigation Strategy

Authorization Number: 76780-30/VCUM

Attn: Liz Archibald, P.Ag.

Dear Ms. Archibald,

The Village of Cumberland (VoC) has received review comments from the BC Ministry of Environment and Climate Change (BC ENV) following submission of the "*Village of Cumberland Draft Stage 3 Liquid Waste Management Plan"* report Version 2, dated May 30, 2025 (Stage 3 LWMP). BC ENV provided several comments for consideration by the VoC prior to preparation of the final Stage 3 Report for submission to the Honourable Minister Tamara Davidson for approval under Section 24 of the *Environmental Management Act (EMA).*

The comment specifically addressed in this amendment addresses a request for "*additional information and details on mitigative measures that will demonstrate with regard to the nature of the discharge and the receiving environment, that the proposed disposal system, treatment and reuse, and the discharges from these, will comply with the regulations respecting the management of municipal liquid waste, meet applicable water quality guidelines and not adversely affect public health or the receiving environment. To ensure compliance with EMA Section 24, the final Stage 3 LWMP must include additional details on the mitigative measures prior to submitting the final LWMP to the Minister for approval*".

One of the challenges of the Cumberland situation is that the low summer dilution means that meeting in-stream aquatic water guidelines cannot be guaranteed based on end-of-pipe effluent quality. However, the current receiving environment of the beaver ponds of the middle reach of Maple Lake Creek and the soon to be added elements of the reed bed and the north wetland, all provide naturalized polishing treatment. This might yet result in downstream

water in lower Maple Lake Creek and the Trent River meeting applicable water quality guidelines. The performance of these natural systems cannot be accurately predicted and the true extent of polishing treatment provided will not be known until the new system is in operation.

This letter summarizes mitigative measures and a range of potential future add-on treatment options for process optimization and further improvement of both the end-of-pipe and post reed bed/wetland water quality, which are intended to further improve the effluent quality discharged to the receiving environment. Implementation of the adaptive mitigation strategy (i.e., any of the possible mitigative measures) would only be required if ongoing monitoring of the wastewater treatment system performance and assessment of downstream environmental impacts demonstrates that further specific treatment is required.

The range of mitigative measures that may be considered is summarized in *Table 1*.

Table 1 Mitigative Measures

Process Improvement	Objective / Need	Adaptive Strategy	Status
2nd Stage Effluent Disinfection	If additional effort for virus removal is required.	Add chlorination and dechlorination after UV disinfection.	Already designed into main works area for future construction.
Additional Nitrification	Effluent toxicity removal due to ammonia.	Pulsed (fill/drain) operation of reed bed.	Operational strategy - potential dry weather operational strategy, for post-commissioning.
		Aeration of reed bed.	Conceptual - to be considered as part of reed bed detailed design.
		Add fixed-film treatment elements into lagoons (e.g., Ringlace, Biocord, Biofixe)	Conceptual.
		Add a new process unit (i.e., MBBR) before SAF lift station, specifically for additional nitrification.	Conceptual – an area adjacent to Excess Wet Weather Flow (EWWF) basin is available and can be allocated for the addition of MBBR.

Table 1 (Continued)

Process Improvement	Objective / Need	Adaptive Strategy	Status
Denitrification	Total nitrogen (nutrient) removal.	Partial lagoon effluent recirculation to headworks (screens) and through the lagoons.	Already designed and constructed into post lagoon SAF treatment system. Implementation to be considered as part of post-commissioning operation.
		Effluent recycle to front-end anoxic section in lagoon with conversion to pulse aeration.	Conceptual
		Flow manipulation in north wetland to force post-reed bed flow through anoxic root-zone.	Conceptual - to be considered as part of reed bed detailed design
Phosphorus Removal	Additional total phosphorus (nutrient) removal.	Optimize coagulant type and dosage.	Planned as part of the commissioning optimization.
		Second coagulant dosing point before tertiary filtration.	Already designed and built into SAF-filtration piping.
		Third coagulant dosing point before reed bed.	Conceptual - to be considered as part of reed bed detailed design.

Notes: UV – Ultra Violet; MBBR – Moving Bed Bioreactor; SAF – Suspended Air Flotation

All of the above-mentioned measures can be implemented, and will be prioritized once the new plant is operational and receiving environment monitoring is completed, identifying any issues with the effluent water quality. Until monitoring results are better known, prioritization of the potential strategies can not be completed, and each will be evaluated based on potential efficacy, ease of operation, and cost to implement among other criteria that are relevant to the project.

Reviewing the environmental performance and consideration of implementing these adaptive strategies will be one of the main tasks of the future LWMP Monitoring Committee.

Yours truly,

Jason Wallace
Manager of Municipal Projects
Village of Cumberland
jwallace@cumberland.ca

McElhanney

CANADA BEST MANAGED COMPANIES