Liquid Waste Management Plan
Technical Memorandum

LWMP Technical Memorandum #1

TO:	Wastewater Advisory Committee
SUBJECT:	Regulatory Framework
DATE:	October 26, 2017
Prepared By:	Troy Vassos
Reviewed By:	Paul Nash, Project Coordinator

1.0 BACKGROUND

This Technical Memo summarizes the current Regulatory Framework affecting liquid waste management planning for the Village of Cumberland, including an assessment of the existing Discharge Permit status and anticipated regulatory changes affecting the discharge in the near future.

2.0 WASTEWATER TREATMENT & DISPOSAL DESCRIPTION

The Village of Cumberland is served by a combined sewer system that collects both domestic wastewater and stormwater from within the community and conveys it to a treatment facility consisting of mechanical screening followed by an aerated lagoon and a facultative (passive natural aeration) lagoon, with a discharge into Maple Lake Creek (MLC). MLC is a man-made drainage course that conveys the water from the facultative lagoon about 4 km to a confluence with the Trent River, which flows into Baynes Sound.

During the dry summer months, both MLC and the Trent River have extremely low flows, such that the discharge from the Cumberland lagoons makes up a high percentage of the flow in both water bodies during the summer. While the flow of water from the stabilization pond is obviously extremely important to the receiving environment in both MLC and the Trent River, phosphorus concentrations in the effluent are of concern due to the effects on primary productivity and algal growth within the Trent River, as evidenced by high chlorophyll-a levels measured in the Trent River downstream of the discharge. The BC Ministry of Environment considers the Trent River as an important fisheries resource and are concerned about phosphorus loading to the river.

The high proportion of lagoon discharge into the two water courses gives rise to concerns regarding the phosphorus loading and its effects on primary productivity and algal growth within the Trent River, as evidenced by high chlorophyll-a levels measured in the Trent River downstream of the discharge. The Ministry ambient water quality objective for the Trent River is 0.005 mg-P/L, which is the analytical detection limit for phosphorus. As will be discussed later, the phosphorus concentration in the Trent River sampled upstream of the confluence with MLC is consistently less than the detection limit of 0.005 mg-P/L throughout the year.

3.0 EXISTING DISCHARGE PERMIT

The Village of Cumberland holds a Permit PE00197 issued on August 25, 1967 by the (then) Ministry of Environment Lands and Parks, under the provisions of the Waste Management Act (now Environmental Management Act). Since issued, the Permit was last amended on December 3, 1997, under the provisions of the Waste Management Act at that time.

The authorization is for "the discharge of effluent from a MUNICIPAL COLLECTION AND TREATMENT SYSTEM SERVING THE VILLAGE OF CUMBERLAND", and is further authorized as follows:

- Discharge to Maple Lake Creek based on an annual averaging period of 910 m^3/d with a maximum rate of discharge of domestic sewage and stormwater of 2,710 m^3/d
- $BOD_5 \leq 30$ mg/L; TSS $\leq$ 30 mg/L; Faecal Coliform < 200 MPN/100 mL; Total-P < 1.0 mg-P/L
- Authorized works at the time of permitting were mechanical screens, an aerated lagoon, a stabilization pond, and related appurtenances;
- After May 1, 1999, the authorized works are to include disinfection, and nutrient removal facilities or alternative methods;
- Prior written approval from the Regional Waste Manager is required prior to implementing changes to the authorized works;
- Plans and specifications for the disinfection and nutrient reduction facilities must be prepared by a professional licensed to practice in BC and submitted to the Regional Waste Manager for review before construction commences, and the works must be certified to have been constructed in accordance with the submitted plans by a qualified professional licensed to practice in BC.
- Standby auxiliary power facilities shall be provided to ensure continuous operation of the sewage treatment facility;
- Sludge and screenings shall be disposed of in a manner authorized by the Regional Waste Manager.
- Based on receiving environment monitoring data and/or other information obtained in connection with the discharge, additional treatment facilities may be required.
- Sufficient land shall be secured and held in reserve to allow for future expansion and upgrading of the sewage treatment facilities;
- If the Region does not develop a Liquid Waste Management Plan that includes the Cumberland area, or the Regional Waste Manager deems the plan is not progressing satisfactorily, the following activities shall be undertaken:
    - 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 were to be submitted to the Regional Waste Manager for approval by December 31, 1999.

4.0 REGULATORY CHANGES

Since Discharge Permit PE00197 was issued in 1967, and even since it was amended in 1997, there have been a number of key changes to the associated municipal wastewater treatment and disposal regulations. The first major change was the promulgation of the Municipal Sewage Regulation (MSR) in 1999. The MSR replaced the Permit process with a Registration process in which a Qualified Professional is responsible for preparing support documentation demonstrating compliance with the MSR including an Environmental Impact Assessment (EIA) and Operations Plan (OP). A key aspect of this legislation was the elimination of government review and the permission associated with Permits, and transferring that responsibility to Qualified Professionals within the private sector. A second key feature was the formal introduction of standards for the reclamation and beneficial reuse of wastewater effluent for a wide range of applications including irrigation for forage and food crops, landscape irrigation and ornamental fountains, toilet and urinal flushing and stream and wetlands flow augmentation.

The second change was the revision of the MSR with the promulgation of the Municipal Wastewater Regulation (MWR) in 2012, which maintained the Registration process and introduced a few significant modifications including:

1. Introduction of a new wastewater reclamation standard for indirect potable reuse (e.g. replenishment of groundwater resources used as a potable water source).
2. Increased requirements for documentation at the time of Registration. In addition to the EIA and OP documents, the MWR now requires complete drawings be submitted.
3. Restrictions from proceeding with construction until Registration is approved (the MSR allowed construction to proceed after 90 days from submission of the Registration documents).

The MSR was subsequently changed and promulgated under the Environmental Management Act as the Municipal Wastewater Regulation in 2012. Like the MSR, the MWR has provision for discharges to ground equal to or in excess of 22.7 m^3/d, a discharge of any quantity from two or more dwellings to a surface body of water (stream, river, lake, or ocean) with a minimum dilution. For surface discharges the effluent quality depends on the type of water body (i.e. stream, river, lake or marine), the minimum dilution available or size of water body, and the environmental sensitivity of the water body.

In comparison with the Discharge Permit process, the MSR significantly reduced the time required to implement wastewater treatment and disposal facilities by eliminating the need for government review and approval of Permit applications, as well as inherently the Permit appeal process. The MWR requirement to prepare construction drawings before applying for Registration, and the prohibition on beginning construction until the government completes the Registration process made it extremely difficult to implement wastewater treatment and disposal projects on a timely basis.

The MWR considers discharges to surface water bodies, with effluent water quality requirements based on the discharge flow and available minimum dilution ratios. Further, if the available minimum dilution is less than 100:1, an environmental impact study must be carried out by a qualified professional to determine if the effluent quality requirements stated in MWR should be more stringent. Key dilution categories are 10:1 and 400:1 and 1000:1. Unless the discharge meets reclaimed wastewater reuse water quality criteria, a discharge with less than 10:1 is not permitted. If the discharge is greater than 10:1 but less than 40:1, the following conditions must be met:

1. The discharge meets advanced treatment water quality requirements of BOD_5 & TSS $\leq$ 10 mg/L; total phosphorus $\leq$ 1 mg-P/L; and ortho-P $\leq$ 0.5 mg-P/L;
2. No other discharge options are available;

3. The discharge must be authorized by a director;
4. If the discharge is to recreational waters the median fecal coliform level at the edge of the initial dilution zone must be less than 200 MPN/100 mL; and
5. If the discharge is to shellfish bearing waters, the median fecal coliform level at the edge of the initial dilution zone must be less than 14 MPN/100mL

Although a discharge is not normally permissible if the dilution ratio is less than 10:1, wastewater that meets the following "Greater Exposure Potential" (GEP) reclaimed wastewater reuse water quality can be discharged into a surface water body with less than 10:1 dilution if it is for beneficial stream flow augmentation:

- Maximum BOD_5 & TSS < 10 mg/L
- Average Turbidity $\leq$ 2 NTU – maximum $\leq$ 5 NTU
- Median Fecal coliform $\leq$ 1 CFU/100 mL – maximum $\leq$ 14 CFU/100 mL

Reclaimed water is discussed further in Section 10 of this Memo.

The 2017 Environmental monitoring program (discussed in Technical Memo #4) confirmed that there is effectively no dilution in Maple Lake Creek during the summer, and there is probably less than 10:1 dilution even under winter conditions

The MWR also authorises the Ministry to impose additional treatment conditions if they deem it necessary to protect the environment, and the Ministry of Environment have established an "in-stream" objective for the Trent River of an average of 0.005 mg-P/L and maximum of 0.01 mg-P/L to be met on a seasonal basis of from May 1 to September 30 each year. As Cumberland is currently required to meet an phosphorus concentration of less than 1 mg-P/L, as an effluent requirement, it is unclear as to whether the Ministry's objective is an addition to the Discharge Permit conditions, or whether the in-stream objective would only apply if Cumberland were required to register the discharge or establish a LWMP under the current Municipal Wastewater Regulation. The Ministry have indicated the in-stream phosphorus objectives do not apply to Maple Lake Creek – only to the Trent River.

With each change in provincial regulations previously authorized discharges were grandfathered and remained in effect. Grandfathering provisions allow existing Permits and Registrations that were created under previous legislation to remain valid until such time as a major change occurs or is required; however, historical precedence indicates the Ministry is willing to consider minor amendments to existing discharge authorizations. For example, a request to increase the authorized discharge flow by up to 10 percent has typically been considered to be a minor amendment. Although the Village of Cumberland is planning on making significant changes and improvements to their wastewater treatment process, as discussed in the next section, as long as the improvements are in line and in compliance with the works authorized under the current Discharge Permit PE00197, a requirement to conform and be in compliance with the MWR is not expected.

5.0 FEDERAL WASTEWATER SYSTEMS EFFLUENT REGULATIONS

On July 12, 2012, the federal government, under the Fisheries Act, passed the Wastewater Systems Effluent Regulations (WSER) that include mandatory minimum secondary wastewater treatment effluent quality standards, along with requirements for monitoring, record-keeping, reporting and toxicity testing are specified in the Regulations. As of January 1, 2015, the following provisions of the Regulations came into effect:

- All treated effluent discharged into a surface water body must meet the following water quality standards:

  - (a) average carbonaceous biochemical oxygen demand (CBOD) must not exceed 25 mg/L;
  - (b) average total suspended solids must not exceed 25 mg/L;
  - (c) average total residual chlorine must not exceed 0.02 mg/L, if chlorine is used; and
  - (d) maximum un-ionized ammonia must be less than 1.25 mg-N/L at 15 ^{o}C +/- 1 ^{o}C.

- Unionized ammonia is calculated by the following formula:

  Unionized Ammonia = Total Ammonia / $(1 + 10^{(9.56 - pH)})$

- Effluent water quality averages are calculated annually if the hydraulic retention time is at least 5 days and the average daily flow does not exceed 2,500 m^3/d; or if the average daily flows exceed 2,500 m^3/d but are less than 17,500 m^3/d.
- For treatment systems with a hydraulic retention time of five or more days, total suspended solids the averages do not include samples collected during the months of July, August, September or October, if that result is greater than 25 mg/L.
- Operate, maintain and annually calibrate equipment to measure the influent or effluent flow or volumes with a margin of error of +/- 15%, with reporting of discharge flows due on or before May 15, 2013.
- For average annual flows less than 2,500 m^3/d, either monthly grab or composite samples must be collected of the treated effluent, and for flows greater than 2,500 m^3/d and less than 17,500 m^3/d a composite sample must be collected at least every two weeks. For treatment systems with a hydraulic retention time of at least 5 days (i.e. lagoon) and average annual flows less than 2,500 m^3/d, the frequency of effluent grab or composite sampling can be reduced to quarterly.
- For average annual flows between 2,500 – 17,500 m^3/d, quarterly effluent toxicity analyses must also be carried out.

The above points capture the major water quality and monitoring requirements under the WSER, but are not comprehensive. For a full description of the requirements, the reader is referred to the federal legislation:

http://laws-lois.justice.gc.ca/eng/regulations/SOR-2012-139/FullText.html

The new federal regulation is of particular concern for many small communities across Canada who, like Cumberland, have up until now relied on a lagoon-based wastewater treatment process, and are now faced with having to upgrade their treatment systems, largely due to the effects of seasonal algae growth on effluent suspended solids levels. While the regulation requirements do not include consideration for reducing municipal effluent phosphorus concentrations, many small communities also discharge to watercourses that can be impacted by phosphorus, and are also influenced by non-point sources of phosphorus – as is the lower portion of the Trent River before it discharges into Baynes Sound. Many of these communities are also faced with addressing sewer separation and providing a high level of wastewater treatment under less than ideal hydraulic loading conditions as a result of peak stormwater influenced flows.

The BC government is committed to work towards an equivalency agreement and have announced it is going to harmonize the existing Discharge Permits, Operational Certificates and Registrations by registering all discharges and transitioning them to the harmonized MWR to ensure they meet the federal WSER. For facilities deemed capable of achieving secondary of better treatment, the Permit Discharge authorization will be cancelled and the discharge deemed to be registered under the harmonized MWR. For facilities not deemed capable of providing secondary treatment, these discharges are to be deemed “Transitionally Registered” under the harmonized MWR, and dischargers will continue to meet their former Permit requirements until their facility is upgraded or the federal

timeline is reached (2020, 2030, or 2040) whichever comes first. No other sections of the MWR will apply while the discharge is Transitionally Registered.

https://www2.gov.bc.ca/assets/gov/environment/waste-management/sewage/changes-to-prov-municipal-wastewater-discharge-auth.pdf

6.0 TRANSITIONAL REGISTRATION

The existing Permit PE00197 will likely be deemed "Transitionally Registered" under the harmonized MWR, and Cumberland will continue to be expected work towards being in compliance with the existing Discharge Permit requirements and water quality requirements under the WSER until that compliance is achieved. It is also not clear as to whether the provinces stated intention to have all discharges registered as part of the harmonization agreement with the federal government will also require dischargers to submit similar documentation to that normally required for registration under the MWR, specifically:

1. Environmental Impact Assessment
2. Operations Plan
3. As-built Construction Drawings.

As previously noted, the Village of Cumberland's current discharge Permit PE00197 includes the necessary regulatory authorization for treatment works to improve BOD, TSS, Total Phosphorus and disinfection treatment. The Ministry of Environment is aware of the Village's intent to upgrade the existing treatment works under the existing authorizations contained within the Permit, noting that the treatment works will be designed to comply with both the BC Municipal Wastewater Regulations and federal Fisheries Act - Wastewater Systems Effluent Regulations.

7.0 LIQUID WASTE MANAGEMENT PLAN

BC Environmental Management Act - Liquid Waste Management Plan Description

The BC Environmental Management Act (EMA) allows local governments to develop a Liquid Waste Management Plan (LWMP) to protect public health and the environment, with public and stakeholder input, that is then submitted to the Minister of Environment for approval, and the minister must be satisfied that there has been adequate public review and consultation during the development of the LWMP. An approved LWMP allows local government to proceed with implementation, and there is no mechanism to appeal a plan once approved by the minister. The LWMP is a long-term plan for building, financing, and managing liquid waste infrastructure, and usually includes an implementation schedule that can be affected by technical issues, pace of development, and the availability of financing.

In addition to protecting public health and the environment, and obtaining public consultation, LWMP objectives include water conservation, drinking water source protection, resources from waste, energy conservation, climate change adaptation, and mitigation and sustainable financing and asset management.

It is generally expected the LWMP will incorporate regulatory requirements under the Municipal Wastewater Regulation (MWR). Where the MWR standards are not currently met, the LWMP is used to establish a schedule for upgrading facilities to meet the MWR requirements.

The MWR and the Organic Matter Recycling Regulation (OMRR) under the EMA allow for the beneficial use as well as disposal of appropriately treated reclaimed wastewater and biosolids.

As the Local Government Act and the Community Charter require approval of electors to borrow funds to finance any wastewater infrastructure capital works, an approved LWMP allows local governments to borrow money without seeking public approval; therefore, public consultation is a critical aspect of developing a LWMP and is expected to foster acceptance and a feeling of ownership within the community. Both capital construction and operation costs of the infrastructure must be included, and the community should prepare long range financial plans to ensure resources will be available when they are needed.

LWMPs take into consideration expected urban and rural land development; timing, location and phasing of water and sewer services; and consideration for centralized, decentralized, and on-site servicing options. LWMP should consider the water, wastewater and stormwater infrastructure as interrelated systems, and minimize environmental impacts, reduce life cycle costs and provide flexibility for future expansion or upgrade of facilities. To avoid costly future changes, facilities should be located where long-term land use conflicts will be minimized, and where there is ample room to upgrade and expand.

Up-to-date regional growth strategies and official community plans are essential to establishing a LWMP, taking into consideration population projections, wastewater quantity and quality, water consumption, precipitation records, surface and groundwater water quality data, inventories of plant and animal species and their habitat, and information regarding soil, local drainage, aquifers, and groundwater flow regimes.

The scope of work for each LWMP is specific to each local government in reflecting the community goals and objectives and should be discussed at the outset of the process with the director (Ministry of Environment Regional Manager). Support of the scope of work should be received from the director and the advisory committee prior to starting work on each of the three stages of plan development.

Normally a LWMP is formally initiated with a resolution being passed by a local government. A copy of the local government resolution and their staff report providing justification for the process must be sent to the director, with copies and a covering letter going to the following agencies and groups:

- All municipalities, regional districts and First Nations within and adjacent to the LWMP area or who may be affected by the LWMP (e.g., downstream users);
- Environment Canada;
- Fisheries and Oceans Canada;
- Ministry of Agriculture;
- Ministry of Community, Sport and Cultural Development;
- Ministry of Health;
- Ministry of Transportation and Infrastructure; and
- Others as appropriate (e.g. as suggested by the director).

A scope of work should be completed and submitted to ministry staff at the beginning of each of the three stages of a LWMP planning process to guide the completion of a report for that stage. At the conclusion of each stage, local governments should seek endorsement of the report produced from the advisory committee(s). The final report should then be submitted to the director for review before proceeding to the next stage. At the conclusion

of Stage 3, local governments should make a resolution to accept the final Stage 3 report (after review by the advisory committees and the director), and then submit the LWMP report to the minister for approval, with a copy to the director.

At the completion of the process, the minister will consider the advice of the director and ministry staff before responding to a request for approval of a LWMP. The minister must be satisfied that the LWMP has been prepared in accordance with the EMA and that adequate public consultation has taken place as no mechanism for appeal will be available after ministerial issues a letter of approval. This letter may incorporate additional requirements to be imposed upon local governments as a condition of plan approval.

At this point the plan monitoring committee should be activated to ensure proper plan implementation. The director will then issue operational certificates for each facility and the municipality can proceed with implementation.

Village of Cumberland LWMP Process

As described above, preparing a Liquid Waste Management Plan (LWMP) involves a three-stage process that develops a strategic plan for dealing with all aspects of liquid waste. From the Provincial Guidelines for LWMP's;

> *A LWMP provides opportunity for a community to develop a long-term plan for building, financing, and managing their liquid waste infrastructure. In addition, it allows local governments to obtain ministry authorization for reuse and disposal of treated liquid waste to the environment. The LWMP forms the implementation plan for the management of liquid waste from collection, through treatment and resource recovery, to residual disposal.*
>
> *Prior to proceeding with the LWMP process, a local government should satisfy itself that a LWMP will substantially benefit the community and the environment. Typically, the LWMP process will be an effective vehicle in areas where there is considerable growth and development or where there are known problems associated with existing infrastructure. Further, a LWMP allows community-specific solutions to be developed and sets a schedule to finance and upgrade infrastructure to ultimately meet the MWR requirements.*

A LWMP has several key points. It

- allows a delayed but defined timetable for meeting the current MWR requirements,
- is an alternate process of obtaining provincial approval, to registering under the MWR;
- mandates extensive public and stakeholder engagement in the LWMP process; and
- confers borrowing authority that normally must be gained by elector approval.

As previously noted, where the MWR standards are not currently met, the LWMP is used to establish a schedule for upgrading facilities to meet the MWR requirements, with the expectation that reasonable efforts are being made to prepare the LWMP.

Having obtained a Discharge Permit, the Village of Cumberland also began to develop a Liquid Waste Management Planning (LWMP) process in 1999 to comply with Discharge Permit conditions. The LWMP process has three stages of development, and the studies completed from 2009-2011 led the community to Stage 3 of the process, whereby the next step would have included construction of plant upgrades. However, the planned upgrades were not completed, despite grant funding having been obtained for the project, as the Ministry of Environment officials

were not satisfied with the option chosen by the Village, and, in 2011, Cumberland elected to investigate joining a proposed regional treatment plant.

The proposed regional treatment plant, called the South Sewer Project, was investigated in great depth, however, due to the high costs associated with participation the Village decided that it wasn't feasible to participate, and in March of 2016, Cumberland began the development of a new approach for the LWMP "to come up with a made in Cumberland" solution. A new Wastewater Advisory Committee (WAC) was formed to steer the process, with representation from the community, government agencies, First Nations, Village of Cumberland staff, and technical consultants. In addition to meeting regulatory needs, the WAC in coordination with the Cumberland Council required the upgrade to align with both the Cumberland Official Community Plan as well as the Comox Valley Regional plans. The overall objective can be summarized as;

- "Develop a method of treating and discharging Cumberland's liquid waste that is not only environmentally sustainable but is also affordable and, ideally, is economically productive, environmentally enhancing and socially beneficial."
- The upgrade is to provide a sustainable plant providing a high-quality treatment and resource recovery. The WAC also confirmed the community's desire to improve their treatment plant as quickly as possible to address the environmental impact.

The strategic goals for wastewater treatment established include:

- Bring the Village of Cumberland into compliance will all current federal and provincial environmental regulations, and set the direction for wastewater treatment for the next 20 years.
- Address the distinct wastewater challenge of the high wet weather flows. The updated works must meet this challenge while not being "overbuilt" purely for these current wet weather peak flows. Cumberland has a program for combined sewer separation to reduce the peak flows, but this will take at least a decade to complete.
- The discharge to the receiving environments must meet the current, and foreseeable future provincial and federal standards. Of special note is the low summertime flows and corresponding low dilutions within Maple Lake Creek and the Trent River.
- Enable the use of reclaimed water for industrial, agricultural, municipal and (eventually) residential purposes, maximising potable water savings and enabling green parks and gardens instead of xeriscaping. This is in keeping with the (Provincially mandated) Comox Valley Sustainability Strategy has the specific wastewater treatment of goal to "treat to tertiary or reuse level".
- Explore options for storage of summertime treated water for winter discharge, to minimise discharge during the summertime phosphorus control period.
- Explore potential for on-site renewable energy generation, kinetic energy recovery, and heat recovery. There are numerous opportunities for the use of recovered heat, including a commercial laundry adjacent to the site
- Evaluate the carbon footprint, and on-going GHG emissions of the treatment plant, and reduce these as much as possible. GHG reductions are a reporting requirement for all BC municipalities and an evaluation criteria for all federal funding programs.

- There is a preference for a simple and robust treatment process requiring minimal operator intervention. Preference will also be given to treatment processes that minimize energy and external input (e.g. process chemical) requirements.
- Preference will be given to treatment systems that are expected to remove pharmaceuticals, endocrine disruptive compounds, and other trace contaminants.
- Once the new plant is completed, the then redundant lagoons will be re-purposed into a publicly accessible constructed habitat wetland, fed by the treated water
- Processing of dewatered biosolids is presumed to be by composting at the nearby CVRD composting facility, but other innovative options will be considered
- The project will follow the recently adopted Village of Cumberland Social Procurement Policy.
- Provide a treatment system that represents the Cumberland attitude, and that the community can be proud of.

Current LWMP Status

Cumberland completed Stage 1 in 2016 and is currently engaged in Stage 2, with completion scheduled for early 2018. Stage 3, the implementation and Financing Plans, is planned for completion by end of 2018, and Ministerial review and approval normally takes another 6-12 months.

While the objective of the LWMP is to eventually meet the MWR requirements, if Cumberland has the opportunity and funding to make upgrades that will meet MWR requirements, it can choose to register under the MWR instead of completing the LWMP process.

8.0 RECLAIMED WATER USE

Reclaimed water is municipal wastewater that has been treated to an appropriate level for the intended reuse purpose(s). It is not to be confused with “greywater”, which is untreated domestic wastewater from laundry bathroom uses.

The BC MWR defines four quality categories of reclaimed water according to their human exposure potential, as shown in Table 1.

Table 1 - Reclaimed Water Quality Requirements

Reuse Category	Example uses	BOD & TSS (mg/L)	Fecal Coliform (CFU/100mL)	Turbidity (NTU)
Indirect Potable Reuse	• Recharging an aquifer	< 5	< 1 (median) < 14 (max)	< 1(max)
Greater Exposure Potential	• Irrigation of public parks • Food crops eaten raw • **Stream augmentation**	< 10	< 1 (median) < 14 (max)	< 2 (avg) < 5 (max)
Moderate Exposure Potential	• Irrigation of restricted access areas • Food crops that are cooked	< 25	< 100 (median) < 400 (max)	N/A
Lower Exposure Potential	• Specific industrial uses • Forage crops or silvicuture	< 45	< 200 (median) < 1000 (max)	N/A

Reclaimed wastewater can be used to satisfy an extremely wide range of non-potable water demands 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. 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 – in the event the reuse water quality is compromised there must be a means of disposing the sub-standard treated effluent. The single exception in the regulation is water that is used to beneficially augment water flows through wetlands, with the approval of the Ministry of Environment. Although not stated in the regulation, this is ostensibly because the wetlands could be designed as a back-up method of treating the effluent. Consequently, the release of reclaimed wastewater to benefit and enhance the natural habitat of the wetlands associated with Maple Lake Creek could be a key integrated water management strategy component.

Potential uses of reclaimed water that have been identified in Cumberland include irrigation of parks, playing fields and gardens, commercial laundry, agriculture, stream and wetland augmentation, and gravel industry. Water treated to Greater Exposure Potential is suitable for all these uses.

Before reclaimed water can be used, Cumberland would need to establish an approved LWMP or MWR registration that included reuse applications, as well as request authorization for those reuse applications from the ministry of Health. The intended reuse applications need to be included and considered in preparing the Operations Plan and Environmental Impact Assessment that are required to be submitted for registration.

9.0 EOCP CLASSIFICATION

The MWR requires that all wastewater treatment, (and collection) systems are classified by 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 plant.

The level of operator certification required to operate the proposed facility must equal the classification level of the facility. If it is to be classified as a small system it will need to be classified as a Class II, but the water reuse elements could result in a Class 3 or possibly Class 4 designation – depending on the operating complexity of the technology that is adopted and not simply because of the reuse applications. Higher level operators must be paid more and are fewer in number than lower level operators. Consequently, technology selection must consider the degree of complexity as well as the overall labour costs.

Application will need to be made at the time of commissioning of the treatment works. EOCP policy does not allow for applications prior to commissioning of a treatment facility or facility upgrade

10.0 EQUIPMENT REDUNDANCY

The BC MWR includes equipment redundancy and auxiliary (backup) power supply requirements that are based on a Reliability Category assignment. A qualified professional is responsible for determining the appropriate Reliability Category based on information gathered through an Environmental Impact Study. Section 34 (2) of the regulation provides the following guidance:

> *(2) For the purposes of this regulation, reliability categories are defined as follows:*
>
> *(a) category I, being wastewater facilities*
>
> *(i) that discharge to ground or water, and*
>
> *(ii) in respect of which short term effluent degradation could cause permanent or unacceptable damage to the receiving environment, including discharges near drinking water sources, shellfish waters or recreational waters in which direct human contact occurs;*
>
> *(b) category II, being wastewater facilities*
>
> *(i) that discharge to ground or water, and*
>
> *(ii) in respect of which permanent or unacceptable damage to the receiving environment, including discharges to recreational waters and land, would not be caused by short term effluent degradation but would be caused by long term effluent degradation;*
>
> *(c) category III, being wastewater facilities that do not fall within reliability category I or II.*

As the proposed upgrade will be improving effluent quality and there is no evidence of long term damage to Maple Lake Creek or the Trent River as a consequence of the lagoon discharge over the past fifty years, it is likely that the facility can be classified as Category II. This will require 2 lagoon cells, dual solids/liquid secondary separation units with each unit capable of 50% of the design flow, dual filters with each filter capable of filtering at least 75% of the design flow, and dual disinfection units with each unit capable of 50% of the design flow. There are cost implications to meeting these redundancy requirements.

While a registered discharge under the MWR would require compliance with the equipment redundancy requirements, the authorized works under the existing Discharge Permit does not include redundancy requirements. However, the issue of equipment redundancy will need to be addressed in conjunction with the plans that the Discharge Permit requires be prepared by a qualified professional and submitted to the Ministry of Environment for review. If that submission is not in compliance with the requirements under the MWR, the Ministry could require full compliance as part of Phase 1, as an outcome of their review of a phased approach submission.

Table 21- Reliability Categories - BC MWR

	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 plants	multiple units or 48 hour repair	yes	2 units or 48 hour repair	yes	single unit	no

Notes: *(a) 50% of the design maximum flow where the notation "a" appears, or*
(b) 75% of the design maximum flow where the notation "b" appears.

11.0 EXISTING TREATMENT SYSTEM STATUS

The Village of Cumberland wastewater discharge has not been in compliance with most of the conditions and requirements stipulated in PE00197, as shown in Table 3. While the treated wastewater effluent BOD_5 and TSS concentrations have generally been in compliance, the requirements for disinfection and nutrient (phosphorus) removal required as of May 1, 1999, have not been implemented – largely due to the impracticality of operating such facilities with the extreme stormwater flows within the combined sewer system.

Table 3 – Status of Permit Compliance

Item	Current Permit requirements	Current Status
BOD- TSS	30-30	Usually compliant
Total Phosphorus	<1	Not compliant
Fecal Coliforms	<200	Not compliant

Add nutrient Removal	By 2015	Not built
Add disinfection	By 2015	Not built
Average flow	< 910 m^3/day	***Compliant*** Currently 800-850 m^3/day in dry weather
Wet weather flow	< 2,710 m^3/day	Not compliant > 15,000 m^3/day
Source Control Program		Implemented
Stormwater Management Plan		Developed and implemented
Sludge Wasting and Screening Disposal and Biosolids Management Plan		Part of current LWMP activities
Inflow and Infiltration Control Program		Developed and in progress
Sanitary and Storm Sewer Separation Plan		Developed and in progress

The Village has completed a number of combined sewer separation projects since 2006, some larger than others depending on what funding has been available, and they are committed to move forward with the design and construction of smaller separation projects as budgets permit. Additional projects are being planned for 2018 that will renew old sanitary collection pipes and install new storm-sewer mains at the same time within a common trench, as well as a continuation of the storm-sewer extension up Egremont Road, and there are more projects planned for 2019 and beyond. The Village is committed to move forward with further I&I investigation including smoke testing and CCTV of pipes. By accelerating sewer design projects over the next couple of years, the Village is anticipating they will be able to combine sewer separation work with other capital projects, based on available funding.

The community recognizes that it will take time to complete the separation program while in the meantime it is also important to provide environmental protection for the downstream environment and marine aquaculture industry. In spite of the severe hydraulic challenges posed by a combined sewer with wet-weather to dry-weather flow variations in excess of 20:1, the wastewater treatment process needs to be significantly upgraded to reduce effluent phosphorus concentrations and improve the overall water quality in MLC and the Trent River.

The 2017 environmental monitoring program (discussed further in Technical Memo #4) has confirmed that the effluent dilution in Maple Lake Creek, in summer, is less than 10:1, and is likely to remain so even under high wet weather flow conditions. As stated in the MWR, the only way treated water can be discharged under such conditions is if is treated to the reclaimed water standard for Greater Exposure Potential (GEP) reuse.

Once treated to the GEP standard, the water is suitable for a wide range of non-potable reuse applications, including irrigation and stream and wetland augmentation, specifically:

- Maximum $BOD_5 \leq 10$ mg/L;
- Maximum TSS $\leq$ 10 mg/L;
- Average Turbidity $\leq$ 2 NTU, Maximum Turbidity $\leq$ 5 NTU); and
- Median Fecal coliform $\leq$ 1 CFU/100mL, and Maximum $\leq$ 14 CFU/100mL
- pH 6.5 – 9

- Total phosphorus ≤ 1.0 mg-P/L (where the discharge is to a surface water body)
- Ortho-P < 0.5 mg-P/L. (where the discharge is to a surface water body)
- Maximum Un-ionized Ammonia < 1.25 mg-N/L at 15 ^{o}C +/- 1 ^{o}C (to meet the WSER requirements where the discharge is to a surface water body)

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.

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. In this regard any proposed works will also need to meet the redundancy and back-up power requirements of the BC MWR for reclaimed water treatment systems.

Due to extremely low dilution conditions, the upgraded treatment works will need to achieve a water quality under summer flow conditions that meets the GEP reclaimed wastewater reuse water quality requirements. The reclaimed water could be used to augment flows within Maple Lake Creek and the Trent River to improve environmental resource conditions.

As Cumberland's Discharge Permit is grandfathered under previous legislation, it does not need to meet the MWR requirements until such time as a major amendment to the Discharge Permit is required. However, under the provinces harmonization agreement with the federal government, Cumberland will have to meet the WSER effluent water quality conditions. One key area that could trigger the need to become registered under the MWR is wastewater flow. By policy, a request for an increase in effluent discharge rates of up to 10 percent have been treated by the Ministry as a minor amendment. The Discharge Permit authorizes an average dry weather flow discharge of 910 m^3/d, so a request for an increase in the authorized average dry weather flow of up to about 1,000 m3/d could be considered as a minor amendment under the existing Discharge Permit, but a need to request authorization for a discharge greater than this amount would be expected to trigger a requirement to meet the conditions under the MWR. However, confirmation of the triggering conditions is subject to discussion and verification with the Ministry.

12.0 IMPLICATIONS FOR THE VILLAGE OF CUMBERLAND

For surface discharges the effluent quality depends on the type of water body (i.e. stream, river, lake or marine), the minimum dilution available or size of water body, and the environmental sensitivity of the water body.

For discharges greater than 50 m^3/d, a minimum dilution of 10:1 is required for discharges to streams and rivers with an effluent quality of BOD_5 ≤ 10 mg/L, TSS ≤ 10 mg/L, total Phosphorus ≤ 1 mg-P/L and Ortho-Phosphate ≤ 0.5 mg-P/L.

In both cases if the discharge is to recreational waters the median fecal coliform level at the edge of the initial dilution zone must be less than 200 MPN/100 mL.

The existing Discharge Permit PE00197 directs and authorizes the Village of Cumberland to do the following:

- Improve and upgrade existing works including pre-treatment, biological treatment to reduce BOD and TSS, disinfection and phosphorus removal to achieve a secondary effluent quality consisting of
    - Maximum BOD_5 ≤ 30 mg/L; and

  - Maximum TSS $\leq$ 30 mg/L;
  - Faecal Coliform < 200 MPN/100 mL; and
  - Total-P < 1.0 mg-P/L

- Professional licensed to practice in BC to prepare plans and specifications, and submit them to the Regional Waste Manager requesting written approval to implement works for disinfection and nutrient reduction to achieve:
  - Faecal Coliform < 200 MPN/100 mL; and
  - Total-P < 1.0 mg-P/L
- Provide standby auxiliary power facilities to ensure continuous operation of the sewage treatment facility;
- Taking into consideration the existing Discharge Permit is expected to be deemed "Transitionally Registered", with the intent to upgrade treatment to meet the federal WSER requirements, the following effluent quality requirements will have to be met:
  - Average Annual $CBOD_5$ $\leq$ 25 mg/L;
  - Average Annual TSS $\leq$ 25 mg/L;
  - Average Annual Total Residual Chlorine $\leq$ 0.02 mg/L; and
  - Maximum Un-ionized Ammonia < 1.25 mg-N/L at 15 ^{o}C +/- 1 ^{o}C.

The Discharge Permit also notes that based on receiving environment monitoring data and/or other information obtained in connection with the discharge, additional treatment facilities may be required.

The Village of Cumberland is also required to carry out the following activities:

  - Source Control Program (Regulations for source control are contained in the new Village of Cumberland Sanitary sewer regulation Bylaw 1025)
  - Stormwater Management Plan
  - Sludge Wasting and Screening Disposal and Biosolids Management Plan
  - Inflow and Infiltration Control Program
  - Sanitary and Storm Sewer Separation Plan

13.0 SUMMARY

While the current Discharge Permit, with consideration for the federal WSER requirements, authorizes a secondary effluent quality discharge to Maple Lake Creek, such a discharge would not be capable of being authorized under current Municipal Wastewater Regulation. While existing discharges are typically grandfathered and exempted from having to meet with new regulatory requirements, the decision by the BC government to register all discharges under the harmonized Municipal Wastewater Regulation and/or increases in average annual wastewater flows greater than 10 percent of the current authorized flows of 910 m^3/d are expected to trigger a requirement for compliance with the MWR.

The MWR does not permit discharges into a surface water body where the dilutions are less than 10:1, and the summer flows in Maple Lake Creek and the Trent River primarily consist of water released from the wastewater

lagoons with dilution ratios well under the minimum 10:1 dilution. Thus continued discharge to Maple Lake Creek during the summer months would not be permissible under the MWR unless a Greater Exposure Potential reclaimed wastewater water quality was achieved, enabling the reclaimed wastewater to be reused for stream augmentation purposes without regard for dilution. This reuse water quality would also enable the reclaimed wastewater to be used for a wide range of non-potable water applications; noting that Maple Lake Creek and the Trent River could be negatively impacted by a reduction in flow as a result of significant reuse applications.

Accordingly, the following is the expected water quality criteria for the upgraded wastewater treatment process with a continued year-round discharge into Maple Lake Creek:

- Maximum $BOD_5 \leq 10$ mg/L;
- Maximum TSS $\leq$ 10 mg/L;
- Average Turbidity $\leq$ 2 NTU, Maximum Turbidity $\leq$ 5 NTU);
- Median Fecal coliform $\leq$ 1 CFU/100mL, and Maximum $\leq$ 14 CFU/100mL
- pH 6.5 – 9;
- Total phosphorus $\leq$ 1.0 mg-P/L (requirement for dilutions less than 40:1);
- Ortho-P < 0.5 mg-P/L (requirement for dilutions less than 40:1); and.
- Maximum Un-ionized Ammonia < 1.25 mg-N/L at 15 ^{o}C +/- 1 ^{o}C)

The concept of continued discharge to Maple Lake Creek of reclaimed wastewater for the purpose of stream augmentation will also require a policy change by the Ministry of Environment. The Ministry have been requiring proponents of reclaimed wastewater systems to have alternative effluent disposal options in the event reuse water quality criteria cannot be met. This policy requirement will either have to be waived by the Director, or an alternative disposal method be developed. Two alternatives are being considered later in this series of technical memos, specifically:

1. Storage with re-treatment; and
2. Sub-surface discharge into the wetlands (fens) to the north of the existing lagoons.

The latter could be considered as a routine discharge location, requiring a lower water quality level and avoiding a direct discharge to a surface water body.

The existing Discharge Permit is expected to remain in effect and deemed “Transitionally Registered” under the harmonized MWR until the treatment process can be upgraded, or the federal timeline is reached (2020, 2030, or 2040), whichever comes first. A requirement to be in compliance with the MWR will be triggered if the Village of Cumberland requests what the Ministry considers to be a Major Amendment to the Discharge Permit. The most likely condition to trigger this is an increase in the average dry weather flow in excess of the current 910 m^3/d. However, seeking authorization to reclaim wastewater for non-potable reuse applications is also expected to trigger a requirement for the discharge to be in compliance with the MWR and the discharge either registered under the MWR or an approved LWMP be in place.

Tables 4 and 5 provide a summary of the regulatory effluent and administrative requirements and

Table 4 Comparison of Regulatory Effluent Requirements

Item	Existing Discharge Permit	Federal WSER	BC MWR "Greater Exposure Potential "
BOD- TSS	< 30 mg/L (maximum)	< 25 (average)	< max 10-10
Total Phosphorus	< 1 mg-P/L	-	< 1 mg-P/L (for dilutions < 40:1) Special requirement < 0.005 mg-P/L in-stream in Trent River
Orthophosphate	-	-	< 0.5 mg-P/L (for dilutions < 40:1)
Fecal Coliforms	< 200 FCU/100mL	-	< 1 CFU/100 mL (median) < 14 CFU/100 mL (maximum)
Turbidity	-	-	<2 NTU (average) < 5 NTU (maximum
Un-ionised ammonia	-	< 1.25 mg-N/L	-
Authorised Average Dry Weather Flow	<910 m^3/day		Determined at Registration
Authorised Wet Weather Flow	< 7,600 m^3/day (to 2026) < 2,730 m^3/day (after 2026)		Determined at Registration

There are additional requirements on administration and management, as shown in Table 5. Many of these have already been done, or will be done as part of a completed LWMP

Table 5 - Comparison of regulatory administrative requirements

Item	Existing Discharge Permit	Federal WSER	BC MWR "Greater Exposure Potential "
Source Control Program	Implemented		
Stormwater Management Plan	Developed and implemented		Required
Sludge Wasting and Screening Disposal and Biosolids Management Plan	Required		Required
Inflow and Infiltration Control Program	Implemented		Required
Sanitary and Storm Sewer Separation Plan	Implemented		Required
Redundancy	Not required		Required
EOCP classification	Required		Required
Detailed Reporting	Required	Required	Required