COMOX VALLEY REGIONAL DISTRICT

LIQUID WASTE MANAGEMENT PLAN

STAGE 1 AND 2

NOVEMBER 18, 2022

FINAL

LIQUID WASTE MANAGEMENT PLAN

STAGE 1 AND 2

COMOX VALLEY REGIONAL DISTRICT

FINAL

PROJECT NO.: 18P-00276-00
DATE: NOVEMBER 18, 2022

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ACKNOWLEDGEMENT

The Comox Valley Regional District respectfully acknowledges the land on which it operates is on the unceded traditional territory of the K'ómoks First Nation, the traditional keepers of this land.

REVISION HISTORY

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Date

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EXECUTIVE SUMMARY

The Comox Valley Regional District (CVRD) owns and operates the Comox Valley Sewerage System (CVSS) which provides regional conveyance and treatment and disposal of wastewater for the City of Courtenay, Town of Comox, Department of National Defense (DND) and the K'ómoks First Nations (KFN). In 2003, the CVRD discovered significant sections of the forcemain along the foreshore below Willemar Bluff were exposed without the protective cover material due to changes in soil deposition patterns and erosion. A risk analysis of the forcemain along Willemar Bluff showed that there was a risk of pipe failure along the beach, and it was recommended that this section of the forcemain be replaced in an alternate alignment to allow the section along Willemar Bluff to be decommissioned. Concerns related to the condition of the Willemar section of the forcemain and the capacity of the pump stations led the CVRD to initiate a program with the objective of decommissioning the section of forcemain along Willemar Bluffs and developing an alternative alignment. This led to wider considerations of the optimum configuration of the conveyance system between the Courtenay Pump Station and the CVWPCC.

The CVWPCC, which was largely constructed in the 1980's, treats wastewater from approximately 20,000 households in the service area, discharging an average daily flow of about 17,000 m^3 of treated effluent to the Georgia Strait via a 3 km outfall. Upgrades will be required to improve effluent quality to meet community commitments, to increase plant capacity due to population growth, and to renew aging assets and related infrastrutre.

The focus of the conveyance assessment for the Stage 1 and 2 LWMP was to conduct an analysis of alternate conveyance concepts for the existing foreshore forcemain system between the Courtenay Pump Station and the CVWPCC. As noted above, potential future wastewater contributions from the South Region in Electoral Area A, which is currently un-serviced, were also considered; however, this work is still pending approvals from its various partners, and funding for servicing of the South Region was not developed at the time of writing this report.

To appropriately consider these regional, long-term liquid waste management planning questions, the CVRD is preparing a combined Stage 1 and 2 Liquid Waste Management Plan (LWMP) wastewater. The objectives of the LWMP process are generally fourfold:

1. It examines the long-term wastewater management needs for the whole community;
2. It is designed to be a participatory process, involving stakeholders and the public to guide decision making;
3. It acts as a written record of a community's decisions and plans for managing liquid waste; and
4. It provides borrowing authorization for the local government to implement capital projects.

This Stage 1 and 2 LWMP describes the decision-making process to achieve the following priorities for this CVRD LWMP:

1. Facilitate a decision on required upgrades to the regional conveyance system,
2. Develop options for upgrades to the Comox Valley Water Pollution Control Centre (CVWPCC) to achieve effluent quality targets and resource recovery options, and
3. Advance solutions within a rigorous framework of stakeholder and rightsholder consultation to inform each stage of decision making. Throughout each stage, decision making was advanced through the Technical and Public Advisory Committee (TACPAC), consultation with K'ómoks First Nation, and public consultation meetings.

The Stage 1 of the LWMP process was completed in 2018-2019 and included:

- A review background information, including past studies, record drawings, GIS and hydraulic models;
- Definition of service plan area, regulatory requirements, treatment standards, and design criteria;
- Public Advisory Committee (PAC) and Technical Advisory Committee (TAC) meetings were held to present and discuss the proposed work plan, roles, initial concerns and thoughts from committee members;
- Consultation with KFN on the proposed conveyance and wastewater treatment options,
- A long-list of conceptual alternative options and associated cost estimates for wastewater conveyance, treatment and resource recovery was developed;

- TACPAC review meetings were held at strategic points to present material and obtain TACPAC feedback and input;
- The long-list of options was evaluated in consultation with the TACPAC to develop a short-list of preferred options to carry forward to Stage 2 of the LWMP;
- Public consultation meetings were held to present information and obtain input from the community at large.

Stage 2 of the LWMP process was completed between 2019-2022 and included:

- Further development of the shortlisted options for wastewater conveyance, treatment and resource recovery that were carried forward from Stage 1, including more detailed technical evaluation and cost estimates;
- Short-listed options were evaluated in consultation with the TACPAC and preferred options for advancement to Stage 3 of the LWMP were identified;
- Public consultation meetings were held to present information and obtain input from the community at large;
- Consultation with K'ómoks First Nation and was held to obtain input on proposed LWMP solutions, including development of a Community Benefits Agreement; and
- Following provincial approval of combining Stages 1 and 2 of the LWMP, completion of a Stage 1 and 2 LWMP Report suitable for submission to the Ministry of Environment & Climate Change Strategy for review and approval to proceed with Stage 3 of the LWMP.

The combined Stage 1 and 2 LWMP process has resulted in the following outcomes and recommendations for further consideration in a Stage 3 LWMP:

1. The effluent discharge from the Comox Valley Water Pollution Control Centre (CVWPCC) reflects a very high performing secondary wastewater treatment facility, with effluent quality parameters well within regulatory requirements. However, the volume of the discharge chronically exceeds the allowable daily maximum of 18,500 m^3/d specified in the plant Discharge Permit No. 5856 by more than 10%; this means that a permit amendment will not be granted by the Ministry of Environment and Climate Change Strategy (MECCS). The CVRD should begin the process of applying for an Operational Certificate (OC) under the LWMP in Stage 3 of the LWMP. Effluent quality should meet the requirements of both the provincial Municipal Wastewater Regulation and the federal Wastewater Effluent Regulations (WSER).

   An updated Stage 2 Environmental Impact Study (EIS) based on the applicable discharge flow and effluent quality will be required to support the application for an Operational Certificate (OC); this and other required supporting information is listed in the Information Requirements Table Issued by the MECCS. Since the Stage 2 EIS will be based on the proposed maximum day discharge contained in the OC, it is prudent to consider using a discharge flow projected well into the future, at least to the year 2030 (45,000 m^3/d) and possibly to 2040 (51,000 m^3/d); this will avoid having to re-do the EIS for an increase in flow prematurely. To avoid paying excessive permit discharge fees in the near term, and to avoid repeated revisions to the OC to accommodate increasing flows, it may be possible to include a table in the OC that ties allowable maximum day discharge to system service population; this should be discussed with MECCS when the draft OC is developed in Stage 3 of the LWMP.

2. There has been consideration of the impacts and costs of additional wastewater flows that would result from future addition of the South Region in Electoral Area A (planned K'ómoks First Nation Development, Royston and Gartley, Kilmarnock, and Union Bay), to the service area of the Comox Valley Sewerage System (CVSS). Should the South Region eventually be included in the CVSS in the future, upgrades to the conveyance system and the CVWPCC should include these additional flows and loads based on the most up-to-date information available at the time of design. Servicing of the South Region will be subject to fair and equitable formal agreements with the system users. In the event that the South Region is not connected to the CVSS within the design horizon, this additional capacity designed into the system will extend the horizon for the next expansion of the system.

3. Several of the unit processes at the CVWPCC are operating at or in excess of design capacity, and a plant expansion will be needed in the near future. As detailed in this Stage 1 and 2 LWMP Report, the recommended

level of treatment for the next CVWPCC expansion is to maintain the current level of treatment (i.e., secondary treatment for the entire plant flow) with the addition of effluent disinfection.

A Facility Master plan is currently being completed to develop the basis of design for the plant expansion, and to develop the best site layout for long-term future expansions and upgrades to optimize the use of space on the site, considering current and future treatment requirements, odour control requirements, addition and integration of new processes in future (e.g., waste sludge digestion, advanced treatment such as effluent filtration for removal of residual suspended solids, resource recovery facilities), energy efficiency, and operational simplicity/robustness. The master planning process is considering production of reclaimed effluent for non-potable use within the treatment plant, and heat recovery from the wastewater stream for in-plant and possibly offsite use.

Before detailed design of the expansion is undertaken, the following studies should be considered:

a Undertake a business case analysis for implementation of anaerobic digestion of waste solids at the CVWPCC, incorporating potential revenue for scrubbing and sale of biogas to the local utility or cogeneration of electrical power for use within the treatment plant, as well as savings resulting from the reduced mass of solids sent to the composting facility and potential revenue from generation of fertilizer pellets from high-strength side streams associated with digestion (this could be a component of the study described above in item a). This study should also include consideration of emerging technologies designed to enhance the efficiency of anaerobic digestion (e.g., a pre-treatment step to solubilize solids in the waste sludge stream and release nutrients to solution).
b Site investigation and seismic modelling to determine if ground improvements are needed for new facilities to meet current BC Building Code requirements for post-disaster facilities.
c Asset condition assessments to determine which assets can continue in use for the long term (major equipment, concrete structures and tanks, buildings).

4 The selected approach for upgrading the wastewater conveyance infrastructure between the Courtenay Pump Station and the CVWPCC is to undertake the project in a single phase using a partial trenchless approach (Option 2) which will include the following infrastructure components:

a Replacement of the existing Courtenay Pump Station with a new Courtenay Pump Station;
b Upgrades to the existing KFN IR1 Pump Station and new return forcemain to the new Courtenay Pump Station;
c A new forcemain from the new Courtenay Pump Station to the Town of Comox using cut and cover installation;
d New forcemain through the Town of Comox using cut and cover installation;
e Upgrades to the existing Jane Place Pump Station and a new forcemain connection;
f New forcemain from the Town of Comox to the CVWPCC using primarily trenchless installation.

This approach has been selected to address the project key issues including replacing the section of forcemain along Willemar Bluff, addressing capacity constraints in the Courtenay and Jane Place Pump Stations, reducing pumping head and energy consumption over the long-term, and optimizing capital and operating costs. It is recommended that the conveyance infrastructure be brought to the CVWPCC at the highest possible elevation to improve CVWPCC and outfall hydraulics.

5 In February 2021, the Comox Valley Sewage Commission approved the 'breaking out' of the wastewater conveyance scope from the LWMP process to fast track its implementation. The CVRD entered an Alternate Approval Process (AAP) to obtain authorization for borrowing to finance the conveyance infrastructure upgrades described in Item 4 above. The AAP was conducted between May and July 2021, and borrowing was approved on July 8, 2021.

6 The effluent outfall from the CVWPCC was originally constructed in 1982, making it nearly 40 years old. The marine section of the outfall is a steel pipe encased in concrete in areas where it is not buried in the seabed. Inspections of the outfall have revealed surface corrosion and some areas where the concrete encasement has separated from the pipe. The capacity of the outfall is a concern during high tide/high wastewater flow

conditions. An effluent storage basin and pumping station are currently in use to prevent overflows, but there are concerns that increasing wastewater flows may lead to overflows. Upgrading or replacement of the outfall will be required by the year 2030. An assessment of outfall upgrade options carried out during the Stage 1 and 2 LWMP shows that an outfall pipe sized to handle all effluent flows by gravity to a design horizon of the year 2060 would not be economical, and that a new outfall pipe (larger than the existing) with pumped assistance and/or temporary storage to deal with peak flows and high tide conditions is the recommended solution.

7 Once this draft Stage 1 and 2 LWMP Report has been finalized, the CVRD should submit the report to the Ministry of Environment and Climate Change Strategy (MoECCS) for review and approval to proceed with Stage 3 of the LWMP.

1 INTRODUCTION

1.1 BACKGROUND

The Comox Valley Regional District (CVRD) owns and operates the regional conveyance and treatment of domestic wastewater, serving the City of Courtenay, Town of Comox, K'ómoks First Nation, and the Department of National Defence. This infrastructure resides upon the unceded traditional territory of the K'ómoks First Nation. Wastewater is conveyed from these communities to the Comox Valley Water Pollution Control Centre (CVWPCC), where it receives secondary treatment followed by outfall discharge to open marine waters in the Strait of Georgia near Cape Lazo. The layout of the system is illustrated on Figure 1.1.

Figure 1-1: Comox Valley Sewerage System

A combined gravity and pressurized wastewater conveyance system serves the north sections of the service area; this consists of various gravity trunks, and the Canadian Forces Base Comox (CFB) pump station, which connects to the CVWPCC. The conveyance system on the south side of the service area includes four pump stations (PS). The Courtenay PS conveys collected wastewater from the City of Courtenay to the CVWPCC eastward along Comox Road and Bayside Road before routing into the foreshore. The Jane Place PS, which receives collected wastewater from the Town of Comox, ties directly into concrete forcemain from the Courtenay PS. The forcemain makes a turn northward at Goose Spit across Hawkins Road and continues on the foreshore along Willemar Bluffs to the CVWPCC. The K'ómoks First Nation PS is relatively small and connects directly to the forcemain approximately mid way between the Courtenay and Comox PS. The HMCS Quadra PS connects to the forcemain at the four-way stop at the top of Hawkins Road, ahead of Willemar Bluffs.

In 2003, the CVRD discovered significant sections of the forcemain along the foreshore below Willemar Bluff were exposed without the protective cover material due to changes in soil deposition patterns and erosion. A risk analysis of the forcemain along Willemar Bluff showed that there was a risk of pipe failure along the beach, and it was recommended that this section of the forcemain be replaced in an alternate alignment to allow the section along Willemar Bluff to be decommissioned. Concerns related to the condition of the forcemain led the CVRD to initiate a plan for an intermediate pump station and overland forcemain to bypass the section along Willemar Bluff. Consideration of how the new pump station and forcemain would fit the long-term plans for conveyance of wastewater within the region, and the fact that the entire forcemain was in the later stages life, led to expansion of the planning picture to include the entire conveyance system between the Courtenay PS and the CVWPCC.

The CVWPCC, which was largely constructed in the 1980's, treats wastewater from approximately 20,000 households in the service area, discharging an average daily flow of about 17,000 m^3 of treated effluent to the Georgia Strait via a 3 km outfall. The CVWPCC is a Class IV treatment facility that includes primary and secondary treatment prior to outfall discharge. Waste solids generated by primary and secondary treatment are dewatered and transported to an offsite composting facility. A capacity assessment of the CVWPCC and outfall was completed in 2016; phased upgrades to the plant were assessed, to increase capacity to accommodate future growth, and to replace outdated equipment. A portion of the recommended upgrades, such as improving the odour control system and construction of an equalization basin, have been completed. The remainder of the recommended upgrades for the CVWPCC have yet to be undertaken.

To develop a long-term plan for upgrades to both the conveyance system and the CVWPCC, the CVRD elected to undertake completion of a Liquid Waste Management Plan (LWMP), which includes technical and public input through the decision-making stages. For the CVRD LWMP, the initial priority was to facilitate a decision on needed upgrades to the wastewater conveyance system, including replacement of the forcemain sections between the Courtenay PS and the CVWPCC, and in particular along the foreshore below Willemar Bluffs. Options for upgrades to the CVWPCC to achieve regulated and optional enhanced effluent quality targets, as well as resource recovery options, were also included.

The LWMP process is generally fourfold:

1. It examines the long-term wastewater management needs for the whole community.
2. It is designed to be a participatory process, involving stakeholders and the public to guide decision making.
3. It acts as a written record of a community's decisions and plans for managing liquid waste.
4. It provides borrowing authorization for the local government to implement capital projects.

The scope of work for the Stage 1 and 2 CVRD LWMP is outlined below. The provincial 2011 Interim Guidelines for Preparing Liquid Waste Management Plans were used in scoping and conducting this work.

1.2 SCOPE OF WORK FOR STAGE 1 LWMP

The following tasks were completed during Stage 1 of the LWMP:

— review background information, including past studies, record drawings, GIS and hydraulic models;

— define service plan area, regulatory requirements, treatment standards, and design criteria;

— hold Public Advisory Committee (PAC) and Technical Advisory Committee (TAC) meetings to present and discuss the proposed work plan, roles, initial concerns and thoughts from committee members;

— develop a long-list of conceptual alternative options and associated cost estimates for wastewater conveyance, treatment and resource recovery;

— hold TAC and PAC review meetings at strategic points to present material and obtain TACPAC feedback and input;

— evaluate long-list options in consultation with the TACPAC to develop a short-list of preferred options to carry forward to Stage 2 of the LWMP;

— hold public consultation meetings to present information and obtain input from the community at large; and

— consult with the K'ómoks First Nation and obtain input on proposed LWMP solutions.

1.3 SCOPE OF WORK FOR STAGE 2 LWMP

The following tasks were completed during Stage 2 of the LWMP:

- further develop the shortlisted options for wastewater conveyance, treatment and resource recovery that were carried forward from Stage 1, including more detailed technical evaluation and cost estimates;
- evaluate short-listed options in consultation with the TACPAC and identify preferred options for advancement to Stage 3 of the LWMP;
- hold public consultation meetings to present information and obtain input from the community at large;
- consult with K'ómoks First Nation and obtain input on proposed LWMP solutions; and
- following provincial approval of combining Stages 1 and 2 of the LWMP, produce Stage 1 and 2 LWMP Report suitable for submission to the Ministry of Environment & Climate Change Strategy for review and approval to proceed with Stage 3 of the LWMP.

1.4 ACKNOWLEDGEMENTS

This LWMP planning process was the result of several years of dedicated effort. The following people were instrumental in managing the planning process, managing the community consultation, and providing information on existing and planned land use, infrastructure and population growth.

- Kris La Rose, Senior Manager of Water/Wastewater Services
- Zoe Berkey, Project Engineer
- Mike Imrie, Manager of Wastewater Services
- Adem Idris, Engineering Analyst
- Marc Rutten, General Manager of Engineering Services
- Russell Dyson, Chief Administrative Officer
- Christianne Wile, Manager of Operational Communications
- Jenna Boguski, Branch Assistant – Engineering Services
- Paul Nash, LWMP Project Coordinator
- Allison Habkirk, Facilitator

The members of the Technical and Public Advisory Committee (TACPAC) are acknowledged for their dialogue, guidance, and recommendations throughout this process:

- Bryan Vroom, Ministry of Environment and Climate Change
- Catriona Weidman, Ministry of Municipal Affairs and Housing
- Dave Cherry, Vancouver Island Health Authority
- Pam Kumar, Vancouver Island Health Authority
- Ella Derby, Vancouver Island Health Authority
- Gary Anderson, Vancouver Island Health Authority
- Carol McColl, K`ómoks First Nation
- Monty Horton, K`ómoks First Nation
- Ryan O'Grady, City of Courtenay Engineering
- Trevor Kushner, City of Courtenay Engineering
- Shelley Ashfield, Town of Comox Engineering
- Craig Perry, Town of Comox Engineering
- Gord Bonekamp, Department of National Defence

- Amanda Gaudet, Department of National Defence
- Alexandra Bissinger, Department of National Defence
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- David Frisch, City of Courtenay Elected Official
- Maureen Swift, Town of Comox Elected Official
- Ken Grant, Town of Comox Elected Official
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- Mary Lang, Area B Resident Representative (Croteau Beach Neighborhood)
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2 PUBLIC, RIGHTSHOLDER, AND STAKEHOLDER CONSULTATION

2.1 ADVISORY COMMITTEE MEETINGS

The Technical Advisory Committee (TAC) and Public Advisory Committee (PAC) were established in June 2018 to provide technical and public engagement input to the LWMP process.

The TAC consists of eight agencies and other rightsholders and stakeholders, including the Ministry of Environment and Climate Change Strategy (MoECCS), Ministry of Municipal Affairs and Housing, Vancouver Island Health Authority, Department of Fisheries and Oceans Canada, K'ómoks First Nation, City of Courtenay Engineering, Town of Comox Engineering, and the Department of National Defence. Input from the TAC is intended to provide third-part recommendations on infrastructure planning and development.

The PAC consists of City of Courtenay elected officials, Town of Comox elected officials, Electoral Area B Director, CV Conservation Strategy Community Partnership, Comox Valley Chamber of Commerce, BC Shellfish Growers Association, Comox Business Improvement Association, and resident representatives from Courtenay, Comox, and Area B.

A total of thirteen TACPAC/TAC Only meetings were held. The meetings were conducted at regular intervals with the exception of the time between TACPAC Meeting No.9 and No.10 as a result of the Covid-19 pandemic. During this time, the LWMP process continued to advance based on prior recommendations from the TACPAC and decision making on the preferred option was delayed to TACPAC Meeting No.10. Minutes of the TACPAC meetings are attached in Appendix A.

Figure 2-1: Public and TACPAC Engagement

2.1.1 ADVISORY COMMITTEE MEETINGS

JOINT TACPAC MEETING NO.1 – NOVEMBER 13, 2018

- Presentations and Discussions:
- Overview of the LWMP process
- Roles and expectations
- Program schedule

Outcomes and Decisions:

- TACPAC members familiarized with the LWMP process
- Initial questions answered

JOINT TACPAC MEETING NO.2 – NOVEMBER 23, 2018

Presentations and Discussions:

- Fundamentals of wastewater treatment
- Regulatory framework and treatment standards
- Phase 1 public consultation results and Phase 2 plan
- Committee and LWMP Goals and Evaluation Matrix

Outcomes and Decisions:

- Preliminary committee and LWMP Goals drafted
- Tour of the CVWPCC scheduled

JOINT TACPAC MEETING NO.3 – DECEMBER 11, 2018

Presentations and Discussions:

- Planning horizons for Conveyance, Wastewater Treatment, and Resource Recovery
- Public feedback on the Goals
- Goals and evaluation matrix weighing
- Conveyance-specific Goals and Evaluation Matrix weighing

Outcomes and Decisions:

- Goals and the Evaluation Matrix weightings for Conveyance finalized
- Finalization of the Goals and the Evaluation Matrix weightings for Wastewater Treatment and Resource Recovery deferred to the next meeting
- Tour of the Compost Facility scheduled

JOINT TACPAC MEETING NO.4 – JANUARY 24, 2019

Presentations and Discussions:

- Wastewater Treatment-specific Goals and Evaluation Matrix weighing
- Resource Recovery-specific Goals and Evaluation Matrix weighing
- Operational Update regarding the wet weather flows in December 2018 and January 2019
- Technical Update on understanding dry and wet weather flows for wastewater planning
- Wastewater Treatment Stage 1 long list options presentation
- Resource Recovery Stage 1 long list options presentation

- Conveyance Stage 1 long list options presentation

Outcomes and Decisions:

- Goals and the Evaluation Matrix weightings for Wastewater Treatment finalized
- Goals and the Evaluation Matrix weightings for Resource Recovery finalized
- TACPAC noted the consultant's recommendation to eliminate Option 5 and 6 of the Conveyance Stage 1 long list options from further consideration
- Wastewater Treatment, Resource Recovery, and Conveyance Stage 1 long list options approved by the TACPAC to be advanced to public review

JOINT TACPAC MEETING NO.5 – FEBRUARY 8, 2019

Presentations and Discussions:

- Reclaimed water as an option for Resource Recovery
- Service Area scope
- Elimination of options 1A, 1B, 1C, 2B, and 6 of the Conveyance Stage 1 long list options from further consideration
- Revision of Option 4 to create options 4A and 4B to include other street alignments
- Elimination of the hydroelectric turbine option of the Resource Recovery Stage 1 long list options from further consideration

Outcomes and Decisions:

- Option 6 of the Conveyance Stage 1 long list options eliminated from further consideration
- Conveyance Stage 1 long list Options 1 through 5, including all their variants, approved by the TACPAC to be forwarded to the Comox Valley Sewage Commission
- Wastewater Treatment Stage 1 long list options approved by the TACPAC to be forwarded to the Comox Valley Sewage Commission
- Resource Recovery long Stage 1 list options approved by the TACPAC to be forwarded to the Comox Valley Sewage Commission
- Decisions to hold a separate TAC only special meeting ahead of TACPAC meeting No.6 to facilitate in-depth technical discussions of the options

TAC ONLY SPECIAL MEETING NO. 6A – MARCH 21, 2019

Presentations and Discussions:

- Prioritization of the Conveyance scope throughout the remainder of the LWMP process
- Conveyance Stage 1 long list options operational considerations, capital and operation costs, and other technical considerations
- Preliminary evaluation of technical and affordability criteria of the Conveyance Stage 1 long list options

Outcomes and Decisions:

- Technical and affordability criteria were evaluated for the long list of conveyance options. This was used as input to the TACPAC conveyance evaluation in Meeting No. 6

JOINT TACPAC MEETING NO.6 – MARCH 22, 2019

Presentations and Discussions:

- Prioritization of the Conveyance scope throughout the remainder of the LWMP process
- Early separation of the Conveyance scope from the LWMP upon finalization of the preferred option

- K'ómoks First Nation consultation and the next steps in obtaining support
- In-depth discussion and review of the Conveyance Stage 1 long list options
- TAC Only Special meeting preliminary evaluation of the technical and affordability criteria of the Conveyance Stage 1 long list options
- Evaluation of the Conveyance Stage 1 long list options using the evaluation matrix
- Advancement of Conveyance Stage 1 long list Options 2A, 3A, 3B and 3C, and 4A to the Stage 2 short list

Outcomes and Decisions:

- Conveyance Stage 1 long list Option 2A advanced as the Stage 2 short list for the Sewage Commission's approval
- Conveyance Stage 1 long list Options 3A, 3B and 3C, combined into one optimized option and advanced to the Stage 2 short list
- Conveyance Stage 1 long list Option 4A not advanced to the Stage 2 short list due to its low weighing score; opposition from some TACPAC members noted

JOINT TACPAC MEETING NO.7 – SEPTEMBER 30, 2019

Presentations and Discussions:

- K'ómoks First Nation consultation and the next steps in obtaining support
- Archeological considerations and requirements
- Wastewater Treatment technical memorandums: Overview of Microplastics, Emerging Contaminants, and Viruses in Wastewater
- Trenchless installation overview

Outcomes and Decisions:

- TACPAC members familiarized with archeological requirements
- TACPAC members familiarized with trenchless installation benefits and risks
- TACPAC members familiarized with Microplastics, Emerging Contaminants, and Viruses in Wastewater

JOINT TACPAC MEETING NO.8 – DECEMBER 5, 2019

Presentations and Discussions:

- K'ómoks First Nation Archeology
- Responsibility of the TACPAC members in the LWMP process
- In-depth discussion and review of the Wastewater Treatment Stage 1 long list options

Outcomes and Decisions:

- Selection of the Wastewater Treatment Stage 2 short list deferred to TACPAC meeting No.9

JOINT TACPAC MEETING NO.9 – MARCH 4, 2020

Presentations and Discussions:

- Conveyance Stage 1 long list and Stage 2 short list options update
- In-depth discussion and review of the Wastewater Treatment Stage 1 long list options
- Evaluation of the Wastewater Treatment Stage 1 long list options using the evaluation matrix
- Advancement of Wastewater Treatment Stage 1 long list Option 2 as the preferred level of treatment to the Sewage Commission, with consideration given to implement Option 3 or Option 4 if and when required or desired
- Dissenting opinions on the advanced Wastewater Treatment Stage 1 long list option preferred level of treatment

- In-depth discussion and review of the Resource Recovery Stage 1 long list options
- Commitment regarding review of Resource Recovery options which may be non-viable at this point but could prove viable in the future

Outcomes and Decisions:

- Conclusion reached to maintain not advancing Conveyance Stage 1 long list Option 4A to the Stage 2 short list due to its low weighing score through further discussions with the K'ómoks First Nation
- K'ómoks First Nation approved consideration of the Conveyance Stage 2 short list options
- Analysis and business case assessment to be undertaken for reclaimed water use at the CVWPCC prior to finalization of the Resource Recovery preferred option
- Wastewater Treatment Stage 1 long list Option 2 advanced as the preferred level of treatment for the Sewage Commission's approval, with consideration given to implement Option 3 or Option 4 if and when required or desired

JOINT TACPAC MEETING NO.10 – SEPTEMBER 28, 2020

Presentations and Discussions:

- Orientation on virtual attendance
- Impacts of Covid-19 pandemic on the LWMP process assessments and consultation plan
- LWMP process update since TACPAC Meeting No.9
- Implementation process
- Conveyance Stage 1 long list options presentation; including hydrogeological and groundwater impacts, and Horizontal Directional Drilling (HDD) considerations
- In-depth discussion and review of the Conveyance Stage 2 short list options

Outcomes and Decisions:

- Reclaimed water Resource Recovery analysis and business case assessment delayed
- Developed an approach to fully reflect the cost impacts for the Conveyance Stage 2 short list phased option

TAC ONLY SPECIAL MEETING NO. 10A – SEPTEMBER 30, 2020

Presentations and Discussions:

- Conveyance Stage 2 short list options operational considerations, capital and operation costs, and other technical considerations
- Joint TACPAC meeting preliminary evaluation of the Conveyance Stage 2 short list options
- Evaluation of technical criteria of the Conveyance Stage 2 short list options

Outcomes and Decisions:

- Technical criteria were evaluated for the Conveyance Stage 2 short list.

JOINT TACPAC MEETING NO.11 – OCTOBER 27, 2020

Presentations and Discussions:

- Public engagement process and results to date.
- Cumulative cost impacts to residents for the various Conveyance Stage 2 short list options.
- Update on the Community Benefit Agreement (CBA) with the K'ómoks First Nation and the impact.
- TAC Only Special meeting preliminary evaluation of the technical criteria of the Conveyance Stage 2 short list options.
- In-depth discussion and review of the Conveyance Stage 2 short list options.

- Evaluation of the Conveyance Stage 2 short list options using the evaluation matrix.
- Elimination of Conveyance Stage 2 short list Option 1 from further consideration.
- Advancement of Conveyance Stage 2 short list Option 2 and Option 3 as the preferred conveyance options to the Sewage Commission.

Outcomes and Decisions:

- K'ómoks First Nation no longer to attend TACPAC meetings moving forward and remain apprised of the project through regular Chief and Council meetings.
- Conveyance Stage 2 short list Option 2 and Option 3 as preferred conveyance options for the Sewage Commission's consideration, selection, and approval.

2.2 CONSULTATION WITH THE K'ÓMOKS FIRST NATION

The CVRD is committed to upholding the principles of the United Nations Declaration on the Rights of Indigenous Peoples and practice meaningful engagement on all projects that impact the lands and waters of the K'ómoks peoples.

The current and planned sewer infrastructure impacted by the Comox Valley Sewer Service's Liquid Waste Management Plan (LWMP) is located in the unceded traditional territory of the K'ómoks First Nation (KFN). Importantly, the preferred conveyance route identified through this planning process incorporates existing conveyance and pump station rights of ways (ROW) that run through K'ómoks Reserve No. 1 (IR1) and includes culturally and archaeologically sensitive lands. Two points are essential to highlight in this summary.

It is the position of KFN that the Conveyance ROW and Pump Station ROW were granted by the Government of Canada without sufficient consultation and accommodation of interests of the KFN.

For thousands of years Indigenous peoples have occupied the lands in the Comox Valley. The CVRD will work with the KFN to protect archaeologically sensitive areas during construction in an effort to preserve cultural heritage sites, ancestral burial practices and artifacts.

Consultation with the K'ómoks First Nation has been a separate and distinct process occurring in parallel with engagement through the Technical and Public Advisory Committee, on which the KFN appointed a representative.

Through the Comox Valley Regional District's established process with KFN Chief and Council, regular updates have occurred at both the political and staff level on the Liquid Waste Management Plan. CVRD staff presented scenarios under consideration by the Technical and Public Advisory Committees, including the long list and short list of options for both treatment and conveyance to obtain essential feedback to be considered in development of the plan and respond to and mitigate concerns identified by the KFN.

The CVRD project team and elected representatives met with Chief and Council to discuss the LWMP project at five meetings in 2019 and five meetings in 2020. On December 15, 2020, the KFN and the CVRD together ratified a Community Benefit Agreement committing both parties to work together collaboratively on a regional solution for conveyance (see Appendix N). The agreement provides for the needed upgrades for regional conveyance infrastructure, while supporting the growth and economic development plans of the K'ómoks community.

Following the ratification of the agreement, the CVRD and KFN came together for an additional seven meetings in 2021 and three meetings from January through April 2022. The KFN provided a letter of endorsement for the LWMP (see Appendix M). Collaboration continues to occur on the Comox Valley Sewer Conveyance Project as a separate and distinct process from LWMP.

2.3 PUBLIC CONSULTATION

Public engagement is key to the management planning process and a public consultation plan was received by the Sewage Commission in spring 2018. The Public Consultation Plan and the summary reports for each of the public consultation phases are attached in Appendix A.

The public consultations for the Stage 1 and Stage 2 combined LWMP process included four phases to date. The following principles guided public consultation throughout the LWMP process:

- Follow IAP2 Spectrum of Public Participation – This acknowledged best practice of public engagement (inform, consult, involve, collaborate, empower) will guide consultation.
- Meet provincial LWMP Requirements– The specific requirements of the LWMP process ensure meaningful input is sought from the public – these will guide consultation plans.
- Support the Work of the LWMP Technical Consultant/Engineer - Public consultation will support and align with the efforts of the technical consultant.
- Demonstrate transparency and competency in planning – By openly sharing information and working through planning and decision-making processes with interested and affected parties (IAPs).
- Offer options for community involvement– By using a range of tools, the public will be able to engage in a method that suits them.

The objectives of the public consultation were to:

- Provide information about the process of engagement and tools to be used.
- Offer opportunities for active public involvement.
- Clearly explain how feedback will be received and considered.
- Create a record of engagement at the end of the process
- Demonstrate how engagement was considered and how input influenced final decisions

The consultation methods and tools used included:

- Ongoing
  - Project Website
  - Online Consultation/Discussion Forum
  - Social media
  - Public Advisory Committee (PAC)
  - Phone/Email Logs and Comment Sheets
  - Traditional media
- Milestone-specific
  - Open Houses and Public Events
  - Promotional Materials
  - Informational Materials
  - Newsletters

2.3.1 PHASE 1

The first phase of the plan was implemented from June to August 2018 and focused on educating the public about the sewer system and the planning process. It collected foundational feedback about community values for sewer system planning and included the following tactics:

- *Advertising:* Promotional "Let's Talk Poop" ads were developed and published to draw attention to the process and the online hub for updates and engagement.
- *Facilitated Sessions:* In mid-June, participants were invited to work together on an interactive activity that saw them prioritize values in sewer service decision making, as part of a two-part workshop led by professional facilitator Allison Habkirk.
- *Online Consultation:* The ConnectCVRD project page was launched with both general information and a structured survey that mimicked the exercise followed in the facilitated sessions.

Despite a challenging time of year for outreach (summer), the results of these were generally good. They included over 1,600 visits to the ConnectCVRD page, and roughly 150 active participants in the values exercise through both the online and in-person components.

Themes of feedback include the importance of the environment in decision making and a keen interest in seeing long-term plans created and followed. There was strong interest by those who have participated to remain involved through future stages of outreach.

2.3.2 PHASE 2

The second phase of the plan was implemented from September to December 2018 and focused on introducing the LWMP process, educating about the sewer service, and collecting feedback on draft goals and objectives developed by the (then) newly created public and technical advisory committees.

To achieve these goals, multiple tools were used, each designed to maximize the opportunity to engage the community which included:

- *Open Houses:* Two open house events were held at the Comox Valley Water Pollution Control Centre (treatment plant) with roughly 120 attending to learn more about the existing sewer system and about the planning process getting underway.
- *Facilitated Sessions:* In late November, following initial meetings by advisory committees, two facilitated sessions were held (one in Comox, one in Courtenay) to collect feedback/input on draft goals and objectives. That input was put back to the committees for review before final goals and objectives were set.
- *Online Consultation:* To supplement the facilitated sessions, a survey was created on ConnectCVRD to mimic the feedback process at the in-person events. An online ad campaign was implemented todraw audiences to the online engagement tool.

From October through December 2018, approximately 662 residents visited ConnectCVRD to learn more about the process and 160 residents provided direct feedback on the goals and objectives through the open house, workshops or online survey.

Themes of feedback included general support for the goals and objectives outlined by the TAC/PAC, and eagerness to know about long-term plans for the sewer system.

2.3.3 PHASE 3

The third phase of the plan was implemented in January 2019 and focused on providing information the public about the ideas on the Stage 1 long list. Residents were also asked about any options that may have been missed. This feedback was important to ensure that technical consultants are assessing all possible options to help the advisory committees form a short list.

Two key tools were used to complete this stage of work:

- *Information Sessions:* Two events were held (one at K'ómoks Community Hall and the other at Rotary Hall – lower Filberg Centre in Courtenay). These included a series of informational displays providing overviews of the options, an informational handout with more technical details and representation from technical experts to provide information and answer questions.
- *Online Consultation:* To supplement the information sessions, a survey was created on ConnectCVRD to mimic the feedback process at the in-person events. An online ad campaign was implemented to draw audiences to the online engagement tool.

The results of this outreach included interaction with roughly 160 people through both the online and in-person components. About 75 of those were actively engaged – attending an event or submitting a survey online.

Themes of feedback included a focus on protecting the foreshore, interest in high treatment standards, and continued concern with the any option that includes a Comox No. 2 pump station.

The long list was also presented to K'ómoks First Nation Chief and Council. KFN is in support of the objective of the LWMP but is opposed to any options involving a forcemain to be installed along the foreshore, or within the inter-tidal zone, due to the high cultural value of the area. Chief and Council also indicated a preference for UV disinfection of treated effluent to minimize the potential for contamination to Baynes Sound.

The summary report attached in Appendix A.

2.3.4 PHASE 4

In April 2020, the engagement process and public consultation was suspended due to the Covid-19 pandemic. In September 2020, the CVRD relaunched its public consultation on the LWMP process.

The fourth phase of the plan was implemented from September to December 2020 and focused on providing information the public about the ideas on the Stage 2 short list, providing costs per household, and receiving feedback from the public on the options.

To achieve these goals, multiple tools were used, each designed to maximize the opportunity to engage the community as well as provide information requested from the public, which included:

- *Virtual and In Person Open Houses:* Four open house events were held – one virtual session in late September, and three in person sessions in early October.
- *Webinar on Groundwater:* A webinar was held on groundwater to answer questions from Lazo Area residents about how groundwater will be protected during the installation and operation of a new conveyance system.
- *Online Consultation:* To supplement the facilitated sessions, a survey was created on ConnectCVRD to mimic the feedback process at the in-person events. An online ad campaign was implemented to draw audiences to the online engagement tool.

The summary report attached in Appendix A.

2.3.5 PHASE 5

As a final phase to the Comox Valley Sewer Service's Liquid Waste Management Plan (LWMP) multi-stage public consultation process, the Comox Valley Regional District (CVRD) provided a report back to the community in the spring of 2022.

This report-back provided details to the public about the Stage 1 and 2 Draft Plan, as well as insight into how community input was considered hand-in-hand with technical evaluations to inform decisions and next steps and ultimately helped determine outcomes and decisions for moving forward.

The CVRD also used the opportunity to inform residents about the next steps for the Sewer Conveyance Project, which is derived from the LWMP planning process. Community updates took place during the month of April, with the following key outreach tools:

- **Information session:** A public open-house event in compliance with COVID-19 protocols was held at the Comox Rec Centre.
- **Online webinar:** For those not comfortable attending an in-person event, and to offer a guided-learning format, an online webinar was also held via ZOOM.
- **Website updates:** Event information (before and after) was posted to the dedicated project web page where background resources are available, along with FAQs, timelines, route maps, etc.

The participation results of this phase were the result of extensive outreach using a variety of methods including a press release, social media, print and radio ads. Roughly 40 participants were in attendance at the in-person open house, with 25 participants attending the online webinar.

In general, the CVRD heard support for the final plan, with interest in next steps for construction planning on the Sewer Conveyance Project, and questions about specific impacts of that work.

The summary report attached in Appendix A.

2.3.6 ADDITIONAL COMMUNITY ENGAGEMENT

Upon completion of the public consultation component of the Liquid Waste Management Plan, the community was informed about the following key milestones to move the plan forward:

- **December 8, 2020:** Sewage Commission approval of the preferred treatment and resource recovery option.
- **February 24, 2021:** Sewage Commission approval of the preferred option for conveyance.
- **March 9, 2021:** Sewage Commission introduction of a loan authorization bylaw for the sewer system conveyance project and approval of the proposed alternative approval process logistics. The AAP was subsequently successful, and the project is branded the Comox Valley Sewer Conveyance Project to ensure future communications are delivered under the new project banner.

Engagement with Lazo Area residents who are concerned about groundwater impacts from the tunnelled portion of the conveyance route continues. A total of six information sessions have been held from September 2020 (as part of the LWMP consultation) through February 2022 (under the new Comox Valley Sewer Conveyance Project) to respond to concerns from the community.

Information sessions to share the long-term plan for sewer services, including a summary of the LWMP process, the final route for the Sewer Conveyance Project and planned future upgrades at the Sewage Treatment Plant, occurred on April 4 and 13, 2022. These sessions highlighted how the Liquid Waste Management Plan will protect the beaches and waters throughout the Comox Estuary, Point Holmes, Goose Spit coastline and Baynes Sound. It explained the next steps to close out the public engagement on the LWMP, including the upcoming submission of Draft 2 of the plan. Based on feedback from the province, the plan will be revised, and the third draft will be shared with the community and then submitted for final approval, which is likely to occur in Spring 2024. Concurrently, engagement for the planning and construction of the Comox Valley Sewer Conveyance Project will be taking place through the remainder of 2022 and 2023. While this project is now proceeding separately from the LWMP, the conveyance solution formed a key part of the LWMP consultation process. Key messaging will be important moving forward for residents to understand how their input factored into the decisions that have been made regarding the chosen route and technology for the conveyance project.

3 SERVICE AREA, LAND USE, DEVELOPMENT, AND POPULATION GROWTH

3.1 SERVICE AREA

The CVRD operates and maintains the sewerage system for the Comox Valley Sewerage Service (CVSS) for the following municipalities and communities:

- City of Courtenay;
- Town of Comox;
- K'ómoks First Nation; and
- Department of National Defence.

The local collection systems are owned and operated by the contributing entities and are not part of the CVSS. The CVSS system and service area is shown on Figure 1-1 in Section 1 of this report.

3.2 DEVELOPMENT AND OFFICIAL COMMUNITY PLANS

In order to properly plan for wastewater facilities, it is necessary to project future land use and populations within the Plan area. The Provincial Guidelines for Preparing a Liquid Waste Management Plan (LWMP) require that the Official Community Plan (OCP) completed by the municipal or regional government(s) form the basis of the LWMP. The LWMP should then be incorporated as part of the OCP.

The Comox Valley encompasses a larger area than that served by the CVSS and CVWPCC. As a whole, the population of the Comox Valley in 2010 was approximately 63,700 people, with roughly 65% living in urban areas and 35% living in rural areas. Estimates conducted in 2010 projected the population in the Comox Valley to increase to 88,500 by 2030, a 20-year horizon from the time the study was conducted.

While each of the contributing municipalities and communities has its own OCP, the CVRD established the Comox Valley Regional Growth Strategy Bylaw No. 120, 2010 to address growth in the Comox Valley over a 20-year horizon to 2030, and to promote coordination between the municipalities and regional district on issues related to regional growth, such as housing and shared infrastructure as well as other land use activities and development. The Regional Growth Strategy encourages individual member municipalities and communities to develop or update their own OCPs to align with the Regional Growth Strategy and its supporting policies, and to ensure that related policies are incorporated. The CVRD itself has an OCP. However, this OCP is focused on rural areas and therefore does not overlap with the LWMP area.

Based on the Regional Growth Strategy, there exists a growing housing demand throughout the Comox Valley in both urban and rural settings. It is estimated that an additional 10,000 homes will be required by 2030, based on population projections at an annual growth rate between 1% and 1.4% to 2030. Consequently, approximately 500 new dwellings per year will be required to account for the increased population, taking into account the current and projected demographics of the Comox Valley.

In order to plan for future growth, the Regional Growth Strategy identified the following four land use designations that target varying housing, amenity, and development densities and intensities, collectively referred to as Core Settlement Areas:

- Existing Municipal Areas – target higher density and intensive development within existing jurisdictional borders which may require infilling and redevelopment;
- Town Centres – target a minimum of one Town Centre in each of the City of Courtenay, Town of Comox, and Village of Cumberland that are developed as walkable and complete communities providing a range of housing types focussing on medium and high-density housing, employment, and commercial uses;
- Settlement Nodes – target densification and intensification, but to a lesser degree than Municipal Areas, and which include centres that are walkable and housing that focusses on low and medium density – these nodes are areas where there is planned growth to accommodate urban forms of development, but they are not contiguous with Municipal Areas; and
- Settlement Expansion Areas – areas of potential future growth that will occur in a phased and orderly manner and will be subject to a public planning process to determine the appropriate scale and form of development.

In order to achieve some of the growth targets within the Comox Valley, the Regional Growth Strategy developed supporting policies that target specific growth based on housing densities that vary with the development area. Figure 3-1 illustrates land use designations for the portion of the CVRD contributing to the CVSS.

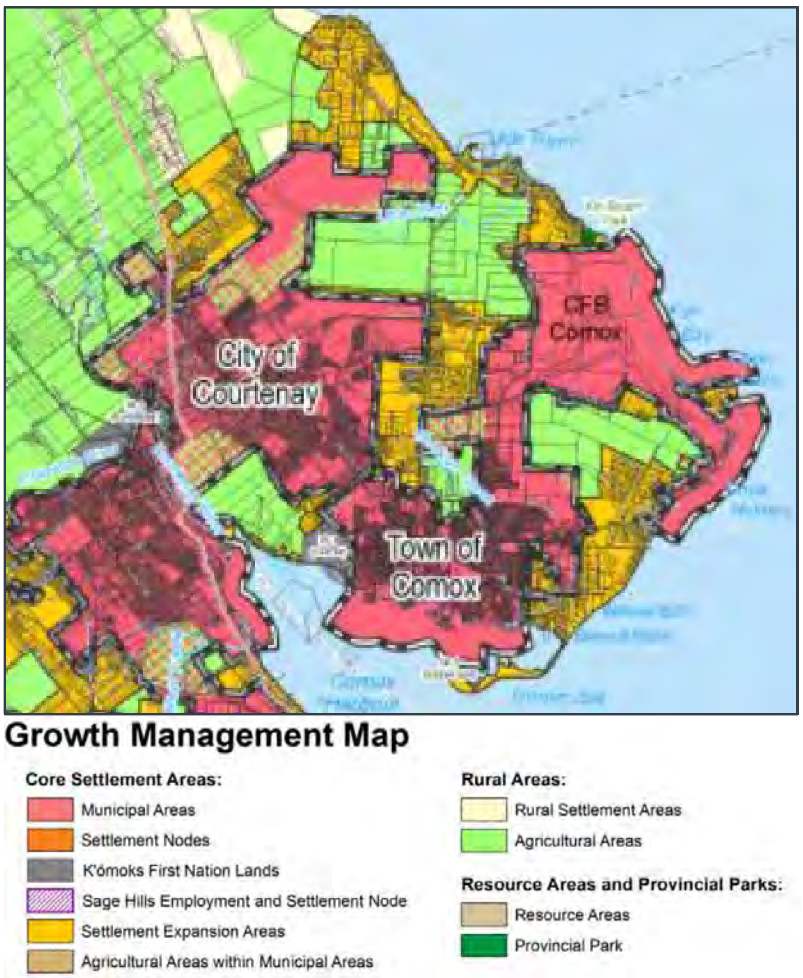

Figure 3-1: Growth Management Map Illustrating Growth and Land Use Designations in the CVSS Service Areas (CVRD RGS, 2010)

3.3 CVWPCC POPULATION PROJECTIONS

Population projections were developed for the purposes of estimating future capacity requirements for the liquid waste infrastructure. Population growth for the CVWPCC service area was projected based on expected growth rates for the area. Current service areas for the CVWPCC include the City of Courtenay, the Town of Comox, Department of National Defence Canada (CFB Comox and HMCS Quadra) and K'ómoks First Nation (KFN). Historical populations for the City of Courtenay and the Town of Comox (includes KFN) were obtained from the BC Stats database. Table 3-1 shows the historical and projected populations for the service area. According to the 2016 ISL *CVWPCC Capacity Assessment* report (ISL, 2016), future connections to the CVWPCC service area include 400 single-family units referred to as the CVRD Annexation; this is included in the population assessment shown in Table 3-1. Service area growth was projected using the annual growth rates used by ISL, 2016.

Table 3-1: Historical and Projected CVWPCC Service Population to Year 2060

YEAR	CITY OF COURTENAY [1]	TOWN OF COMOX [2]	CFB COMOX	CVRD ANNEXATION [3]	K'ÓMOKS FIRST NATION [4]	TOTAL
2013	24,815	13,933	966	-		39,714
2014	25,187	14,216	966	-		40,369
2015	25,782	14,518	966	-		41,266
2016	26,736	14,652	966	-		42,354
2017	27,146	14,850	966	-		42,962
2018	27,533	14,706	966	-	293	43,498
2019	28,117	14,994	966	-	293	44,370
Projected Population						
2020[5]	28,713	15,281	966		299	45,259
2030	33,053	17,558	966	1,098	343	53,018
2040	37,759	20,057	966	1,274	392	60,448
2050	43,135	22,913	966	1,478	448	68,940
2060	49,277	26,176	966	1,716	511	78,645

1 2020 to 2021 annual growth rate 2.12%, with 2022 and beyond annual growth rate 1.34% from ISL, 2016
2 2020 to 2021 annual growth rate 1.92%, with 2022 and beyond growth rate 1.34% from ISL, 2016
3 Annual growth rate 1.5% from ISL 2016
4 Assuming 122 units, with 2.4 people per connection, annual growth rate 1.34%.
5 Note that population projections were completed prior to 2020 census data being available.

3.4 SOUTH REGION POPULATION

Electoral Area A, also know as the South Region of the CVRD, is located to the south of the City of Courtenay and does not have a centralized sewage collection system and uses privately owned onsite septic systems for wastewater management. There is interest in a future connection of the South Region to the existing CVRD sewerage area.

During the development of the Stage 1 and 2 CVRD LWMP, population and sewage flow estimates were developed for the South Region based on the previous work and more recent information regarding planned development. This information was used to assess the impacts of conveying the South Region wastewater flows to connect with the

CVRD wastewater conveyance and treatment systems. The impacts of the planned K'ómoks First Nation (KFN) development, as well as planned development in developed areas of the South Region were included in the evaluation.

The developed area for the South Region currently includes Royston and Gartley, collectively known as Royston, and Kilmarnock and Union Bay, collectively known as Union Bay. It was assumed that the development would be limited in these areas to maintain their existing density. There were no available data for the current population; for the purpose of this study, the existing population was estimated based on the existing number of dwellings and an assumed population density of 2.1 people per dwelling taken from the 2016 Census for the CVRD's Area A. As of 2019, the estimated population of the South Region was estimated at 2,756 people.

Development projections in the area are varied and changing, with multiple residential development projects proposed, which creates uncertainty for future build-out populations. High, medium, and low growth scenarios were developed, to show the potential range of future service population over the next 50 years. The growth projections included the impact of KFN development on the fee simple and treaty settlement lands (including on the old Sage Hills property), and Union Bay Estates. According to the information supplied by the CVRD, the proposed developments are either in the planning and/or design/construction phase. Union Bay Estates will be developed in phases with construction due to commence in 2020. Development of KFN lands had not commenced at the time of writing this report.

High (4.5%), medium (2.7%), and low (1.8%) annual growth scenarios were developed for the South Region, to show the potential range of future service population over the next 50 years. The medium growth scenario was used for the purpose of the conveyance study, resulting in a service population for the South Region of approximately 9,100 people by the year 2060. The South Region projections were not included in the wastewater treatment options development at the time of assessment. More detail is provided in the memorandum entitled *South Region Service Area Impacts on CVSS Conveyance and Wastewater Infrastructure,* and *South Region Forcemain Cost Estimate,* attached in Appendix B.

4 REGULATIONS AND GUIDELINES

4.1 CVWPCC DISCHARGE PERMIT

The CVWPCC discharge is grandfathered under Permit No. 5856, originally issued by the Ministry of Environment and Climate Change Strategy in 1980 (copy attached in Appendix C). Under this Permit, the CVRD is required to meet the following discharge criteria:

- Maximum effluent discharge rate in a given year: 18,500 m^3/d
- Maximum effluent five-day biochemical oxygen demand (BOD_5) concentration: 45 mg/L
- Maximum effluent total suspended solids (TSS) concentration: 60 mg/L

The recorded discharge flow rates at the CVWPCC and the effluent quality are summarized later in this report in Sections 5.2 and 5.4, respectively. As shown therein, the effluent quality is consistently well within the permitted values for BOD_5 and TSS. However, the annual maximum daily discharge rate regularly exceeds the permitted maximum of 18,500 m^3/d by an amount more than 10% of the permitted maximum day discharge; this means that a permit amendment will not be granted by the Ministry of Environment and Climate Change Strategy, and the District will have to either obtain an Operational Certificate under the Liquid Waste Management Plan, or apply to register the discharge under the provincial Municipal Wastewater Regulation (see discussion below).

4.2 PROVINCIAL MUNICIPAL WASTEWATER REGULATION

In July 1999, the Province of B.C. introduced regulatory standards for wastewater discharges and for the use of reclaimed water under the Municipal Sewage Regulation (MSR). The MSR was updated in 2012, with the objectives of clarifying registration requirements, reorganizing the regulation to improve ease of use, simplifying the requirements for reclaimed water use, and providing flexible storage and alternate disposal options for reclaimed water. Because of the extensive reorganization that the Regulation underwent, it was renamed the Municipal Wastewater Regulation (MWR). Despite the extensive reorganization, the water quality standards for effluent discharges and for reclaimed water have not changed from the earlier version of the Regulation. The MWR standards for discharges greater than 50 m^3/d to open and embayed marine waters are summarized in Table 4-1. Note that the outfall discharge from the CVWPCC is to Open Marine Waters.

Effluent discharges and use of reclaimed water that are authorized by an Operational Certificate under an approved LWMP do not have to be registered under the MWR; however, the Ministry of Environment and Climate Change Strategy generally uses the MWR standards in developing standards for Operational Certificates. The CVRD has elected to pursue an Operational Certificate under the LWMP process.

Table 4-1: Provincial (MWR) effluent requirements for discharges to marine waters

PARAMETER	EFFLUENT CRITERIA FOR DISCHARGES TO MARINE WATERS FOR 50 M³/DAY OR GREATER	
	OPEN WATERS [1]	EMBAYED WATERS [2]
Treatment required	Secondary	Secondary
Maximum Day BOD_5 (mg/L)	45	45
Maximum Day TSS (mg/L)	45	45
pH	6 - 9	6 – 9
Maximum Day Total Phosphorus (mg P/L)	n/a [3]	n/a [3]
Maximum Day Orthophosphate (mg P/L)	n/a [3]	n/a [3]
Disinfection	see [4]	see [4]
Ammonia	see [5]	see [5]

1 Open marine waters mean they are not embayed.

2 Embayed marine waters means marine waters either located within a bay from which the access to the sea, by any route has a maximum width of less than 1.5 km, located, if a line less than 6 km long is drawn between any two points on a continuous coastline, on the shore side of the line, or in which flushing action is identified to be inadequate.

3 Phosphorus and orthophosphate limits are not applicable for discharges to marine waters.

4 For discharges to shellfish bearing waters the geometric mean at the edge of the initial dilution zone must not exceed 14/100 mL, with not more than 10% of the samples exceeding 43/100 mL, based on 5 samples taken over a 30-day period. For discharges to recreational use waters, the geometric mean at the edge of the initial dilution zone must not exceed 200/100 mL, based on 5 samples taken over a 30-day period. Where domestic water extraction occurs within 300 m of a discharge, fecal coliform < 2.2 MPN/100 mL with no sample exceeding 14 MPN/100 mL. Where chlorine is used, dechlorination will be required. Wherever possible alternate forms of disinfection to chlorine should be implemented.

5 The allowable effluent ammonia concentrations at the "end of pipe" must be determined from a back calculation from the edge of the initial dilution zone. The back calculation must consider the ambient temperature and pH characteristics of the receiving water and known water quality guidelines.

4.3 FEDERAL WASTEWATER SYSTEMS EFFLUENT REGULATIONS

The Canadian Council of Ministers of the Environment has developed a Canada-wide Strategy for the Management of Municipal Wastewater Effluent (CCME, 2007 and Environment Canada, 2007). The CCME strategy focuses on effluents released from wastewater treatment systems and overflows from sewer collection systems of over 100 m^3/d. National performance standards regulated under the Fisheries Act are contained in the Wastewater Systems Effluent Regulations (WSER), which are now in force.

The WSER is the only federal regulation that exists to control domestic wastewater discharges nationwide. The WSER is established under the Fisheries Act and includes mandatory minimum effluent quality standards that must be achieved through secondary wastewater treatment. The WSER applies to wastewater treatment systems that treat more than 100 m^3 of wastewater per day. The regulated compounds are total suspended solids (TSS), carbonaceous biochemical oxygen demand ($cBOD_5$), total residual chlorine, and un-ionized ammonia. Effluent standards set out in the WSER are shown in Table 4-2. In the case of the CVWPCC, the characteristics of the effluent (BOD and TSS) will be based on monthly averages.

Table 4-2: Federal (WSER) effluent requirements for discharges

PARAMETER	DISCHARGE CRITERIA
$cBOD_5$	effluent average not to exceed 25 mg/L
TSS	effluent average not to exceed 25 mg/L
Residual chlorine	maximum 0.02 mg/L
Acute toxicity	include specific requirements and timelines to identify and reduce toxicity in cases of acute toxicity test failure
Ammonia	include specific requirements if acute toxicity test failure is due to ammonia that would authorize discharge of ammonia in effluent based on receiving environment considerations

4.4 REGULATORY REQUIREMENTS FOR I&I REDUCTION

Inflow and Infiltration (I&I) into the sewer collection system can substantially increase the volume of wastewater arriving at treatment facilities. I&I varies depending on antecedent weather, soil moisture, groundwater levels, and the duration and intensity of storm events.

Infiltration can be divided into two components. Groundwater infiltration enters the system through defects in pipes, which are located below the water table; groundwater infiltration is relatively constant in intensity and is of long duration. Rainfall-derived infiltration occurs during and immediately after rainfall events and is caused by the seepage of percolating rainwater into defective pipes, which lie near the ground surface; rainfall-derived infiltration is typically of relatively short duration and high intensity, compared to groundwater infiltration.

Inflow can also be divided into two components. Dry weather inflow results from surface water not caused by rain that enters the sewer system (e.g., street and vehicle washing). Stormwater inflow results from the diversion of storm surface runoff into sanitary sewers (e.g., roof downspouts that are connected to the sanitary sewer and surface runoff entering manholes). Some older systems are designed to carry both wastewater and storm surface runoff; these are commonly referred to as combined sewers.

I&I affects the design of wastewater collection systems and treatment facilities. Collection systems must be designed to accommodate the peak instantaneous I&I that occurs during a precipitation (and/or snowmelt) event. At wastewater treatment facilities, hydraulic design must accommodate the peak instantaneous I&I, and the treatment processes must accommodate the sustained high hydraulic loads that occur over several hours or days during wet weather.

The Municipal Wastewater Regulation (MWR) for British Columbia contains the following requirements (Part 3 Division 2 Section 44):

5 *A discharger must ensure that inflow and infiltration does not occur such that the maximum daily flow exceeds 2 times the average dry weather flow (ADWF) at the treatment plant during storm or snowmelt events with 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.*

The service population of the Comox Valley WPCC exceeds 10,000 people, so paragraph (a) above applies. The intent of this clause in the MWR is to avoid requiring local governments to construct secondary treatment facilities with the capacity to treat high wet weather flows that occur infrequently. The MWR requires secondary treatment for all flows up to 2.0 times ADWF, and allows flows in excess of this amount to receive only primary treatment; however, a plan and schedule should be in place to achieve secondary treatment for all flows, and this will include ongoing reduction of I&I.

4.5 CONTAMINANTS NOT CURRENTLY REGULATED IN WASTEWATER DISCHARGES

A number of contaminants that are not currently regulated but were identified for discussion with the TACPAC are reviewed in this section as part of the CVRD LWMP process, to provide context for these contaminants in relation to wastewater treatment and to determine their applicability and feasibility to future CVWPCC upgrades. The following three categories of unregulated contaminants are discussed in this section.

— Contaminants of Emerging Concern;
— Microplastics; and
— Viruses

4.5.1 CONTAMINANTS OF EMERGING CONCERN

Contaminants of emerging concern (CECs), also referred to as micropollutants, emerging contaminants, emerging substances of concern, trace contaminants or microcontaminants, are the residual substances released to the water-soil-air matrix due to human activities in almost undetectable concentrations (low to sub-parts per billion). Many of these substances are present in the natural environment and have only recently been detected. The potential risks to public and environmental health are only now being evaluated. CECs can be divided into the following groups of chemicals:

— Persistent organic pollutants (POPs) such as diphenyl ethers (PBDEs; used in flame retardants, furniture foam, plastics, etc.) and other global organic contaminants such as perfluorinated organic acids;
— Pharmaceuticals and personal care products (PPCPs), including a wide suite of human prescribed drugs (e.g., antidepressants, blood pressure), over-the-counter medications (e.g., ibuprofen), bactericides (e.g., triclosan), sunscreens and synthetic musks;
— Veterinary medicines such as antimicrobials, antibiotics, antifungals, growth promoters and hormones;
— Endocrine-disrupting chemicals (EDCs), including synthetic estrogens (e.g., 17a- ethynylestradiol (EE2) used as an oral contraceptive) and androgens (e.g., trenbolone, a veterinary drug), naturally occurring estrogens (e.g.,17b-estradiol (E2), testosterone), as well as many others (e.g., organochlorine pesticides, alkylphenols) capable of modulating normal hormonal functions and steroidal synthesis in aquatic organisms;
— Nanomaterials such as carbon nanotubes or nano-scale particulate titanium dioxide.

CECs as a group contain an extremely large number of chemicals with different origins. They can be polar (water soluble) or nonpolar (water insoluble), biodegradable or persistent, hydrophilic or hydrophobic, and their physicochemical properties vary over a wide range (Mulder et al., 2015).

Although conventional WWTPs are not designed to eliminate CECs from wastewater, some CECs are removed through the typical wastewater treatment processes designed to remove suspended solids, easily biodegradable dissolved organic matter, and nutrients (phosphorus and nitrogen). The main mechanisms for CECs removal in conventional WWTPs are as follows:

— sorption onto particulate matter (CECs attach to particulate or colloidal particles);
— biological transformation (CECs are mineralized or biodegraded to other compounds);
— volatilization (transfer of CECs from water to air); and
— abiotic degradation (CECs are degraded through photolysis and hydrolysis) (Margot, 2015).

Relatively hydrophobic CECs such as heavy metals, polycyclic aromatic hydrocarbons (PAHs), POPs, household chemicals like brominated flame retardants and personal care products, are typically relatively well removed from the liquid stream (> 70%), mostly by sorption onto wastewater sludge (Margot, 2015). Easily biodegradable CECs such as surfactants, plastic additives, hormones, PCPs, some pharmaceuticals and household chemicals, are also well removed during the treatment by biodegradation/transformation.

More hydrophilic and poorly-to-moderately biodegradable CECs are typically not well removed during conventional treatment. Many polar and poorly biodegradable substances (e.g., most pharmaceuticals, pesticides, and several household chemicals including corrosion inhibitors, sweeteners, ethylenediaminetetraacetate, and phosphorus flame retardants), are not significantly removed even in modern biological treatments.

In general, the removal rates of CECs by various processes utilised in conventional WWTPs cannot be quantified, due to varying operational conditions such as aerobic, anaerobic, anoxic, sludge retention time, hydraulic retention time, pH, redox potential and water temperature (Das et al., 2017). As a result, different substances are removed to varying degrees depending on the treatment processes employed at each WWTP.

Wastewater treatment to remove CECs using activated carbon separates these pollutants from the liquid stream, but does not degrade or transform them. If granular activated carbon (GAC) is used, high-temperature regeneration of the media will degrade most or all of the captured pollutants (this requires specialised regeneration facilities). If powdered activated carbon (PAC) is used, the captured CECs will be incorporated into the waste solids (sludge), which may make this material unsuitable for beneficial reuse such as compost production or land application. Ozonation will result in degradation of some CECs, but this may generate toxic by-products which require additional treatment (e.g., filtration or activated carbon).

No operating WWTPs were identified in North America specifically designed to remove CECs, although a plant is under construction in Montreal. There are operating plants elsewhere, such as Switzerland.

Ongoing research and development can be expected to continue advances in the detection, characterisation and control of CECs in domestic wastewater. Further information regarding contaminants of emerging concern in relation to wastewater treatment plants is provided in the Memorandum entitled *"An Overview of Emerging Contaminants in Wastewater*" attached in Appendix D.

4.5.2 MICROPLASTICS

Microplastics (MPs) is a term generally applied to plastic particles under 5 mm in size. Particles smaller than 0.1 micrometer (µm) are further classified as nanoplastics. There are between 13 and 30 types of MPs that have been identified in wastewater treatment plant influent and effluent streams, with polyester (PES), polyethylene (PE), polyethylene terephthalate (PET), polyamide (PA), polypropylene, and polystyrene being the most common.

The numerous sources of MPs include car tires, fisheries, textiles, personal care products, agriculture, and industry waste. These sources broadly categorize MPs as either primary or secondary, based on their initial manufacturing purpose. Primary MPs are purposefully manufactured micro-sized particles for specific applications. Secondary MPs are indirectly produced from the breakdown of larger plastic waste or debris. The predominant source of MPs entering WWTPs is microfibres from washing of textiles (such as polyester fleece garments), which accounts for approximately 50-70% of MPs entering WWTPs (Gies et al., 2018).

A 2019 report presented by the World Health Organization (WHO) indicates that potential health risks associated with MPs have not yet been well-defined and have so far been found to pose low concern for human health (WHO, 2019). However, the 2019 report does describe some potential negative effects associated with MPs, which come in three forms: physical from the particles themselves, chemical from their composition and potential for leaching, and biofilms that may form and cause MPs to act as microorganism carriers (WHO, 2019).

On average, it has been found that WWTPs with primary and secondary treatment (as practiced at the CVWPCC) can remove between 80% to 95% of MPs, depending on the MPs size and wastewater quality (i.e., amount of fats, oils, greases to entrap and remove MPs during sedimentation); this removal efficiency increases to about 97% with tertiary treatment (Sun et al., 2019). While this appears to be significant removal, the percentage not removed by WWTPs still results in large overall loads to the receiving environment, due to the high volume of wastewater treated (SAPEA, 2019).

Certain MPs shapes have found to be better captured during specific stages of treatment, pre-treatment is more effective at capturing fibers; skimmers from primary sedimentation are effective in capturing microbeads; fragment particles removed through secondary treatment (Sun et al., 2019). There have been some studies indicating that the concentration of MPs has been reduced through WWTPs where sludge has been treated by anaerobic digestion (Prata, 2018).

During conventional wastewater treatment, the majority of MPs are captured as a component of the solid fraction during sludge removal processes (Sun et al., 2019). While this does not remove MPs entirely, it does divert a large portion from directly entering receiving environments via liquid discharges. Depending on the end use of biosolids (e.g., if land application of biosolids is used), MPs may still enter aquatic environments through surface runoff or may remain in terrestrial environments (Kay et al, 2018).

A potential option for targeting MPs removal from WWTPs without revising infrastructure would be to adjust relevant operational parameters of current wastewater treatment processes to improve MPs removal efficiency. For example, adjusting hydraulic retention time (HRT) to improve skimming and sedimentation in primary treatment units, contact time during secondary treatment increasing potential for surface biofilm coating to develop on MPs which can increase settlement, or amending chemical additives to be Al-based as this was shown to improve removal efficiency compared to Fe-based flocculants/coagulants (Sun et al., 2019). This option has yet to be explored to determine its viability and effectiveness.

Due to the limited framework, lack of standardized testing, inconsistency in studies performed to date, and the consequent limitations for comparing results, it has been difficult to develop regulations establishing the presence and quality of MPs in wastewater. Microbeads in most toiletries were banned in Canada effective July 1, 2018. While microbeads represent a small portion of overall MPs, it is an effective first step in reducing primary MPs sources.

Further information regarding microplastics in relation to wastewater treatment plants is provided in the Memorandum entitled *“An Overview of Microplastics in Wastewater”* in Appendix E.

4.5.3 VIRUSES

A variety of viruses are present in domestic wastewater, and these pose various risks to human health and the environment. Some studies report that wastewater contains the largest quantity of virus diversity, including viruses that have yet to be characterized or placed into specific taxa of organisms (Cantalupo, et al. 2011). The viruses of concern in wastewater generally researched are those that affect humans, either via the waterborne route or through food that has come into contact with contaminated water; these are enteric viruses as they are transmitted via the fecal-oral route, and thus are generally found in water contaminated with domestic wastewater. Enteric viruses are some of the most hazardous waterborne pathogens, and cause outbreak-related illnesses such as gastroenteritis (i.e., stomach flu); however, more sever illnesses such as hepatitis, skin disease, and death have also been reported.

Viruses can be difficult to target for removal, because they have an ability to adapt to new hosts and environments and have been reported to survive and remain infective for up to 130 days in seawater (La Rosa, et al. 2012).

Of the numerous human viruses potentially transmitted by the waterborne route, norovirus is considered one of the leading causes of acute gastroenteritis worldwide, and the leading cause of both gastroenteritis and foodborne infection in the United States. Among reported outbreaks between 2009 and 2012 in the United States, 69% were person-to-person, 23% were foodborne, 0.4% were environmental, and 0.3% were waterborne. The most common foodborne outbreaks are associated with leafy greens, estimated at 36% (National Advisory Committee on Microbiological Criteria for Foods 2016).

Viruses are not a standard measurement in wastewater treatment; it requires specialty testing in laboratories to identify virus concentrations in water, and often these measurements can be costly and time consuming. Additionally, detection methods that indicate quantities of viral genome copies found in a sample may not be related to the number of active virus particles that are infectious (Pouillot, et al. 2015). To determine if a virus is infectious, the virus needs to be grown in a stable environment in the lab on petri dishes, and the number of plaque forming units (PFU) determined, representing active infectious viruses; the concept is similar to coliform forming units (CFU) used to quantify bacteria.

In wastewater treatment, the generally accepted microbiological parameter for measurement is colony-forming units (CFU's) or Most Probable Number (MPN) for indicator organisms such as fecal coliforms and *E.coli*. These indicator organisms act as a surrogate to indicate the presence of fecal contamination, and therefore a strong likelihood of the presence of pathogens (disease-causing organisms). However, recently many studies have shown that these indicator organisms may not be indicative for viruses and new methods should be considered (USEPA 2015).

All stages of wastewater treatment contribute to the removal of viruses from the liquid stream. Viruses can be entrained in the solids and separated during physical separation processes in the primary and secondary treatment stages of wastewater treatment. The inclusion of an effluent disinfection process, such as ultraviolet (UV) light or chlorine disinfection, can de-activate or kill pathogens; however, the effect of UV disinfection on specific viruses such as Norovirus is poorly understood. Norovirus is of particular interest, since it has been known to be ingested in contaminated shellfish, causing severe gastroenteritis (diarrhea, vomiting, stomach pain).

UV disinfection is an increasingly popular treatment process, because of its simplicity to dose the water and lack of by-products produced. When chlorine is used in disinfection, the chlorine can react with organic matter in the water to form disinfection byproducts (DBPs) that can be carcinogenic. Residual chlorine in the water can also be toxic to species in the receiving environment, and therefore de-chlorination of the wastewater is required after chlorination to meet regulations.

A third form of disinfection relies on ozone as an oxidizing agent as it is a very strong oxidant and viricide. Ozonation is the least used method in the United States in wastewater treatment; however, it has been used widely in Europe for an extensive amount of time (USEPA 1999). Researchers have shown ozone disinfection to be more effective than conventional methods (UV and Chlorination), although further research is required into the effectiveness on both bacteria and viruses.

A fourth type of disinfection that is relatively new and has increased in use in wastewater treatment in the last 5 to 10 years is peracetic acid (PAA); this disinfection process is used locally at the Metro Vancouver Northwest Langley WWTP. PAA is a combination of acetic acid and hydrogen peroxide, which react to form peracetic acid, a strong oxidant and virucide (although not as strong as ozone). Unlike chlorination, PAA does not form DBP's and has a generally lower aquatic toxicity (Bell and Wylie, 2016). PAA requires similar dosing concentrations and contact time to chlorination and is expected to have similar costs; the effectiveness depends on the wastewater quality and contact time (USEPA, 2012).

As described earlier in Section 4, the current regulations affecting wastewater treatment in the CVRD are the Provincial Municipal Wastewater Regulation (MWR) and Federal Wastewater Systems Effluent Regulation (WSER). Neither of these regulations specify virus standards for discharge to receiving environments. Under the MWR, discharges to shellfish-bearing marine waters require a disinfection limit of 14 MPN/100 mL fecal coliforms at the edge of the initial dilution zone (IDZ), and discharges to recreational waterways requires 200 MPN/100 mL fecal coliforms at the IDZ boundary (see Table 4-1 in Section 4.2 for more detail).

To help alleviate some risks for the CVRD, it will be important that the wastewater treatment plant incorporates the most appropriate wastewater disinfection technology, ensuring the indicator organism concentration can be met in the discharge. Considerations can be given to providing a more advanced oxidation process for the CVRD treatment system such as ozone disinfection or a combined two-stage disinfection process such as UV and chlorination, depending on the available research and applicable guidelines at the time of design.

Further information regarding microplastics in relation to wastewater treatment plants is provided in the Memorandum entitled *"An Overview of Viruses in Wastewater"* in Appendix E.

5 CVWPCC WASTEWATER FLOWS, PERFORMANCE, AND DESIGN CRITERIA

5.1 CVWPCC OVERVIEW

The existing Comox Valley Water Pollution Control Centre (CVWPCC) is a secondary treatment facility located at 445 Brent Road in the Town of Comox, that is owned and operated by the CVRD. Treated wastewater is discharged from the CVWPCC to open marine waters in the Strait of Georgia through a submerged outfall pipe with diffuser that extends 2,825 metres from shore near Cape Lazo, with the outfall terminus 60 metres below the water surface at low tide.

The CVWPCC currently has the following treatment processes at the facility:

- preliminary treatment with two coarse bar screens and three pre-aeration grit removal tanks;
- three primary clarifiers;
- three activated sludge aeration basins;
- three secondary clarifiers;
- effluent outfall and pump station for peak flows;
- two gravity thickeners for waste primary sludge (WPS);
- two dissolved air flotation (DAF) units for waste activated sludge (WAS) thickening;
- one combined (WPS and WAS) thickened sludge storage tank;
- two centrifuges for dewatering thickened waste solids; and
- ancillary processes such as odour control and grit classification.

5.2 CVPWCC WASTEWATER FLOWS

The daily wastewater flows at the CVWPCC from 2013 to 2019 are shown in Figure 5-1. The maximum allowable daily discharge according to the plant discharge permit is 18,500 m^3/d (see Section 4.1). As shown, the discharge from the CVWPCC frequently exceeds the permitted maximum; this means that the CVRD will have to apply to the BC Ministry of Environment and Climate Change Strategy for an increase in the allowable daily discharge. For discharge increases of 10% or less over currently permitted amounts, a Permit Amendment may be possible. However, the data in Figure 5-1 show that an increase of more then 10% will be needed; this will require that the CVRD apply for an Operational Certificate under an approved LWMP (either apply to register the CVWPCC discharge under the Municipal Wastewater Regulation). The CVRD has elected to pursue an Operational Certificate within the LWMP.

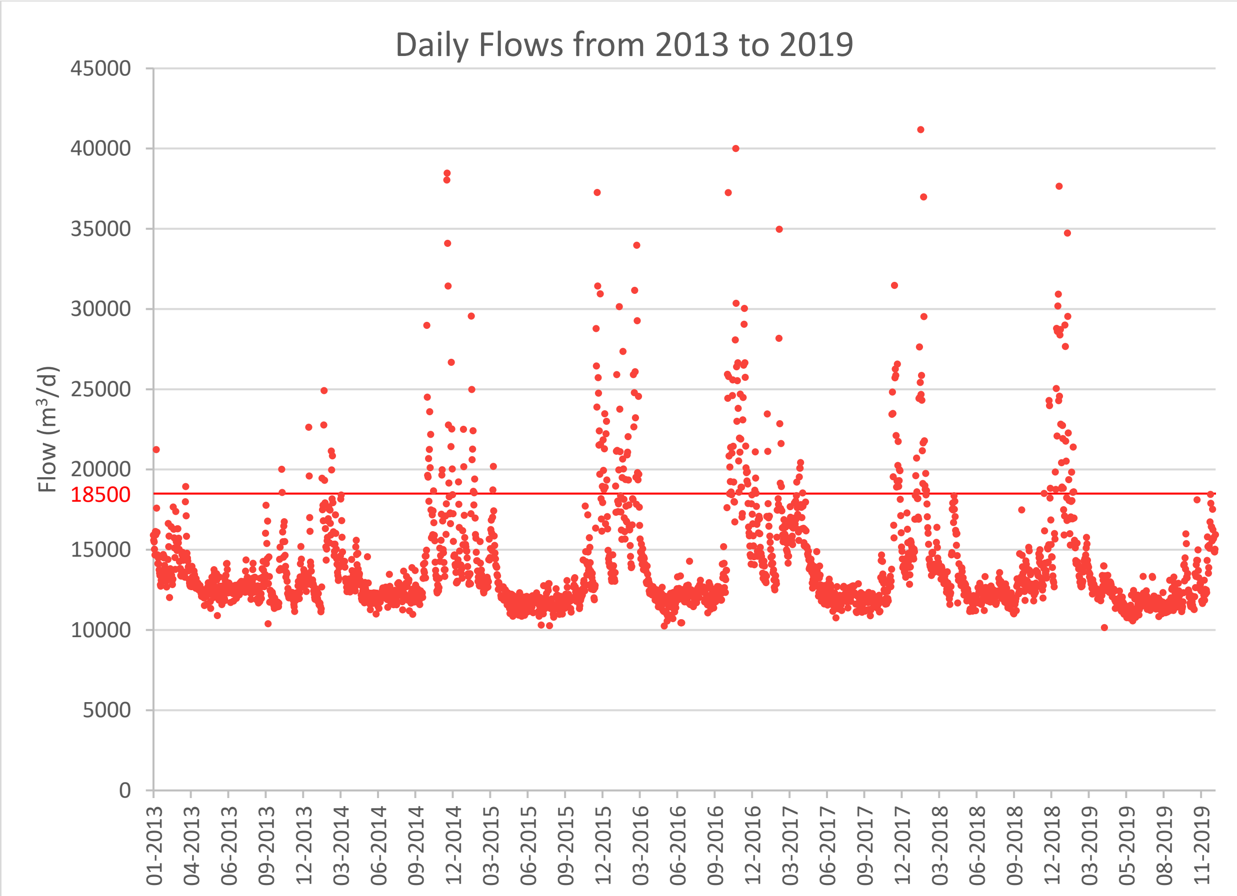

Figure 5-1: Daily Flows at the CVWPCC from 2013 to 2019

The 2013 to 2019 flow rates recorded at the CVWPCC were used to estimate average per capita flow rates into the plant. The per capita flow rates were then applied to future year population projections to determine future flow rates to the year 2060. The flow rates were determined as follows:

- Average Dry Weather Flow (ADWF): Minimum 30-day rolling average flow for the year;
- Average Daily Flow (ADF): Average flow during the year;
- Average Wet Weather Flow (AWWF): Maximum 30-day rolling average flow for the year;
- Max day flow (MDF): Maximum single day flow in the year;
- Peak Hourly Flow (PHF): Peaking factor developed by ISL (2016) was used to determine projected PHF (3.0 x ADF); and
- Maximum Instantaneous Flow: Peaking factor developed by ISL (2016) was used to determined projected maximum instantaneous flow (3.2 x ADF).

A summary of the historical and per capita flow rates generated over the review period is shown in Table 5-1:

Table 5-1: Historical CVWPCC Influent Flows (2013-2019) and Per Capita Flows Generated

Year	Service Population	HISTORICAL FLOWS[1], M^3/DAY ADWF	ADF	AWWF	MDF	UNIT FLOWS, L/C/D ADWF	ADF	AWWF	MDF
2013	39,714	12,113	13,249	14,978	21,225	305	334	377	534
2014	40,369	11,900	14,221	20,150	38,462	295	352	499	953
2015	41,266	11,503	13,729	21,914	37,253	279	333	531	903
2016	42,354	11,506	15,433	23,681	39,998	272	364	559	944
2017	42,962	11,709	14,316	19,706	34,965	273	333	459	814
2018	43,498	11,877	14,638	22,069	41,168	273	337	507	946
2019	44,370	11,264	13,052	24,151	34,726	254	294	544	783
Average						**279**	**335**	**497**	**840**

[1] From Daily Influent Plant Data.

5.3 COMOX VALLEY SEWERAGE SYSTEM I&I

The ratio of maximum day flow (MDF) to average dry weather flow (ADWF) at the CVWPCC for the years 2013 to 2019 is summarized in Table 5-2. As shown, the ratio of MDF:ADWF ranged as high as 3.5 :1 with numerous occurrences in most years of record, indicating that I&I to the WWTP collection system is excessive according to the MWR criterion (see I&I discussion in Section 4.4 of this report).

Table 5-2: Comox Valley WPCC ratio of MDF to ADWF 2013 - 2019

YEAR	ADWF (M^3/D)	MDF FLOW (M^3/D)	RATIO MDF:ADWF	NO. OF DAYS WHEN RATIO MDF:ADWF > 2.0
2013	12,113	21,225	1.8	0
2014	11,900	38,462	3.2	8
2015	11,503	37,253	3.2	11
2016	11,506	39,998	3.5	33
2017	11,709	34,965	3	11
2018	11,877	41,168	3.5	22
2019	11,264	34,726	3.1	4

The wastewater collection systems serving the CVWPCC are owned and operated by the member municipalities and CFB Comox, with the Regional District owning and operating the trunk mains, pumping stations and treatment facilities. I&I reduction measures are generally focused on collector sewers, so in this case, the I&I program must be a municipal initiative. I&I reduction activities typically focus on inspection, identification and elimination of large sources of inflow during wet weather (e.g., at manholes), cross connections between the wastewater collection and storm drainage system (including roof drains), and ongoing inspection and remediation of collection sewer pipes (leaky joints, root intrusion, cracked and failing pipes). Successful I&I reduction programs are generally based on ongoing inspections and remediation efforts.

Efforts have been made in recent years by member municipalities to reduce I&I. A summary of these efforts and planned activities are summarized below:

- Between 2016 and 2020, the City of Courtenay analyzed their collection system using a variety of collection measures, including but not limited to CCTV, smoke testing, flow monitoring, and field/manhole inspections. Approximately 99 km of the collection system was analyzed, with approximately 258 minor issues and 26 major issues identified. Of these identified issues, 36 of the minor issues were repaired and 14 of the major issues were repaired.
- The Town of Comox analyzed their collected system using similar measures such as manhole inspections, CCTV, and smoke testing. Additionally, they utilize an Asset Management plan to regularly review and ensure infrastructure is replaced at appropriate times. Capital replacements of select sections of sewermains identified to be contributing to I&I are planned between 2021 and 2025. Planned activities for manholes include reviewing lids are set above the high mark, plugging lid lifting holes, and investigating rubber lid seals. Planned activities using smoke testing will investigate if roof water leaders and road catchbasins are connected to the sanitary system. The City is planning on developing a CCTV program to video all storm and sanitary sewers on a 5 to 10 year rotation for condition assessment and identification of infiltration locations.

The CVRD and its member municipalities are committed to limiting I&I on an ongoing basis, and to maintaining the wastewater collection system in good working condition. The member municipalities should continue with ongoing programs to identify and eliminate sources of I&I, including cross connections between storm and sanitary systems.

5.4 CURRENT CVWPCC TREATMENT PERFORMANCE

The CVWPCC effluent quality data was reviewed and analyzed for the period from 2014 to 2019. The effluent was sampled and analyzed for five-day carbonaceous biochemical oxygen demand ($cBOD_5$) and total suspended solids (TSS) at least once a month as required by the discharge permit.

The plant effluent concentration of TSS from 2014 to 2019 is shown in Figure 5-2 (monthly average concentration) and Figure 5-3 (daily concentration). The monthly average TSS concentration exceeded the WSER criteria of 25 mg/L only once during the review period (in 2017). The effluent daily TSS concentration was consistently below the allowable maximum specified in both Permit No. 5856 (60 mg/L) and the MWR (45 mg/L). Study of Figure 5-2 shows that the monthly average effluent TSS concentration was typically in the range of 5 mg/L to 15 mg/L from 2014 to 2019.

The plant effluent quality for $cBOD_5$ is shown in Figure 5-4 (monthly average concentration) and Figure 5-4 (daily concentration). All of the values were within the regulatory limits specified in the WSER, the MWR, and Permit No. 5856. Similar to the data for TSS, the monthly average $cBOD_5$ concentration was typically in the range of 5 mg/L to 15 mg/L.

The average percentage removal of TSS during the assessed period (2014 to 2019) was consistently high, ranging from 90% to 99% with an average effluent concentration of less than 9 mg/L. The removal rate of $cBOD_5$ was consistently at least 93% with an average effluent concentration of less than 7 mg/L. This is indicative of excellent performance for a secondary treatment plant.

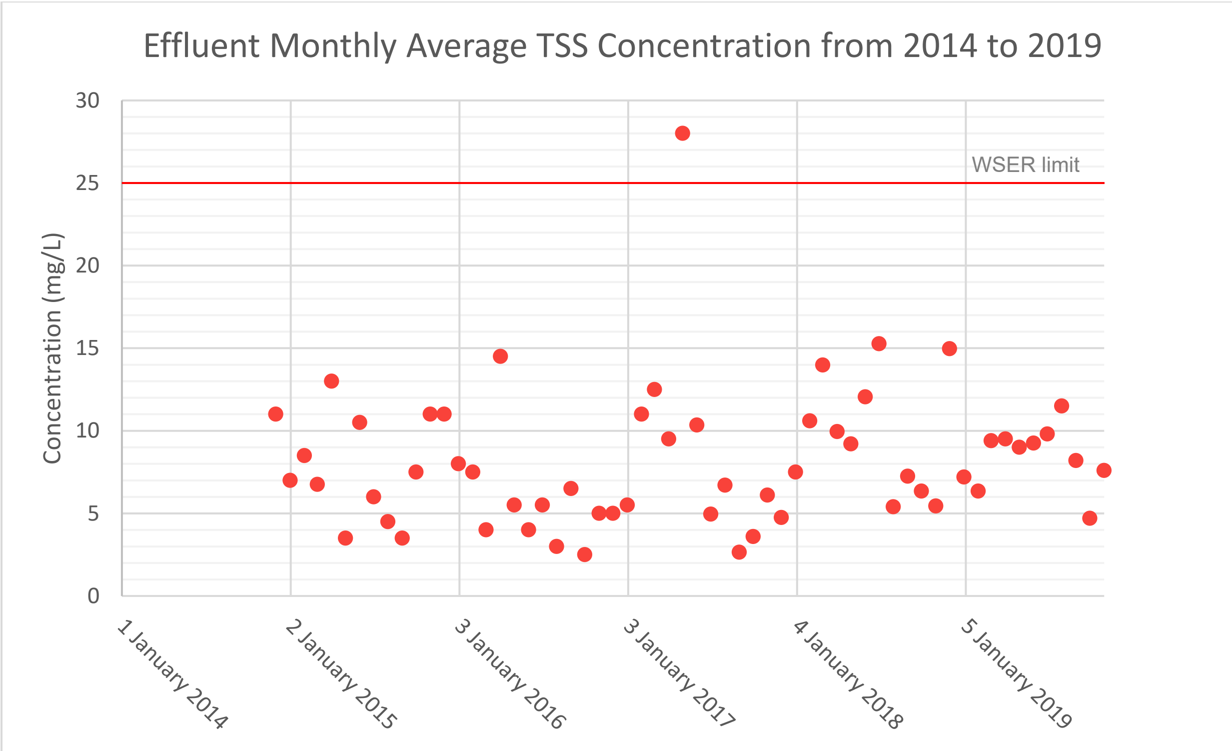

Figure 5-2: Effluent Monthly Average TSS Concentration (2014-2019)

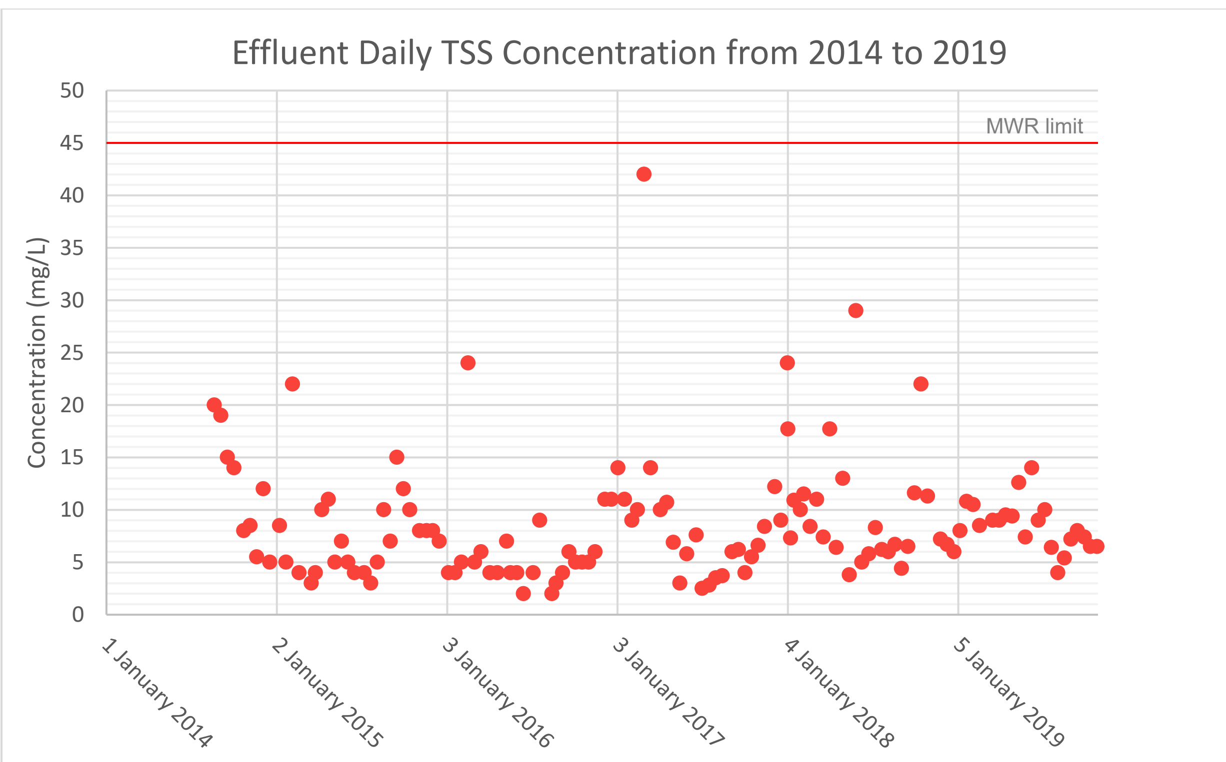

Figure 5-3: Effluent Daily TSS Concentration (2014-2019)

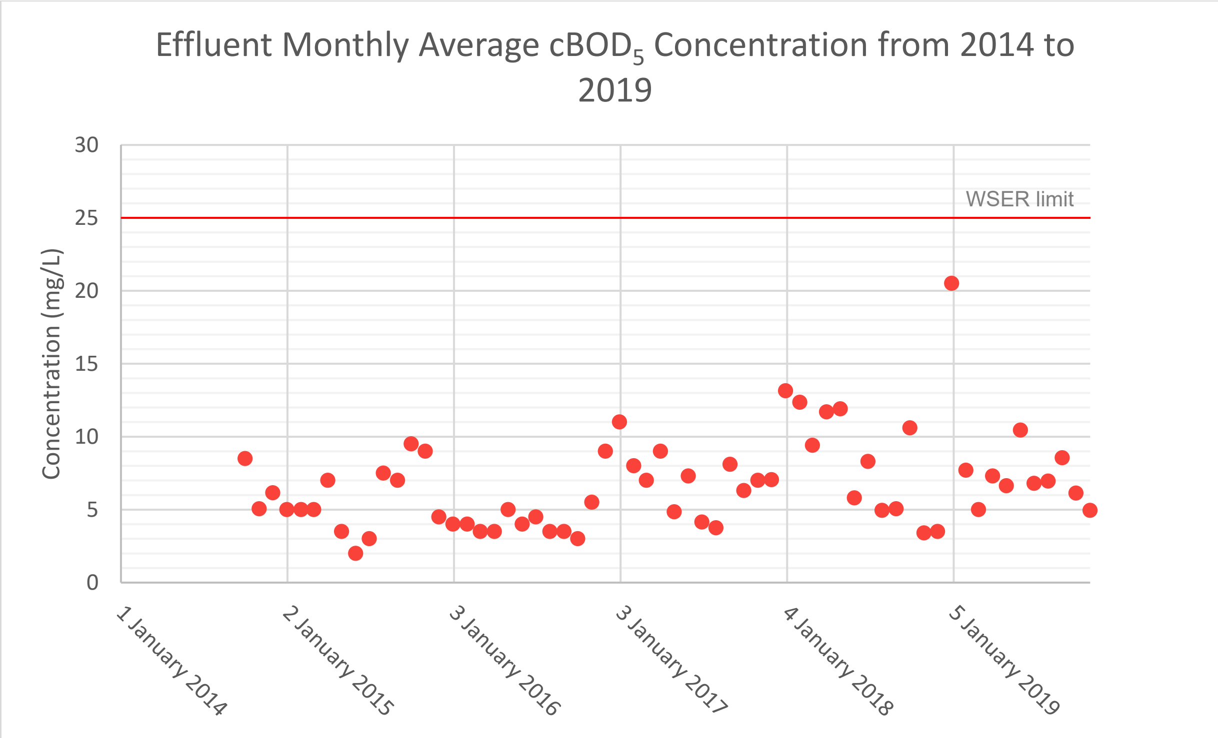

Figure 5-4: Effluent Monthly Average $cBOD_5$ Concentration (2014-2019)

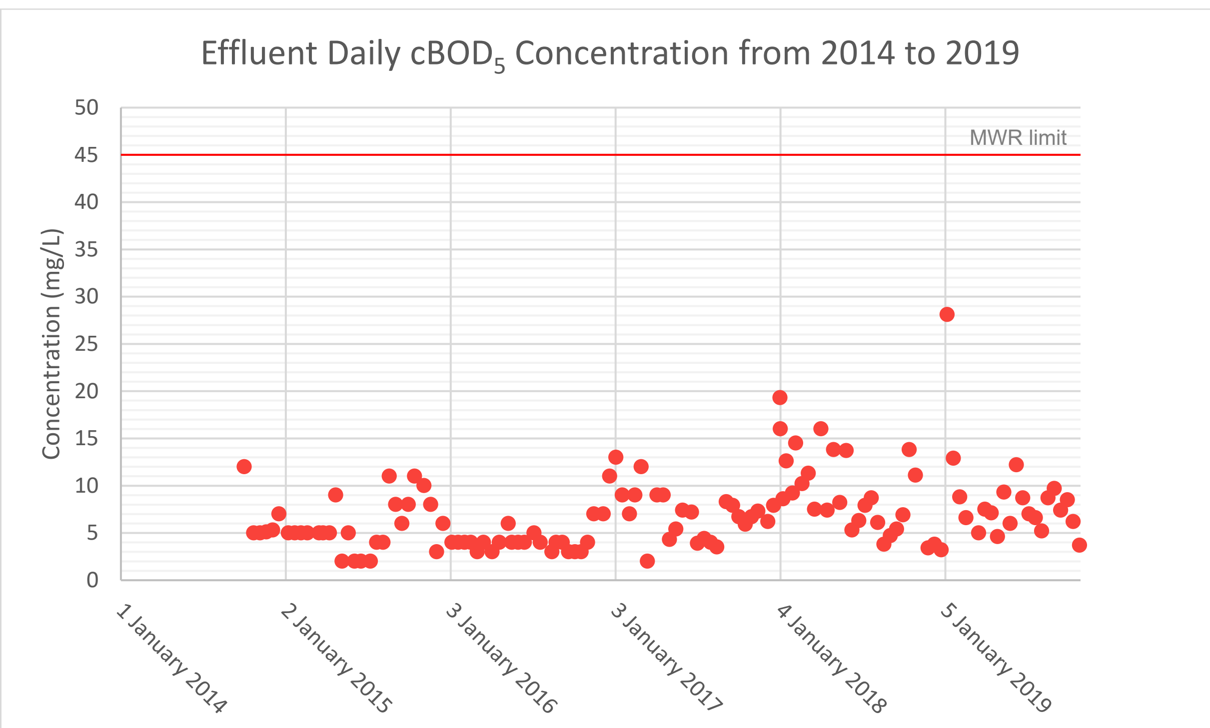

Figure 5-5: Effluent Daily $cBOD_5$ Concentration (2014-2019)

5.5 CVWPCC WASTEWATER FLOW PROJECTIONS

Table 5-3 shows the projected wastewater flows from 2020 to 2060 based on the unit flows shown in Table 5-1 in Section 5.2. Note that the population projections and corresponding wastewater flows shown in Table 5-3 do not include the South Sector (see Section 3.4 of this report for detail on the impacts of servicing the South Sector).

With the data available to WSP at the time of completing developing this LWMP, peak hourly flows (PHF) and maximum instantaneous flow were not able to be determined with the data; therefore, the peaking factors from ISL (2016) were used.

Table 5-3: Flow Projections, 2020 to 2060

	2020	2030	2040	2050	2060
Population Projections	45,259	53,018	60,448	68,940	78,645
Average Dry Weather Flow (ADWF) (m^3/d)	12,606	14,766	16,836	19,201	21,904
Average Day Flow (ADF) (m^3/d)	15,174	17,775	20,266	23,114	26,367
Average Wet Weather Flow (AWWF) (m^3/d)	22,480	26,333	30,024	34,242	39,062
Max Day Flow (MDF) (m^3/d)	38,000	44,514	50,753	57,883	66,031
Peak Hour Flow [1] (PHF) (m^3/d)	45,522	53,325	60,799	69,341	79,102
Maximum Instantaneous Flow [2] (m^3/d)	48,557	56,881	64,853	73,964	84,375
Maximum Instantaneous Flow (L/s)	562	658	751	856	977

[1] Peaking Factor of 3.0 was adapted from the ISL CVWPCC Capacity Assessment (2016).

[2] Peaking Factor of 3.2 was adapted from the ISL CVWPCC Capacity Assessment (2016).

5.6 CVWPCC WASTEWATER LOADING PROJECTIONS

Historical (2013 to 2019) CVWPCC influent 5-day Biochemical Oxygen Demand (BOD_5) and Total Suspended Solids (TSS) loadings used to develop average per capita unit loading rates. The $cBOD_5$ and TSS data were taken from weekly composite samples. Table 5-4 shows the historical per capita loads.

Table 5-4: CVWPCC Historical Influent Loading, 2013 to 2019

		HISTORICAL INFLUENT LOADING [1] KG/D				INFLUENT UNIT LOADING G/C/D			
Year	Population [2]	Average BOD_5	Max Month BOD_5	Average TSS	Max Month TSS	Average BOD_5	Max Month BOD_5	Average TSS	Max Month TSS
2013	39,714	3,327	4,241	3,425	4,383	84	107	86	110
2014	40,369	3,720	8,983	4,144	6,198	92	223	103	154
2015	41,266	3,675	5,641	3,977	5,351	89	137	96	130
2016	42,354	2,605	6,919	4,405	6,988	62	163	104	165
2017	42,962	2,946	4,306	4,116	5,189	69	100	96	121
2018	43,498	2,764	5,530	4,375	6,824	64	127	101	157
2019	44,370	4,245	5,722	3,292	7,145	96	129	74	161
					Average	**79**	**127[3]**	**94**	**142**

1 Plant Data. We have assumed this data includes all return streams from the plant.
2 Population was obtained from BC Stats.
3 Excludes 223 data point.

No data were available for Total Kjeldahl Nitrogen (TKN), therefore loading data is based on per capita unit rates from ISL (2016). The TKN loading determined in ISL (2016) was based on 13 g/c/d, which is considered typical for domestic wastewater without any industrial loading. ISL (2016) also determined a peaking factor of 1.1 between average and max month loading. These same values were carried forward for projecting TKN load to the CVWPCC. Table 5-5 shows the projected future loads to the CVWPCC for BOD_5, TSS, and TKN.

Note that the projected populations and CVWPCC loads do not include the South Region (see Section 3.4 of this report for detail on impacts of servicing the South Region).

Table 5-5: CVWPCC Load Projections, 2020-2060

	2020	2030	2040	2050	2060
Population Projections	45,259	53,018	60,448	68,940	78,645
Average BOD_5 (kg/d)	3,575	4,188	4,775	5,446	6,213
Max month BOD_5 (kg/d)	5,757	6,743	7,688	8,769	10,003
Average TSS (kg/d)	4,254	4,984	5,682	6,480	7,393
Max month TSS (kg/d)	6,427	7,528	8,584	9,790	11,168
Average TKN (kg/d)	588	689	786	896	1,022
Max month TKN (kg/d)	647	758	864	986	1,125

5.7 CVWPCC CURRENT CAPACITY AND UPGRADE NEEDS

A review of unit process capacity at the CVWPCC and identification of expansion needs to meet projected 2040 plant loadings was undertaken as part of the Stage 1 and 2 LWMP.

The capacity assessment is summarized below. Note that condition assessments were not undertaken, and some equipment may need to be replaced before 2040 based on condition rather than capacity.

- Influent screens: adequate capacity to 2040
- Grit removal: current loads exceed recommended design values
- Secondary treatment:
  - aeration basins: current loads exceed recommended design values
  - aeration blowers: adequate capacity to 2040
  - secondary clarifiers: additional unit recommended to meet 2040 loads
- Waste sludge thickeners:
  - primary sludge: current load exceeds recommended design values
  - biological (secondary) sludge: adequate capacity to 2040
- Sludge dewatering centrifuges: adequate capacity to 2040

As shown above, capacity expansions are required at the CVWPCC for grit removal, the aeration basins, the secondary clarifiers, and the waste primary sludge thickeners; this represents a major expansion project at the CVWPCC. Additional considerations for the upgrade are listed below:

- Age and condition of concrete tanks and structures, mechanical and electrical equipment (corrosion, wear and tear, plant originally constructed in 1982)
- Existing facilities may not meet current standards and codes for electrical installations, worker safety, seismic resilience (BC Building Code for post-disaster facilities), process reliability (redundancy) standards as set out in the MWR

CVRD started a site master planning process in 2022 which is reviewing treatment process selection, configuration and optimum site layout for future plant facilities, including identification of space for processes that may be added in future such as advanced treatment, solids digestion and resource recovery. At the time of writing this report, the work is still underway.

Before detailed design for the next CVWPCC expansion/upgrade is undertaken, the following should be considered:

- Site investigation and seismic modelling to determine if ground improvements are required to meet seismic resilience requirements under the BC Building Code;
- Asset condition assessments to determine which assets can continue in use for the long term (major equipment, concrete structures and tanks, building);

5.8 CVWPCC PROPOSED DISCHARGE CRITERIA

Table 5-6 summarizes the proposed discharge criteria for effluent from the CVWPCC; these criteria should be used to guide planning and design of future upgrades to the CVWPCC.

Table 5-6: Effluent Quality Criteria

EFFLUENT PARAMETER	PROVINCIAL REQUIREMENTS (MWR)	FEDERAL REQUIREMENTS (WSER)
5-day Carbonaceous Biochemical Oxygen Demand	Max day < 45 mg/L	Monthly average < 25 mg/L (carbonaceous BOD_5)
Total Suspended Solids (TSS)	Max day < 45 mg/L	Monthly average < 25 mg/L
pH	6 – 9	N/A
Un-Ionized Ammonia	N/A	<1.25 mg/L
Total Residual Chlorine	N/A	<0.02 mg/L
Fecal Coliforms [1]	<14 MPN/100 mL at the edge of the initial dilution zone (IDZ)	N/A

[1] Requirements for shellfish receiving waters

6 CONVEYANCE OPTIONS

6.1 CONVEYANCE INFRASTRUCTURE

The CVRD operates and maintains the sewerage system for the Comox Valley Sewerage Service (CVSS) for the City of Courtenay and the Town of Comox, and for the K'ómoks First Nation and the Department of National Defence by contracts with each. A combined gravity and pressurized wastewater conveyance system serves the north sections of the service area; this consists of various gravity trunks, and the Canadian Forces Base Comox (CFB) pump station, which connects to the CVWPCC. The conveyance system on the south side of the service area includes four pump stations (PS). The Courtenay PS conveys collected wastewater from the City of Courtenay to the CVWPCC eastward along Comox Road and Bayside Road before routing into the foreshore. The Jane Place PS receives collected wastewater from the Town of Comox and ties directly into concrete forcemain from the Courtenay PS. The forcemain makes a turn northward at Goose Spit across Hawkins Road and continues on the foreshore along Willemar Bluffs to the CVWPCC. The K'ómoks First Nation PS is relatively small and connects directly to the forcemain approximately mid way between the Courtenay and Jane Place PS. The HMCS Quadra PS forcemain discharges to a gravity sewer at the four-way stop at the top of Hawkins Road, ahead of Willemar Bluffs. This sewer then flows south to the foreshore and west toward the Jane Place PS.

The two main pump stations which together pump sewage into a common forcemain to the CVWPCC are the Courtenay PS and Jane Place PS. The Courtenay PS is located on Comox Road near the Highway 19A bridge crossing the Courtenay River, and the Jane Place PS is located at Jane Place near the Comox Valley Marina. Wastewater is conveyed across the Courtenay River from areas of Courtenay on the west side of the river via siphon under the river to the Courtenay PS. Currently, wastewater is conveyed from the Courtenay PS in a 750 mm diameter reinforced concrete pipe eastward along Comox Road and Bayside Road before routing into the foreshore, and the diameter increases to 860 mm diameter. The Greenwood and Hudson Trunk service the areas to the north of the Town of Comox and DND; these trunk sewers convey flows to the CVWPCC via the CFB PS. The existing system is shown in Figure 6-1 (repeat of Figure 1-1).

Figure 6-1: Comox Valley Sewerage System

Electoral Area A, also known as the South Region of the CVRD, is located to the south of the City of Courtenay; Area A does not have a centralized sewage collection system, and generally uses privately owned onsite septic systems for wastewater management. There is interest in a future connection of the South Region to the existing CVRD sewerage system though timing is uncertain at the time of writing. Additional discussion on the impacts of servicing Area A, including the planned K'ómoks First Nation development, Royston, Union Bay, and Union Bay Estates, can be found in Section 3.4 of this Report.

In 2003, the CVRD discovered that significant sections of the forcemain along Balmoral Beach below the Willemar Bluffs were exposed without the protective cover material due to changes in soil deposition patterns and erosion. This was confirmed by Northwest Hydraulic Consultants Ltd. (NHC) in 2003, and was reaffirmed in a 2016 study, *Risk Analysis of CVRD Force main on Balmoral Beach*, NHC, 2016. The erosion prompted the placement of rip rap at the base of bluffs which stopped the bank erosion but lead to sand loss on the beach and subsequent exposure of pipe sections. Rock gabions were placed to cover the pipe but are now near the end of their service life.

Concerns related to the condition of the Willemar section of the forcemain and the capacity of the pump stations led the CVRD to initiate a program with the objective of decommissioning the section of forcemain along Willemar Bluffs and developing an alternative alignment. This led to wider considerations of the optimum configuration of the conveyance system between the Courtenay PS and the CVWPCC.

The focus of the conveyance assessment for the Stage 1 and 2 LWMP was to conduct an analysis of alternate conveyance concepts for the existing foreshore forcemain system between the Courtenay PS and the CVWPCC. As noted above, potential future wastewater contributions from the South Region in Electoral Area A, which is currently un-serviced, were also considered; however, this work is still pending approvals from its various partners, and funding for servicing of the South Region was not developed at the time of writing this report.

The flows conveyed through the Hudson Trunk, Greenwood Trunk, and the CFB Pump Station and associated forcemain were not included in this assessment, since that conveyance network was recently upgraded, and does not contribute to the foreshore forcemain system. Some of the flows to the foreshore forcemain system were diverted to this gravity system as a result of the upgrade.

6.2 STAGE 1 LWMP CONVEYANCE OPTIONS

The Stage 1 evaluation of wastewater conveyance alternatives produced a preliminary long-list of options that could feasibly be used to convey wastewater from Courtenay, K'ómoks First Nation (KFN), and Comox to the CVWPCC. Options which were considered technically viable were carried forward to the TACPAC and KFN for review and consideration. There were eleven (11) long-list conveyance alignments and concepts developed. Details of each of the Stage 1 alternative conveyance long-list options together with illustrative figures are provided in the Memorandum entitled *Stage 1 Conveyance Long List Study* in Appendix G.

The long list of options developed for the Stage 1 conveyance assessment were all aimed at eliminating the section of forcemain along the Willemar Bluffs. Additional considerations were to replace other sections of the forcemain in the intertidal zone between the Courtenay PS and the CVWPCC. This led to the development of various overland alignments for eventual or immediate replacement of the entire forcemain. Overland routes for the new forcemain were constrained by the topography, which includes two large hills, namely Comox Hill and Lazo Hill.

The long-list conveyance options were developed using the following criteria:

- general location and size of critical infrastructure such as pipes, pump stations, and treatment facilities;
- technical challenges such as hydraulics, servicing capacity, and risks of construction and installation;
- environmental considerations such as habitat impact, ecosystem impacts and proximity to known sensitive habitat;
- archaeological considerations such as proximity to known sites;
- operations and maintenance considerations including ability to isolate the system, shutdown operations, undertake repairs, flexibility, and complete spill management activities;
- potential to expand the system to address future capacity; and
- relative capital and operational costs.

In consultation with the TACPAC, three of the eleven long-list options were selected for advancement to Stage 2 for more detailed evaluation (see Section 6.3 below).

6.3 STAGE 2 CONVEYANCE FEASIBILITY ASSESSMENTS

In consultation with the TACPAC, KFN and the community as a whole, the following three options from the Stage 1 Conveyance Options Assessment were advanced to Stage 2 (see Section 2 for more detail on consultation).

1. Option 1: Cut & Cover Forcemain Installation;
2. Option 2: Trenchless Forcemain Installation; and
3. Option 3: Phased Trenchless Forcemain Installation.

These options were subsequently modified as follows:

- Option 1: Cut & Cover Forcemain Installation

  This is the "Overland Forcemain" option from the Stage 1 Assessment, re-named to more appropriately describe the installation method.
- Option 2: Trenchless Forcemain Installation

  Trenchless (tunnel) options were combined into one option, called Trenchless Forcemain Installation. The trenchless conveyance concept uses trenchless methods to install the forcemain through Lazo Road Hill and Comox Road Hill, which will reduce the pumping requirements of the upgraded pump stations. Horizontal Directional Drilling (HDD) is the trenchless method proposed.
- Option 3: Phased Trenchless Forcemain Installation

  This is the same as Option 2 but the forcemain would be installed in 2 phases. Phase 1, from Jane Place PS to the CVWPCC, would be installed initially, and Phase 2, from Courtenay PS to Jane Place PS would be installed in a future phase. This would allow deferring significant capital spending to a later date. Feasibility assessments of the short list of conveyance options are described in the Memorandum entitled *Stage 2 Conveyance Options Assessment* in Appendix H.

6.3.1 CONVEYANCE SYSTEM POPULATION PROJECTIONS

Population projections for the CVWPCC service area, including the City of Courtenay, the Town of Comox, CFB, K'ómoks First Nation (KFN), and potential flows from the South Region are shown in Table 6-1.

The CVRD, with support from the City of Courtenay and the Town of Comox, recently completed the construction of the Greenwood and Hudson Trunk Sewers, which collect portions of the future wastewater flows generated in the two communities. Approximately 20% of the current wastewater flows from Courtenay will eventually be diverted away from the Courtenay PS to the Hudson and Greenwood Trunk Sewers. The population projections for the Courtenay PS service area shown in Table 6-1 reflect these changes.

Table 6-1: Projected Population for the Regional Collection System

YEAR	COURTENAY PS SERVICE POPULATION[1]	JANE PLACE PS SERVICE POPULATION	TOTAL COURTENAY AND JANE PLACE
2016	21,389	14,652	**36,041**
2020	23,366	15,580	**38,946**
2030	27,706	17,901	**45,607**
2040	32,412	20,449	**52,861**
2050	37,788	23,361	**61,149**
2060	43,930	26,687	**70,617**
2105[2]	84,350	45,578	**132,928**

[1] Accounting for 20% Diversion from existing population to Hudson and Greenwood Trunk Sewers and includes South Region
[2] Used for sizing forcemain (80-year design life)

Based on the population estimates shown in Table 6-1, flow projections were estimated for both the Courtenay PS and the Jane Place PS. To account for the diversion of approximately 20% of existing sewage flows from Courtenay with respect to I&I, the calculated geographical area was reduced from 1,950 ha to 1,560 ha.

Due to the construction of the Hudson and Greenwood Trunk Sewers, not all flows from future growth will be directed to Courtenay PS and Jane Place PS. Based on direction provided by the CVRD, it was assumed that 50% of additional future flows will be diverted to the Greenwood/Hudson system. Table 6-2 shows the total estimated flows to be conveyed through the foreshore forcemain system based on the above diversion assumptions (includes future flows from the South Region).

Table 6-2: Projected Future Flows for the Foreshore Forcemain System

	COURTENAY PS			JANE PLACE PS			TOTAL		
	ADWF	PDWF	PWWF	ADWF	PDWF	PWWF	ADWF	PDWF	PWWF
YEAR	L/S	L/S	L/S	L/S	L/S	L/S	L/S	L/S	L/S
2016	59	138	350	41	98	209	**100**	**236**	**559**
2020	70	161	469	42	101	212	**112**	**262**	**680**
2030	79	181	488	45	108	218	**124**	**289**	**707**
2040	91	203	511	49	115	226	**139**	**318**	**737**
2050	103	228	534	53	124	234	**156**	**351**	**769**
2060	116	253	559	57	133	244	**173**	**386**	**803**
2105	193	392	700	88	193	303	**281**	**585**	**1003**

Projected future flows account for diversions to the new Greenwood and Hudson Trunk sewers, as well as contribution from the South Region

6.3.2 STAGE 2 ADDITIONAL ASSESSMENTS COMPLETED

The following additional desktop level assessments were completed for Stage 2:

— review of previous assessments of condition and capacity of existing infrastructure, including the forcemain, the three pump stations, Courtenay PS, Jane Place PS, and K'ómoks First Nation PS;

— review of existing data related to anticipated sea level rise and assessment of potential impacts on conveyance infrastructure.

— assessment of the potential to upgrade, rather than replace the existing pump stations – construction of a new replacement station would be needed if the pump size can not be accommodated in the existing wet well/dry well structure at Courtenay PS and in the existing wet well structure at Jane Place PS – it may be preferred to upgrade existing stations by installing newer, higher capacity pumps in the existing structures, and replacing aging equipment, for the following reasons:
  — lack of available land in the vicinity of Jane Place PS to construct a replacement station;
  — lower capital costs to upgrade rather than replace; and
  — potential to use remaining life of structures which may be in good condition.

— assessment of the ability to phase upgrades; with a large amount of infrastructure to potentially be replaced or upgraded (3 pumps stations and 8,800 m of forcemain) – the ability to phase upgrades would allow the CVRD to spread costs over a number of years.

The following specialist assessments were also completed:

— Environmental: *CVRD Sanitary Forcemain – Marine and Inland Options Study*, Current Environmental, August 12, 2019.

— Archaeological: *AOA of Comox Road from 17th St. to KFN IRI*, Baseline Archaeological Services Ltd., August 9, 2019; *Archaeological Site Summary: Comox Sewer Line, K'ómoks IR 1 to Curtis Road*, Baseline Archaeological Services Ltd., August 12, 2019.

— Hydrogeological: *CVRD Liquid Waste Management Plan – Preliminary Hydrogeological Assessment of Tunnel Options*, GW Solutions, July 29, 2019.

— Trenchless Installations (tunneling): *Conceptual Trenchless Design*, McMillen Jacobs Associates, October 4, 2019.

— Structural: *Pump Station Wet Wells - Structural Assessment,* WSP, April 12, 2021

— Geotechnical:

  - *Geotechnical Report – Liquid Waste Management Plan – Comox Hill, Comox, British Columbia,* WSP, April 12, 2021
  - *Geotechnical Report – Liquid Waste Management Plan – Lazo Hill, Comox, British Columbia,* WSP, April 12, 2021
  - *Geotechnical Report – Liquid Waste Management Plan – Lazo Marsh, Comox, British Columbia,* WSP, April 12, 2021
- Trenchless Installations
  - *Horizontal Directional Drilling Preliminary Design,* WSP, November 19, 2020
  - *Preliminary Value Engineering Study Report,* Strategic Value Solutions, December 2020
  - *CVRD Preliminary Forcemain Design (HDD Sections) Value Engineering Review,* WSP, April 12, 2021

6.3.3 STAGE 2 ASSESSMENT CRITERIA

The Stage 2 conveyance options were assessed based on the additional information from the investigations completed, and an expanded list of critical factors initially identified in the Stage 1 options assessment. The expanded list of evaluation criteria is as follows:

- hydraulics considerations;
- condition of existing infrastructure, including remaining life and Post Disaster earthquake resilience considerations;
- opportunity for upgrading versus replacing the pump stations;
- opportunity for phasing;
- flooding and climate change resilience for existing and proposed infrastructure;
- construction risks;
- operations and maintenance considerations including ability to isolate the system and shut down operations to undertake repairs, flexibility, and redundancy;
- K'ómoks First Nation impacts;
- archaeological considerations such as proximity to known sites;
- environmental considerations such as habitat impact, ecosystem impacts, and proximity to known sensitive habitat;
- geotechnical and hydrogeological considerations;
- public impacts such as construction disturbance and visibility of constructed works;
- permitting requirements;
- land and ROW acquisition requirements and considerations, property availability; and
- high-level capital and operational and maintenance costs (primarily consist of pumping energy costs).

6.3.4 OPTION 1: CUT & COVER FORCEMAIN

Option 1 would operate similarly to the existing system, where a single forcemain conveys wastewater directly from the Courtenay PS to the CVWPCC; however, the forcemain would be moved out of the foreshore and located beneath existing streets. The three pump stations (Courtenay PS, K'ómoks First Nation PS and Jane Place PS) would operate independently of each other, and pump into the common forcemain as they do now. The forcemain would follow the natural topography of the land rather than run along the foreshore, and therefore the pump stations would have to provide significantly higher discharge pressures to overcome the topography of the new overland forcemain alignment.

The forcemain would be installed using traditional cut and cover trenching methods and would generally follow existing road rights-of-way and contours to minimize low points and high points in the system. This approach is very common and well established. Complexities would involve relocating existing utilities and restoring surface roadways, sidewalks, and landscaping. Due to the nature of sanitary conveyance systems, the installed depth excavation would be set to be below the existing water distribution system; it would be prudent to install relatively large mains deeper leaving space above for other smaller utilities.

The general alignment for Option 1 is shown on Figure 6-2. The route would follow the existing forcemain alignment along Comox Road from the Courtenay PS for about 2.3 km through farmland and K'ómoks First Nation lands, where it would be re-routed out of the foreshore and continue through Comox to the CVWPCC. The length of the overland route would be in the order of 8,800 m. The forcemain would pass over Comox Road Hill at roughly 40 m elevation and over the Lazo Road Hill at roughly 51 m elevation.

High discharge pressures for Option 1 associated with the high elevations of Comox and Lazo Hills would approach the working pressure limitations of the existing forcemain and increase the risk of failure if the existing forcemain were retained between Courtenay PS and Jane Place PS. Therefore, replacement of the entire forcemain with a pipe that has a higher pressure rating would be prudent for Option 1, to reduce the risk of pipe failure; this means that phasing of Option 1 was not recommended.

Figure 6-2: Option 1 - Cut and Cover Forcemain Alignment

Energy costs for pumping would increase significantly compared to the current costs, due to the high pumping discharge head requirements associated with Comox and Lazo Hills.

RISKS AND UNKNOWNS

- Pumps at the Courtenay PS will have significantly higher discharge pressures (>60 m TDH); these pressures are considered very high for sanitary pumping systems, and pumps can be expected to have higher maintenance challenges and greater maintenance requirements.
- For the Courtenay PS, although it is possible to retrofit the required large pumps into the existing station, modifications inside the wet well/drywell would be required, and installation of the pumps will be more challenging.
- It is likely that the Courtenay PS wet well/dry well structure and the Jane Place PS wet well structure do not meet current Post Disaster seismic standards; the structures will be assessed to determine how they compare to the current Post Disaster standard, and what upgrades would be needed to bring the structures up to the current Post Disaster standard. Based on the assessments, the decision whether to retrofit each station will be made; for the Courtenay PS, the need for a seismic upgrade will be considered along with other factors, to determine if a

rebuild is warranted compared to upgrading the station; due to site constraints. A retrofit is envisaged for the Jane Place PS.

– Due to their location, both pump stations will require floodproofing against the impacts of climate change and sea level rise; because the Jane Place PS is constrained by space limitations, flood proofing will be more challenging.
– The discharge pressures for this option are approaching the design working pressures of the forcemain, so phasing of the system upgrades (by retaining a portion of it to be replaced in a future phase) is not recommended, due to increased risk of forcemain failure at higher pressures.

6.3.5 OPTION 2: PARTIAL TRENCHLESS FORCEMAIN

Option 2 was similar to Option 1; however, a portion of the forcemain would be installed through Comox Hill and Lazo Hill using trenchless methods, to reduce the elevation and associated pumping pressure. The three pump stations (Courtenay, Jane Place and KFN) would operate independently of each other and pump into the common forcemain.

Using trenchless methods to install the forcemain would allow the forcemain elevation and the pumping head to be lowered by going through Comox and Lazo Hills rather than over them. The optimal trenchless conveyance concept optimizes the length and cost of a trenchless installation against the additional pumping costs associated with shorter trenchless sections at higher elevations. For the anticipated alignment, the Comox Road Hill is approximately at 40 m elevation and the Lazo Road Hill is approximately at 51 m.

With the exception of the trenchless sections, the overland portion of the forcemain would be installed using standard cut-and-cover installation methods, with the general intention of following existing roadways, similar to Option 1.

The general alignment of Option 2 is shown on Figure 6-3. The forcemain would follow the same overland route as for Option 1; however, it would pass through Lazo Hills and Comox Road Hill using trenchless methods (in this case Horizontal Directional Drilling, also know as HDD). The overall forcemain length at 8,300 m would be shorter than for Option 1, because the HDD sections would not need to follow roadways.

Figure 6-3: Options 2 and 3 - Trenchless Forcemain Alignment

RISKS AND UNKNOWNS

- Right-of-ways would be needed for trenchless sections which may cross several properties, including private properties;
- Geotechnical and hydrogeological investigations indicate trenchless installations through Lazo Road Hill, Comox Road Hill and Lazo Marsh are feasible, but trenchless installations have higher risks with costly consequences should the risk be realized, compared to a cut and cover installation;
- As with Option 1, it is likely that the Courtenay PS wet well/dry well structure and the Jane Place PS wet well structure do not meet current Post Disaster seismic standards; the structures will be assessed to determine how they compare to the current Post Disaster standard, and what upgrades would be needed to bring the structures up to the current Post Disaster standard. Based on the assessments, the decision whether to retrofit or replace each pump station will be made; for the Courtenay PS, the need for a seismic upgrade will considered along with other factors, to determine if a rebuild is warranted compared to upgrading the station. Due to site constraints, a retrofit is envisaged for Jane Place PS in the short term.
- Due to their location, both pump stations will require floodproofing against the impacts of climate change and sea level rise; because the Jane Place PS is constrained, flood proofing will be more challenging.

6.3.6 OPTION 3: PHASED PARTIAL TRENCHLESS FORCEMAIN

Option 3 is the same as Option 2, except that the forcemain replacement would be constructed in two phases. Phase 1 would replace the forcemain from the Jane Place PS to the CVWPCC (this would eliminate the Willemar Bluffs section). Replacement of the remaining section from Courtenay PS to Jane Place PS would be deferred to Phase 2, assumed to occur in 2050. Pump station upgrades would be as for Option 2. The tie in point for Phase 1 would be in Marina Park, near the Jane Place PS, where the forcemain is aligned out of the foreshore.

Since Option 3 is essentially the same as Option 2 (Option 3 is phased, and Option 2 is not), the assessment is not repeated here.

6.3.7 LIFE CYCLE COST ASSESSMENT

Order of magnitude life cycle cost estimates were calculated for each option as the sum of the present value of each of the following components:

1. Capital costs, estimated based on the following:
   - Similar infrastructure installed in other communities, where available; and
   - Cost curves and unit rates.
2. Operating costs consisting of:
   - Estimated annual average power consumption for pumping;
   - Estimated labour effort.
3. Asset renewal requirements, based on renewal frequency of 60 years for cut and cover and HDD forcemain sections, and 25 years for pump stations. Asset renewal cost was estimated as complete (100%) replacement for forcemains at end of life (60 years), and 40% of initial costs for pump stations for subsequent upgrades (25 year life).

The costs presented in Table 6-3 and 6-4 are in $2020 CAD and do not include GST. These costs were developed for options comparison and discussion and are not considered suitable for budgeting. Costs include contingency at 40% for cut and cover forcemain sections and pump stations, 60% for HDD, and engineering at 15% of construction cost.

Table 6-3: Net Present Value Calculation Assumptions Parameters[3]

PARAMETER	VALUE	UNIT
Assumed annual rate of return	3.5	%
15-yr Engineering News-Record (ENR) Construction Index rate of inflation	3.0	%
Demand Charge[1]	12.34	$/kW
Power Rate Increase	5.0	%
Operating hrs/day	10	hr
Energy Charge[2]	0.0606	$/kW-hr
Labour Rate	100,000	$/yr
Labour Inflation	3	%

[1] BC Hydro Demand Charge, current

[2] BC Hydro Power Rate, current

[3] Costs are in $2020 CAD

Table 6-4 shows the 30-year and 50-year life cycle cost for each conveyance option. The higher initial capital cost of Option 1 Cut & Cover ($54.7 M) is primarily due to the larger pipe size needed for the forcemain to reduce the dynamic headlosses so the pump discharge pressure is within acceptable values. The length of the forcemain is also longer, and the pump station upgrades more extensive for the needed higher head pumps.

The 30-year and 50-year present value for Option 3 are slightly higher than for Option 2 because of the additional costs that will be incurred due to phasing. This is offset somewhat because the assumed average annual rate of inflation over the next 50 years (represented by the ENR Construction Index, at 3.0%) is less than the assumed average annual rate of return (3.5%). As well, the benefits of the phased approach of Option 3 is that it defers some of the costs so that future users can bear some of the costs, and it allows the CVRD to accrue funding for the second phase over a number of years.

Table 6-4: Stage 2 Options Cost Summary

COST PARAMETER	OPTION 1 CUT & COVER	OPTION 2 PARTIAL TRENCHLESS	OPTION 3 PHASED PARTIAL TRENCHLESS
Initial Capital Cost	$54.7M	$51.0M	$35.9M
Future Capital Cost (2050)	N/A	N/A	$17.5M
Initial Annual Operating Cost	$460,000	$360,000	$360,000
30-year Net Present Value[1]	$77.5M	$67.6M	$68.6 M
50-year Net Present Value[1]	$97.2M	$81.6M	$82.7 M

[1] includes capital, operating, and asset renewal costs

6.3.8 STAGE 2 CONVEYANCE ALTERNATIVES EVALUATION SUMMARY

A summary of the evaluation of the short-listed conveyance options is shown in Table 6-5, along with a brief summary highlighting the comparisons between Options 1 and 2. Option 3 is simply a phased version of Option 2, and shares most of the same attributes except as noted.

Table 6-5: Stage 2 Conveyance Alternative Options Evaluation Summary

CRITERIA	OPTION 1	OPTIONS 2 AND 3
Hydraulics	Significantly higher discharge pressures will be needed at all pump stations. Pressures are considered very high for sanitary pumping systems, and pumps will have significantly higher maintenance challenges and requirements.	Upgrades driven by hydraulic changes are required for the Courtenay PS, Jane Place PS, and Comox FN PS, but are less costly than for Option 1 and can be accommodated using pumps that would operate within typical ranges.
Opportunity for upgrading vs. replacing pump stations	Upgrading is feasible at Courtenay PS and Jane Place PS stations by installing new pumps in the existing wet wells; however, upgrading Courtenay PS will require significant modifications and be very challenging – replacement is likely preferred	Upgrading is feasible at the Courtenay PS and Jane Place PS stations by installing new pumps in the existing wet wells. Upgrading is especially favourable for the Jane Place PS where the land requirement for a replacement station is a concern, and where a replacement station at higher elevation will require an additional small lift station for the properties below.
Opportunity for Phasing	Not recommended	Option 3 is the phased version of Option 2.
Flooding and climate change resilience for existing and proposed infrastructure	Climate change will increase risk of flooding to pump stations now located at sea level. Re-constructed pump stations can be built at a higher elevation or with appropriate flood protection. Note that for the Courtenay PS this may impact the ability for flows to siphon to the PS wet well from the south shore.	No unique risks, issues, or advantages are identified that will differentiate Options 1 and 2 or 3 with regards to this criterion. As with Option 1, replacement of the Courtenay PS at a higher elevation may impact the ability for flows to siphon to the pump station from the south shore.

CRITERIA	OPTION 1	OPTIONS 2 AND 3
Construction risks	Construction of new conveyance system through an area with existing infrastructure and high traffic may require re-location of existing utilities.	Risks similar to Option 1 can reduced for Options 2 and 3 because a portion of the alignment will be installed using trenchless methods; however, construction risks are higher for a trenchless installation compared to a cut and cover installation. If the risks are realized, this potentially can be costly.
Operation and maintenance considerations including ability to isolate the system and shut down operations to undertake repairs, flexibility, redundancy	Maintenance and repair of the cut & cover forcemain would be completed using well established repair methods based on open excavation. Should a pipe failure occur, standard methods of isolation and pumping off-site using a vacuum truck would be employed.	Trenchless sections would be inaccessible for repair but would be well protected.
K'ómoks First Nation impacts	Forcemain will cross IR1 Reserve on Comox Ave.	No unique risks, issues, or advantages are identified that will differentiate Options 1 and 2 with regard to this criterion.
Geotechnical/hydrogeological considerations	With forcemain in roadways, geotechnical conditions can generally be accommodated	Additional investigations needed to confirm geotechnical/ hydrogeological conditions for trenchless sections
Public impacts such as construction disturbance and visibility of constructed works	Potential for utility breaks and service disruptions.	Less disruption through sections installed using trenchless methods; however, impacts are increased at entry/exit pit locations
Land and ROW acquisition requirements and considerations, property availability	ROW will be needed across forested area/wetlands to CVWPCC. Crosses K'ómoks First Nation Reserve. No current land availability to construct a new Jane Place PS.	ROWs needed for trenchless sections which may cross several properties. ROW will be needed across forested area/wetlands to CVWPCC. Crosses K'ómoks First Nation Reserve. No current land availability to construct a new Jane Place PS.
Relative capital and operational costs.	Option 1 has the highest initial capital expenditure of $54.7 M. Option 1 also has the highest 30-year LCC at $77.5 M, and 50 year LCC at $97.2 M	Option 2 has an initial capital expenditure of $51 M, which is less than Option 1. Option 2 has a lower 30-year LCC than Option 1 at $67.6 M, due partly to lower energy demand for pumping. Pumping costs at all PS are lower for Option 2 than those for Option 1. Costs for Option 3 are similar to Option 2, but phasing reduces the initial capital cost to $35.9 M, with an additional $17.5 M required around 2050.

6.3.9 RECOMMENDED CONVEYANCE APPROACH

The selected approach for upgrading the wastewater conveyance infrastructure between the Courtenay Pump Station and the CVWPCC is Option 2, to undertake the project in a single phase using a partial trenchless approach. Option 2 was ranked highest of the three options by the TACPAC on technical, affordability, local economic benefit, environmental benefit and social benefit criteria. Updated Class C cost estimates were developed in 2021 for comparison of the options as shown in Table 6-6.

Table 6-6: Updated 2021 Class C Cost Estimates for Conveyance Infrastructure

CONVEYANCE OPTION	CAPITAL COST	30 YEAR O&M COSTS	COST PER HOUSEHOLD FOR 20 YEARS
Option 1: Cut & Cover	$65M	$17M	$240/household
Option 2: Partial Trenchless	$58M	$13M	$210/household
Option 3: Partial Phased Trenchless	Phase 1: $43M Phase 2: $18M (15-20 years later)	$13M	Phase 1: $160/household (until Phase 2)

This approach has been selected to address the project key issues including replacing the section of forcemain along Willemar Bluffs, addressing capacity constraints in the Courtenay and Jane Place Pump Stations, reducing pumping head and energy consumption over the long-term by using trenchless sections.

Additionally, following the Value Engineering exercise conducted in December 2020, the existing pre-stressed concrete cylinder pipe (PCCP) was identified as more typically used for water transmission than wastewater. The failure mode of this type of pipe was noted as a large blow out rather than a leak. As such, the importance of a single phase replacement of such pipe in the wastewater system was stressed, rather than the phased approach proposed in Option 3 which would require the existing PCCP to remain in service until approximately 2050.

The conveyance project will be broken out of the LWMP process at the end of Stage 2 and will not proceed to Stage 3 to fast track the implementation of the project. CVRD entered an Alternate Approval Process (AAP) to obtain authorization for borrowing to finance the conveyance infrastructure upgrades. The AAP was conducted between May and July 2021, and borrowing was approved on July 8, 2021.

7 WASTEWATER TREATMENT OPTIONS

7.1 OVERVIEW

The wastewater treatment options presented in this section are based on the level of treatment to be implemented (i.e., the effluent quality that will be produced), which is the level of analysis that is appropriate for a Liquid Waste Management Plan (LWMP). More detailed engineering analysis is then undertaken in feasibility and predesign studies (normally following completion of the LWMP), to select and size the treatment processes that will be used to achieve the recommended effluent standards.

Other aspects of wastewater treatment included in LWMPs typically include identification of wastewater treatment service areas (present and future), and the number and location of treatment facilities. For the CVRD LWMP, the study area is based on the service areas for the existing Comox Valley Water Pollution Control Centre (CVWPCC), namely the Town of Comox, the City of Courtenay, Canadian Forces Base Comox, and K'ómoks First Nation (KFN), with consideration for adding the South Region to the service area in future (see Section 3.4 for more detail on the South Region).

The CVWPCC is a secondary treatment facility located at 445 Brent Road in Comox that is owned and operated by the Comox Valley Regional District (CVRD). Treated wastewater is discharged from the CVWPCC to the Strait of Georgia through a submerged outfall pipe with diffuser that extends 2,825 metres from shore near Cape Lazo, with the outfall terminus 60 metres below the water surface at low tide.

7.2 LOCATION AND NUMBER OF TREATMENT FACILITIES

In some LWMPs, sites for one or more new treatment facilities may be identified and investigated. Identifying one or more locations for a new wastewater treatment plant is a challenging undertaking. One of the challenges is to identify a suitable location for a new outfall discharge; among other things, this requires a right-of-way for the land section of the outfall from the treatment plant site to the water's edge, where the marine (submerged) section of the outfall pipe begins. The discharge itself is preferably located far from shore in deep water, so that risks to swimming beaches and shellfish beds are minimized. It is often practical to begin with identification of one or more feasible locations for an outfall discharge, and then identify potential sites for treatment facilities that are within a reasonable distance of the outfall location, and where a feasible route for the land section of the outfall can be developed. Environmental Impact Studies of the receiving environment are required when selecting the location of the outfall discharge; these studies typically consider receiving water ecology and use (marine flora and fauna, recreational use, etc.), local currents, prevailing winds, expected migration and dilution of the discharge plume, etc. The environmental impacts of construction (especially in the intertidal zone) must also be evaluated and mitigated.

The costs and benefits of a single wastewater treatment plant versus several smaller plants located throughout a service area (sometimes referred to as "distributed treatment") have been extensively evaluated in British Columbia at a number of locations (e.g., the Greater Victoria area, North Vancouver, and a number of smaller communities such as Powell River). In general, the evaluations have resulted in selection of the single treatment plant approach, due to the significantly higher costs associated with construction and operation of multiple treatment facilities, and the difficulties associated with finding multiple locations for treatment plants and outfall discharges that are acceptable to local residents and that meet all of the technical and regulatory requirements.

As noted above, in the case of the CVRD a single existing wastewater treatment facility (located at Brent Road near Cape Lazo) and outfall serves the communities of Courtenay and Comox, CFB Comox and KFN. The existing treatment plant site has adequate unused area for major expansion of the facilities in future as required. Attempting to locate a site for a second treatment facility within the existing service area would be very difficult, partly due to the challenges associated with finding a suitable location for a second outfall to deep water. In this case, there is no apparent driver for constructing additional treatment plants and outfalls to serve the Comox/Courtenay/CFB/KFN area, and consequently this does not form part of the wastewater treatment options analysis.

It is possible that a location may be identified within the service area where there is potential for significant use of reclaimed water (e.g., for irrigation or other purposes); in this case, it may be feasible to locate a water reclamation facility near the user(s) of reclaimed water and direct a portion of the untreated wastewater to that location, thereby reducing the wastewater load to the CVWPCC at Brent Road. This would require identification of one or more larger volume users of reclaimed water, and it may be a possible future approach to preserve capacity at the CVWPCC.

7.3 COSTS OF WASTEWATER TREATMENT

The costs of constructing wastewater treatment facilities have risen dramatically in recent years. Capital costs for constructing new facilities can sometimes be partially offset by grants from senior government. However, ongoing operating and maintenance (O&M) and replacement (asset management) costs are entirely borne by the local government. In general, the higher the effluent standards, the greater the capital and ongoing O&M costs of treatment. In general, it is more economical to have a single treatment plant, unless the service area is relatively large with development concentrated in nodes that are far apart.

For the purpose of the LWMP, it is important to carefully consider the capital, O&M and asset replacement costs of wastewater treatment, since these costs are borne by taxpayers. Therefore, it is essential to balance the desire for implementing the highest treatment standards possible with the financial resources available to the community; this particularly applies to O&M and asset replacement costs, which are not eligible for grant funding and fall entirely on local taxpayers.

7.4 STAGE 1 WASTEWATER TREATMENT OPTIONS

For the purposes of Stage 1 of the LWMP, four options for treatment were identified for discussion with the TAC PAC. The four options were based on the effluent quality to be produced and were presented as concepts for planning future expansions and/or upgrades at the CVWPCC. Option 1 would be to meet the provincial and federal discharge standards; these standards have been developed to protect the receiving environment, and the provincial regulation allows the regulating body to impose additional standards in specific cases where this is shown to be needed to protect the environment. Options 2, 3 and 4 are based on voluntarily enhancing effluent quality beyond what is required by the regulations. Options 1 through 4 are described below. Note that Option 2 describes the current configuration of the CVWPCC, with the addition of effluent disinfection to reduce risks to human health and the environment (e.g., shellfish).

The preliminary long list of Stage 1 options was discussed with the CVRD and the TAC PAC, and revisions were made as necessary before advancing to Stage 2 for more detailed analysis. The discussion below describes the options configured as deemed suitable for advancement to Stage 2.

7.4.1 DESIGN CRITERIA

The options outlined below are based on the following design conditions and information available at the time of completing this assessment:

— design horizon: 20-year design horizon to 2040;
— flows and loads as outlined for the year 2040 in Section 5.5 and Section 5.6;
— technologies similar to those currently in use at the CVWPCC were assumed to be used for expansion (other possible process options for treatment should be considered at the time of designing the next plant upgrade);
— effluent disinfection is to be included for all options; and
— provincial and federal effluent quality requirements are applicable, as outlined in Section 4 of this report.

Details of the Stage 1 CVWPCC upgrade long-list options are provided in the memo entitled *Preliminary Wastewater Treatment Long List Options* in Appendix I.

7.4.2 OPTION 1: MEET REGULATORY DISCHARGE STANDARDS (PROVIDE SECONDARY TREATMENT FOR FLOWS UP TO 2XADWF)

For Option 1, flows up to twice the average dry weather flow (2xADWF) would receive secondary treatment, with flows in excess of 2xADWF receiving only primary treatment. Option 1 would meet federal and provincial regulatory requirements for secondary treatment with discharge to open marine waters.

As with the other options, an updated Environmental Impact Study (EIS) would be required to identify any additional treatment requirements that might be needed to address protection of the receiving environment according to provincial regulations. An EIS was completed for the CVWPCC discharge in 2010; this showed that disinfection of the effluent to achieve a fecal coliform count of less than 8,000/100 mL in the CVWPCC discharge would be required to protect local shellfish resources outside the initial dilution zone (IDZ). Disinfection to this standard was assumed for Option 1. The 2010 EIS will require updating before the CVRD will be able to submit a complete application for an Operational Certificate under the LWMP. If the updated EIS does not identify any additional requirements the secondary treatment discharge standards set out in the B.C. Municipal Wastewater Regulation (MWR) and the Canada Wastewater Systems Effluent Regulations (WSER), as shown in Section 4 would apply to Option 1.

MWR

- Secondary treatment for flows up to two times average dry weather flow (2xADWF):
- 5-day Biochemical Oxygen Demand (BOD_5): max. day 45 mg/L
- total suspended solids (TSS): max. day 45 mg/L
- pH 6 to 9
- ammonia concentration does not cause chronic toxicity at the edge of the initial dilution zone (IDZ)
- effluent disinfection – fecal coliforms to meet appropriate standard for recreational or shellfish bearing waters (see Section 4.2) – it was assumed that the disinfection process would be designed to achieve recreational standards (i.e., 200 FC/100 mL) in the undiluted effluent, meaning that shellfish protection criteria would be met at the edge of the IDZ.

Primary treatment for flows in excess of 2xADWF (interim):

- 5-day Biochemical Oxygen Demand (BOD_5): max. day 130 mg/L
- total suspended solids (TSS): max. day 130 mg/L
- note that if flows are > 2xADWF during a storm or equivalent snowmelt event with a less than 5-year return period, a discharger must (have a liquid waste management plan or specific study and implement the plan or study measure).

WSER

- 5-day Biochemical Oxygen Demand (BOD_5): monthly avg. not to exceed 25 mg/L
- total suspended solids (TSS): monthly avg. not to exceed 25 mg/L
- total residual chlorine < 0.02 mg/L
- un-ionized ammonia < 1.25 mg N/L at 15°C
- note that the WSER standards apply to the combined discharge – this may require chemical addition to enhance primary treatment or other measures to ensure that the secondary treatment bypass during high wet weather flows does not cause the combined effluent to exceed the WSER discharge standards for BOD_5 and TSS

Note that plant data from 2013 to 2019 show that the number of days when flows exceeded 2xADWF ranged from 0 days (2013) to 33 days (2016). Over the 7 years of record, flow exceeded 2xADWF on a total of 89 days (the total volume of flow greater than 2xADWF represented only about 1.2 % of the total plant flow over that period).

Advantages of Option 1 are as follows:

- meets regulatory requirements for discharge to open marine waters
- avoids the cost of subjecting relatively infrequent high wet weather flows to secondary treatment

— coagulating chemicals can be added to enhance primary treatment if needed when flows exceed 2xADWF
— includes disinfection to protect shellfish resources outside the IDZ

A disadvantage of Option 1 is that flows in excess of 2xADWF would bypass secondary treatment and so would not receive biological treatment.

A process schematic for Option 1 is presented on Figure 7-1.

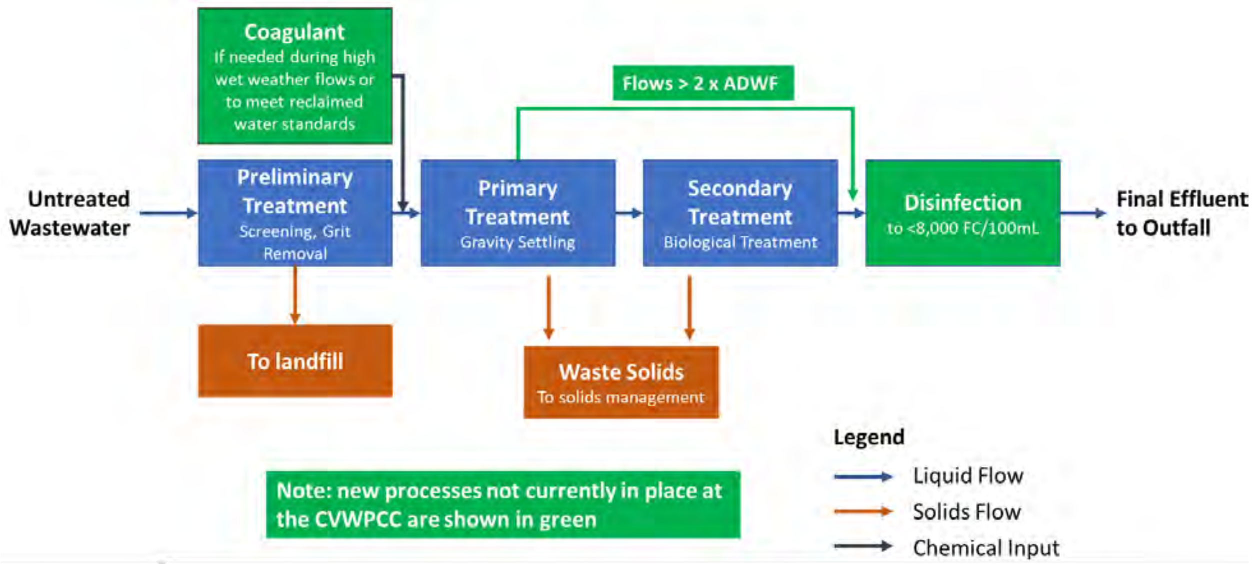

Figure 7-1: CVWPCC Upgrade Option 1

7.4.3 OPTION 2: PROVIDE SECONDARY TREATMENT FOR ALL FLOWS

Option 2 is similar to Option 1, except that there would be no wet weather bypass of flows in excess of 2xADWF around secondary treatment. For Option 2, the entire plant influent flow would pass through secondary treatment (this is the current configuration of the CVWPCC). As with the other options, an updated Environmental Impact Study (EIS) would be required to identify any additional treatment requirements that might be needed to address protection of the receiving environment. The following treatment and discharge standards will apply to Option 2.

Secondary treatment for the entire plant flow to meet MWR and WSER Standards:

— 5-day Biochemical Oxygen Demand (BOD_5): max. day 45 mg/L, monthly avg. not to exceed 25 mg/L
— total suspended solids (TSS): max. day 45 mg/L, monthly avg. not to exceed 25 mg/L
— pH 6 to 9
— ammonia concentration does not cause chronic toxicity at the edge of the initial dilution zone (IDZ)
— total residual chlorine < 0.02 mg/L
— un-ionized ammonia < 1.25 mg N/L at 15°C
— disinfection - fecal coliforms to meet appropriate standard for recreational and shellfish bearing waters (see Section 4.2) – it was assumed that the disinfection process would be designed to achieve recreational standards (i.e. 200 FC/100 mL) in the undiluted effluent, meaning that shellfish protection criteria would also be met at the edge of the IDZ.

Advantages of Option 2 are as follows:

— exceeds regulatory requirements for discharge to open marine waters
— entire plant flow is subjected to secondary (biological) treatment
— includes enhanced disinfection to protect shellfish resources

— effluent meets standards for reclaimed water use for lower exposure potential

The disadvantage of Option 2 is that secondary treatment must be sized to accommodate all wet weather flows, increasing capital and operating costs compared to Option 1. However, Option 2 represents the current configuration at the CVWPCC (with the exception of adding disinfection), and this was determined to be the minimum standard going forward in consultation with the CVRD and TACPAC.

A process schematic for Option 1 is presented on Figure 7-2.

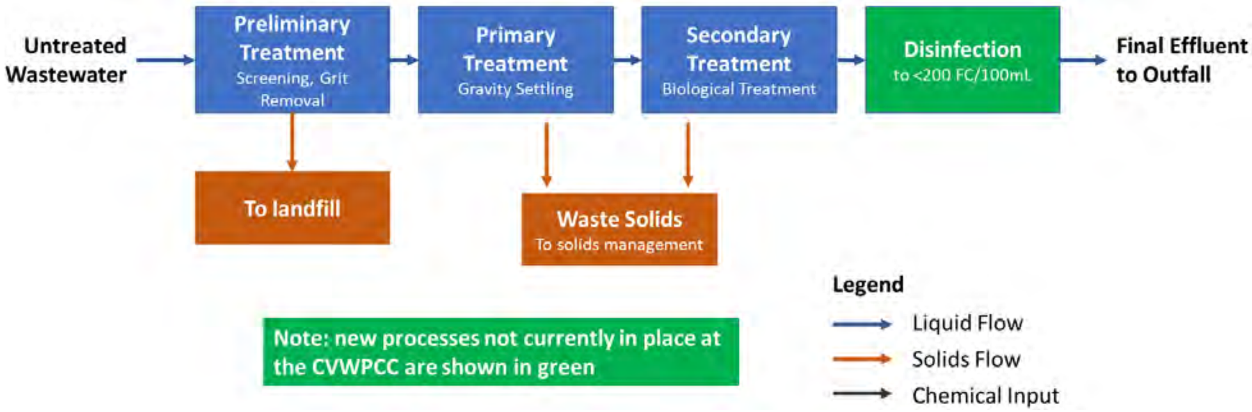

Figure 7-2: CVWPCC Upgrade Option 2

7.4.4 OPTION 3: ADVANCED TREATMENT FOR FLOWS UP TO 2XADWF

Option 3 would incorporate the same preliminary, primary and secondary treatment processes as Option 2. In addition, Option 3 would include advanced filtration of the secondary treated effluent for flows up to two times the average dry weather flow (2xADWF) to enhance removal of suspended solids. As with the other options, an updated Environmental Impact Study (EIS) would be required to identify any additional treatment requirements that might be needed to address protection of the receiving environment. For Option 3, it was assumed that the disinfection process would be designed to achieve standards of 200 FC/100 mL in the undiluted combined effluent, to meet shellfish criteria following dilution. The following treatment and discharge standards would apply to Option 3.

Secondary treatment for the entire plant flow to meet MWR and WSER Standards:

— 5-day Biochemical Oxygen Demand (BOD_5): max. day 45 mg/L, monthly avg. not to exceed 25 mg/L
— total suspended solids (TSS): max. day 45 mg/L, monthly avg. not to exceed 25 mg/L
— pH 6 to 9
— ammonia concentration does not cause chronic toxicity at the edge of the initial dilution zone (IDZ)
— total residual chlorine < 0.02 mg/L
— un-ionized ammonia < 1.25 mg N/L at 15°C

Advanced treatment (filtration) for flows up to 2xADWF:

— 5-day Biochemical Oxygen Demand (BOD_5): max. day 10 mg/L, avg. 5 mg/L
— total suspended solids (TSS): max. day 10 mg/L, avg. 5 mg/L
— pH 6 to 9
— ammonia concentration does not cause chronic toxicity at the edge of the initial dilution zone (IDZ)
— total residual chlorine < 0.02 mg/L
— un-ionized ammonia < 1.25 mg N/L at 15°C
— future addition of processes that are proven for removal of emerging contaminants at municipal wastewater plants

Disinfection for entire plant flow:

— disinfection - fecal coliforms to meet appropriate standard for recreational and shellfish bearing waters (see Section 4.2) – it was assumed that the disinfection process would be designed to achieve recreational standards (i.e., 200 FC/100 mL) in the undiluted effluent, meaning that shellfish protection criteria would be met at the edge of the IDZ.

Note that plant data from 2013 to 2019 show that the number of days when flows exceeded 2xADWF ranged from 0 days (2013) to 33 days (2016). Over the 7 years of record, flow exceeded 2xADWF on a total of 81 days (the total volume of flow greater than 2xADWF represented only about 1.2 % of the total plant flow over that period.

Advantages of Option 3 are as follows:

— exceeds regulatory requirements for discharge to open marine waters
— majority of plant flow is subjected to advanced treatment
— includes enhanced disinfection to protect shellfish resources
— tertiary effluent meets standards for reclaimed water use for greater exposure potential, combined effluent meets standards for reclaimed water use for lower exposure potential
— ability to upgrade coagulation and disinfection to meet reclaimed water standards for moderate or greater exposure potential

Disadvantages of Option 3 are as follows:

— higher capital and operating costs than Options 1 and 2
— flows > 2xADWF do not pass through advanced treatment
— increased operational costs if treating reclaimed water to greater exposure potential standard

A process schematic for Option 3 is presented on Figure 7-3.

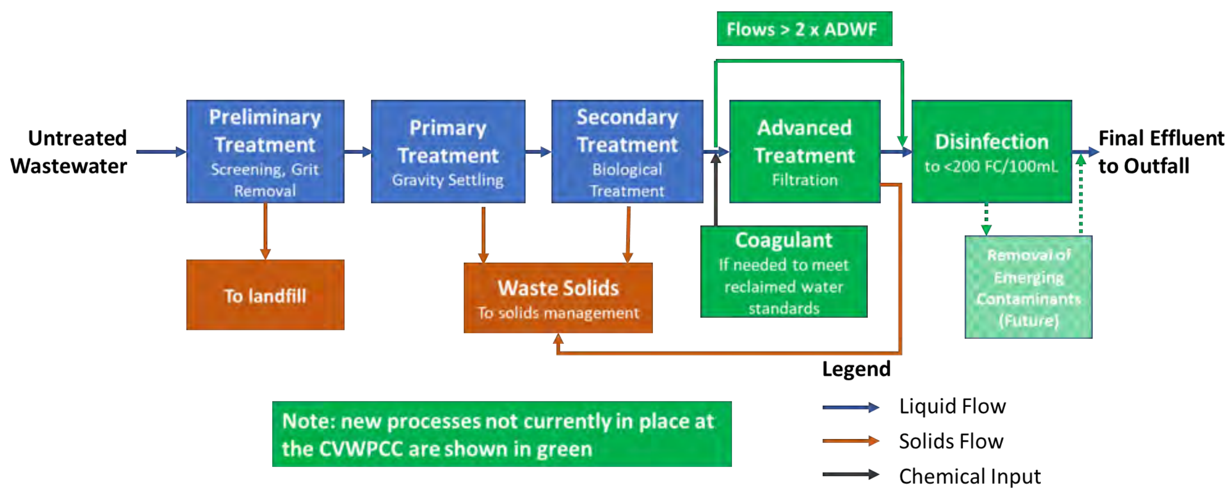

Figure 7-3: CVWPCC Upgrade Option 3

7.4.5 OPTION 4: ADVANCED TREATMENT FOR ALL FLOWS

Option 4 would incorporate the same preliminary, primary, secondary, and advanced treatment processes as Option 3. However, for Option 4, the entire plant influent flow would pass through advanced filtration to enhance removal of suspended solids. As with the other options, an updated Environmental Impact Study (EIS) would be required to identify any additional treatment requirements that might be needed to address protection of the receiving environment. For Option 4, it was assumed that the disinfection process would be designed to achieve shellfish standards (i.e., 14 FC/100 mL) in the undiluted effluent, and disinfection could be increased to meet the reclaimed water standards for greater exposure potential (<1FC<100mL) if desired.

The following treatment and discharge standards would apply to Option 4.

- Advanced treatment for the entire plant flow:
- 5-day Biochemical Oxygen Demand (BOD_5): max. day 10 mg/L, avg. 5 mg/L
- total suspended solids (TSS): max. day 10 mg/L, avg. 5 mg/L
- pH 6 to 9
- ammonia concentration does not cause chronic toxicity at the edge of the initial dilution zone (IDZ)
- total residual chlorine < 0.02 mg/L
- un-ionized ammonia < 1.25 mg N/L at 15°C
- disinfection - fecal coliforms to meet appropriate standard for recreational and shellfish bearing waters (see Section 4.2) – it was assumed that the disinfection process would be designed to achieve recreational standards (i.e. 200 FC/100 mL) in the undiluted effluent, meaning that shellfish protection criteria would be met at the edge of the IDZ.
- future addition of processes that are proven for removal of emerging contaminants at municipal wastewater plants

Advantages of Option 4 are as follows:

- exceeds regulatory requirements for discharge to open marine waters
- entire plant flow is subjected to advanced treatment
- includes enhanced disinfection to protect shellfish resources
- effluent meets standards for reclaimed water use for greater exposure potential

Disadvantages of Option 4 are as follows:

- higher capital and operating costs than Options 1, 2 and 3
- higher operational costs if treating reclaimed water to greater exposure potential standard

A process schematic for Option 4 is presented in Figure 7-4.

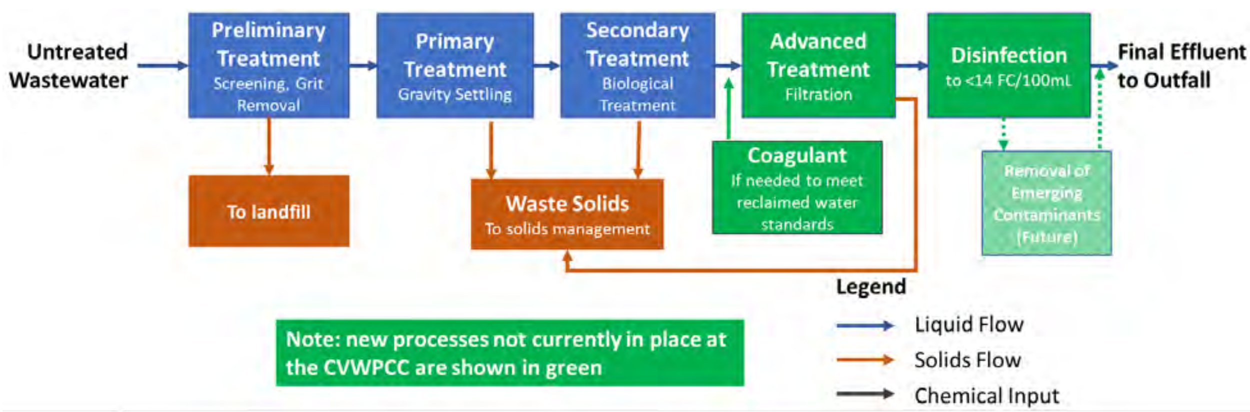

Figure 7-4: CVWPCC Upgrade Option 4

7.5 STAGE 2 WASTEWATER TREATMENT OPTIONS ASSESSMENT

The Stage 2 work was a high-level review of the estimated capacity of the existing infrastructure at the CVWPCC, what would be required for expansion to handle 2040 flows and loads, and cost estimates for different levels of wastewater treatment at the CVWPCC as described in the previous section.

The objective of the Stage 2 wastewater treatment options assessment was to enable decision making to identify the desired level of wastewater treatment to provide at the CVWPCC by comparing the costs and benefits of the different options. The CVWPCC Capacity Assessment completed by ISL Engineering and Land Services in 2016, was a significant input to this assessment.

From the Stage 1 long-list for CVWPCC and outfall upgrade options, the following options were progressed for Stage 2 assessment in consultation with the TAC PAC and the District:

- Option 2: Provide Secondary Treatment for all flows (base case and currently practiced at the CVWPCC)
- Option 3: Advanced Treatment for flows up to 2xADWF
- Option 4: Advanced Treatment for All Flows

Note that Option 1 was not carried forward from Stage 1, since it would represent a step down from the effluent quality currently produced at the CVWPCC.

Details of each of the Stage 2 CVWPCC upgrade short-listed options are provided in the Memorandum entitled *Stage 2 Wastewater Treatment Level Assessments* in Appendix J.

7.5.1 DESIGN CRITERIA

The purpose of this review was to provide sufficient information to decide on the treatment level to be implemented at the CVWPCC when the plant is next expanded or upgraded. Evaluation of the options that advanced to Stage 2 was based on the following design conditions and information available at the time of completing this assessment:

- Design horizon: 20-year design horizon to 2040
- Flows and loads as outlined for year 2040 in Section 5.5 and Section 5.6.
- For the purpose of this evaluation, it was assumed that similar technologies to those currently in use at the CVWPCC would be used for expansion (alternate technologies can be considered at the time of the plant upgrade).
- Effluent disinfection to meet shellfish standards would be added for all options.
- Provincial and Federal effluent quality requirements are applicable, as outlined in Section 4. Process reliability (redundancy) requirements according to the MWR.

7.5.2 KEY CONSIDERATIONS

Several considerations should be given to how the plant might be laid out for future upgrades, and how new infrastructure components can fit into the existing plant and mesh with future plans for the facility. A new offline equalization tank is currently being constructed at the CVWPCC to handle peak flows to the treatment plant, and this should be incorporated into future planning of conceptual layouts if possible. At the time of writing, a master planning study is currently underway to determine the optimum plant layout for future expansions and upgrades for the level of treatment identified.

Key considerations that have been identified for potential future upgrades and expansions of the CVWPCC are summarized in Table 7-1.

Table 7-1: CVWPCC Key Consideration Identification

KEY CONSIDERATION	RISK	POTENTIAL MITIGATION OPTIONS
1. How is new infrastructure integrated with the existing plant?	— By 2040 the existing infrastructure will be 60 years old. Condition assessments may find that some of the assets are at the end of their useful life and may not be in the plans for future expansions to 2060. — The available head in the hydraulic profile is limited and may limit options to avoid pumping between unit processes. — The new equalization tank under construction reduces the available area for construction of other facilities in future.	— Ensure new infrastructure can be used well into the future. — Incorporate flow control options within plant layout or allow for tie-in to future flow control options to maintain equal division of flows to multiple process units and allow addition of future processes and upgrades. — Coordinate design of the new wastewater conveyance infrastructure to provide as much additional static head at the discharge to the CVWPCC headworks; this will maximize opportunities to maintain gravity flow through the plant when new processes are added in future.
2. How much longer can the existing infrastructure be used?	— The generally harsh conditions from H_2S exposure can erode concrete and mechanical components in the headworks and primary clarifiers. Re-use of these systems beyond 2040 may be limited and new facilities will likely be required.	— Condition assessments can be completed on these components that outline faulty or weak components, and repairs can be designed to extend the life of the systems. This would be included for aeration basins and secondary clarifiers as well to maximize life beyond 2040.
3. What will the solids handling components look like in the future?	— The wastewater treatment plant currently hauls dewatered waste solids to a composting facility. Changes in regulations, cost-benefit analysis, and other factors can drive decisions for future solids handling options such as anaerobic digestion where biogas and energy can be recovered. — The age of current solids handling equipment might require refurbishment to ensure the equipment will last until at least 2040.	— Future space considerations for anaerobic digestion with resource recovery (biogas, fertilizer pellets) should be included when developing future plant layouts. Digestion could potentially be part of a future overall solids handling system upgrade that could enhance resource recovery, reduce loading on the compost facility, and reduce the mass of compost produced. — A condition assessment of structural and mechanical components on the thickeners (gravity and DAF units) and dewatering centrifuges can provide insight into repairs that may be needed to ensure the life of the equipment will last until at least 2040, as the components do have the capacity.
What are the geotechnical conditions of the site and post-disaster structural considerations?	— Building codes and the status of wastewater facilities have become more stringent. New infrastructure at wastewater treatment plants now has to be "post-disaster", which means operable after a natural disaster, such as a major earthquake.	— Complete geotechnical assessments to evaluate the ground conditions at the site in light of the new regulations. — Complete a structural condition assessment to review the existing infrastructure, expected lifespan, and possible upgrades that may be required to help the infrastructure meet post-disaster requirements.

KEY CONSIDERATION	RISK	POTENTIAL MITIGATION OPTIONS
What are the odour concerns?	— New infrastructure should not create increased odours in the area	— Include allowances for odour control measures in new infrastructure. The capacity of the existing odour control system was not reviewed for the LWMP.

7.5.3 OPTION 2 - PROVIDE SECONDARY TREATMENT WITH DISINFECTION FOR ENTIRE FLOW

Option 2 is the base case scenario that will provide secondary treatment for the entire wastewater flow, as is currently the case at the CVWPCC. (Note that Option 1 was not advanced from Stage 1 of the LWMP, since it would represent a step down from current practice at the CVWPCC.)

A UV disinfection system is included, to disinfect the wastewater to not exceed 200 MPN/100 mL fecal coliform concentration at the end of the outfall pipe. Based on the dilution modelling in the Initial Dilution Zone (IDZ), there will be sufficient dilution at the edge of the IDZ to stay below the 14 MPN/100 mL requirement for protection of shellfish.

A detailed condition assessment of some of the structures should be completed to fully assess the suitability of re-using some of the existing plant infrastructure. In this base case, the following items were identified as requiring a capacity increase to satisfy the flow and load projections to 2040:

PRELIMINARY TREATMENT

— Upgraded grit removal is required and will benefit the plant in several ways, including improved sludge thickening in the primary clarifiers.

PRIMARY CLARIFIERS

— The existing primary clarifiers have adequate capacity to 2040.

AERATION BASINS

— There is not enough capacity in the existing three aeration basins to handle 2040 loads and a fourth aeration basin is required (refer to the Memorandum contained in Appendix J for the capacity assessment).

— It was assumed that the existing blower room could be re-used and that there is currently sufficient blower capacity in the existing system (refer to capacity assessment in Appendix J). Installing new, higher efficiency blowers may be desired and would be evaluated in a pre-design of the next plant upgrade.

SECONDARY CLARIFIERS

— A fourth secondary clarifier is required and could be installed to the north of the existing clarifiers.

— A new flow splitting box should be installed to ensure equal flow to the four clarifiers, if determined feasible during pre-design (this would add head loss within the plant hydraulic profile).

UV SYSTEM

— A new two-unit UV disinfection system would be installed outdoors; this was assumed to be a Trojan UV Signa system with 96 UV lamps.

The items identified above depict a possible upgrade scenario for the CVWPCC to meet treatment objectives until 2040 and provide flexibility for expansion beyond 2040. Investigating the feasibility of various upgrade options and scenarios, together with alternative treatment technologies, optimum plant layout, and a condition assessment of the existing infrastructure, should be completed during a Master Plan or pre-design to confirm the recommended approach, before beginning detailed design of the next plant upgrade.

7.5.4 OPTION 3 – ADDITION OF ADVANCED TREATMENT FOR FLOWS UP TO 2XADWF

Option 3 includes the Option 2 components, plus the inclusion of disk filters for advanced treatment to produce a higher quality effluent, i.e., consistently less than 10 mg/L TSS and BOD_5, and average TSS and BOD_5 less than 5 mg/L, for flows up to 2xADWF. It is anticipated in this scenario that a type of flow control weir would be installed to divert flows in excess of 2xADWF exiting secondary treatment around the disk filters and directly to UV disinfection.

Four disk filter units were assumed, designed to handle the 2040 flows, which provides the required 75% process reliability (redundancy) according to the MWR. The filters would be placed inside a building. Based on the size of the disk filters required to handle flows up to 2xADWF, the building size would be approximately 20 by 15 meters. The building was sized to include the UV system, since the UV system has a generally small footprint and inclusion of the UV system indoors would have many benefits at a minimal cost.

7.5.5 OPTION 4 – ADDITION OF ADVANCED TREATMENT FOR ENTIRE FLOW

Option 4 is the same as Option 3, except the disk filters would be sized for the entirety of the 2040 design flow (62,000 m^3/d). The disk filter system was assumed to include eight disk filters, each sized for 8,750 m^3/d, providing a redundant unit. The larger disk filter footprint would require a building approximately 20 by 20 meters, and would also include the UV system. The UV system in this scenario would benefit from the disk filters located upstream, since the suspended solids in the stream entering the disinfection system would be reduced; appropriate adjustments were made to the design of the UV disinfection system.

7.5.6 OPTION 5 – RECLAIMED WATER FOR IN-PLANT USE

Option 5 was based on including reclaimed water use at the CVWPCC for equipment wash water and other non-potable reuse applications. Reclaimed water standards are set-out in the provincial regulation (MWR) and are classified by exposure potential to the public. Reclaimed water use within the treatment plant would need to meet the lowest exposure potential standards as the reclaimed water would be controlled in the plant setting.

For low exposure potential, the MWR requires a maximum TSS and BOD_5 concentration of 45 mg/L, disinfection to 200 MPN/100 mL, and maintaining a pH between 6.5 and 9. Additionally, the MWR requires the reclaimed water to be chlorinated to have a minimum of 0.5 mg/L chlorine residual in the reclaimed water at the point of use.

The reclaimed water system was assumed to include a pressure filter to remove residual TSS, and a chlorination system to maintain a residual of 0.5 mg/L total chlorine in the reclaimed water storage tank and distribution system. There would be a reclaimed distribution pumping and piping network installed at the plant that would service the various mechanical equipment, and/or onsite irrigation as appropriate.

Note that Option 5 is for including reclaimed water use under all treatment options and does not represent a stand-alone option in terms of upgrading the CVWPCC. The design criteria for the reclaimed water system are shown in Table 7-2. A detailed investigation into the wash water requirements for the reclaimed water system was not included in the scope of work. However, based experience with using this size system at other wastewater treatment plants, the system described in Table 7-2 would have sufficient capacity to service most equipment at the CVWPCC.

Table 7-2: Reclaimed Water Design Criteria

CRITERIA	
Capacity	50 m^3/d
Pressure Filter Capacity (L/min)	100
Chlorine Dosing System Capacity (mL/min)	10 – 110
Distribution Pump Capacity (L/s)	5
Reclaimed Water Clearwell Tank (m^3)	100 – 150
Chlorination Dosing	12% Sodium Hypochlorite @ 15 mg/L

The cost estimate shown in Table 7-3 would be for a system treating Option 2 secondary effluent to reclaimed water standards. If disk filters are included and provide a higher quality effluent (Option 3 and 4), the reclaimed water system overall cost could potentially be reduced by approximately $100,000 to $150,000.

Table 7-3: Option 5 Cost Summary

OPTION 5 - RECLAIMED WATER	AMOUNT
Civil Works	$24,000
Process Mechanical	$130,000
Structural Components	$180,000
Plumbing & HVAC	$8,000
Electrical	$68,000
General Requirements	$109,000
Subtotal Option 5 Cost Estimate	**$519,000**
Engineering (15%)	$78,000
Contingency (30%)	$179,000
Total Option 5 Cost Estimate	**$776,000**
Estimated Annual O&M Addition	$6,900
PV Annual O&M (20 years, 5% Discount Rate)	$88,000
Total Net Present Value Option 5	**$864,000**

7.5.7 OUTFALL UPGRADE OPTIONS

The existing CVWPCC outfall was constructed in 1982. The onshore section of the outfall consists of 2,830 m of 900 mm diameter pre-stressed concrete pipe. The marine section is 2,825 m of 860 mm diameter steel pipe, encased in 100 mm thick concrete in areas where it is not entrenched in the seabed. The multi-port diffuser is a 175 m long

610 mm diameter steel pipe encased in concrete. The outfall has experienced capacity exceedances under gravity flow conditions that have resulted in reliance on overflow basins and effluent pumping on an increasingly frequent basis.

Several studies, summarized by ISL in 2016, have been completed over the past decade to assess the condition of the outfall and to provide options for upgrading the marine outfall capacity. A capacity assessment by ISL (2016) described the situation as follows:

During dry weather and/or low flow/tide periods, the CVWPCC discharges its treated effluent by gravity from the secondary clarifiers directly to the Cape Lazo outfall. When the treated effluent flow exceeds the capacity of the outfall or during high flow/tide periods, the excess overflows into an effluent storage basin, which is then pumped to the outfall for discharge. Three submersible pumps (2 duty/1 standby) are installed inside the storage basin to pump the effluent when required. Correspondence with Operations staff indicate that during certain high flow periods, the existing effluent pumps are struggling to pump the excess flow to the outfall. This results in water levels becoming critical and the possibility of discharging to the adjacent ditches via the storage basin overflow. No events of discharge to the adjacent ditches have occurred historically; however, the available storage volume and capacity of the outfall is critical and of concern as increasing population and flows in the future will require increased storage/pumping capacity to prevent flooding of the storage basin.

In 2019, as an interim solution to constructing a new outfall, the CVRD installed a new offline equalization basin, which is designed to temporarily store primary treated wastewater when the plant influent flow rate exceeds the treatment capacity of the plant. The new primary wastewater storage basin together with the existing effluent storage basin described above by ISL helps to buffer peak flows at the plant to reduce the peak flow to the outfall and address the concerns of potential overflows caused by high tide and peak wastewater flows. When the wet weather flows ease the stored primarily treated wastewater is pumped back to the primary effluent channel for secondary treatment and discharge. The size of the new equalization basin was constrained by the site, but based on modelling results, it is expected that the basin will have adequate storage volume to the year 2031.

As part of this Stage 1 and 2 LWMP, GreatPacific Consulting Ltd. (GPC) was engaged to review the state of the current outfall, assess outfall hydraulic performance under future flows from the CVWPCC service area, provide outfall upgrade options, update dilution modelling using future flows for the current service area and current outfall configuration, and provide an opinion on the information needed to satisfy an application for an Operational Certificate, including an updated Environmental Impact Study based on current data (an Environmental Impact Study (EIS) based on the existing outfall and diffuser was completed in 2010). The memo produced by GPC entitled "*Cape Lazo Outfall Assessment Memo*" is included in Appendix K; this includes a summary of the information expected to be required to support an application for an Operational Certificate.

Based on future flows for 2060 (ADWF = 22,390 m^3/d and MDF = 65,244 m^3/d) future upgrade options for the outfall presented by GPC included:

- Twinning the existing outfall;
- Replace the outfall with a single large diameter pipe to accommodate gravity conveyance only; and
- Replace the outfall with a single large diameter pipe to accommodate pump assistance and/or temporary storage.

Following a hydraulic review of the outfall upgrade options, the recommended option was to replace the existing outfall with a single, larger diameter pipe with a new multiport diffuser design incorporating fewer ports to improve the hydraulic efficiency and dilution performance. It was determined that the large pipe diameter needed to accommodate gravity conveyance only would not be economical, and it was recommended that the new outfall include pumping of peak flows and/or equalization storage. Disinfection of the effluent was also recommended.

The following were identified as having the potential to affect the future outfall system performance, and were not described in previous studies; these should be addressed as part of future engineering phases:

1. Accommodation of sea level rise
2. Effects of air entrapment (if any) as velocities in the outfall increase
3. Competence of PCCP to accommodate higher service pressures and risk of rupture/leaks
4. Insufficient condition assessment data of the offshore steel pipe to adequately estimate a remaining service life

7.5.8 STAGE 2 CVWPCC EVALUATION SUMMARY

Table 7-4 shows the cost summary of wastewater treatment options, based on the estimated total cost for the CVRD to expand the CVWPCC to handle 2040 flows to the appropriate effluent standard for each option. The Option 3 and 4 estimates show the incremental increase in cost associated with adding effluent filtration for 2xADWF and all flows, respectively. The actual path forward, and staging of the expansion, would be determined during a Pre-Design Study or Master Plan for the treatment facilities. The costs prepared in this assessment represent a total amount that would be required to meet 2040 treatment objectives. Phasing of the work would typically be completed during a Pre-design or Master Plan and is not accounted for in the cost estimates.

The costs shown in Table 7-4 do not include the estimate from the ISL (2016) *Cape Lazo Outfall Capacity Assessment* ‘of approximately $24.4M to replace the outfall; this amount should be carried to indicate future planning for capital upgrade requirements.

Currently, advanced treatment is not a regulatory requirement for an ocean discharge, and advanced treatment is not required to meet the regulatory treatment objectives for the CVWPCC, assuming appropriate expansion of the existing systems. Study of Table 7-4 shows that, to provide advanced treatment for the entire flow with disk filters (Option 4), there would be a 35% to 40% increase in capital costs ($10.5 M) compared to Option 2. To provide advanced treatment for 2xADWF with disk filters (Option 3), there would be an approximate 25% to 30% increase in capital costs ($8.2 M) compared to Option 2.

The added benefit of disk filters includes treating the effluent to a slightly higher standard, enhanced removal of microplastics, and additional (unquantified) removal of other contaminants such as CECs associated with the solids in the effluent; however, secondary treatment can also provide significant removal of unregulated contaminants (see Section 4.4 for detail). As described earlier in this report (Section 5.4), the CVWPCC currently achieves excellent removal of TSS and BOD_5, with average values for both parameters less than 10 mg/L; this would be expected to improve to less than 5 mg/L average with the addition of disk filters. If phosphorus removal became a regulatory requirement in the future, the disk filters would provide additional filtration to reduce phosphorus concentrations following chemical coagulation (or implementation of enhanced biological phosphorus and nitrogen removal). Additionally, implementation of disk filters would meet the effluent standards for reclaimed water, enabling a wide range of potential uses. However, in the absence of a user for large scale reclaimed water, the estimated 35% increase in capital cost between Option 2 compared to Options 3 or 4 may not justify installation of disk filters for advanced treatment at this point in time.

A summary of the risks and benefits of the different options is included in Table 7-4. As described in Section 2, evaluation of the treatment options in consultation with the TACPAC resulted in selection of Option 2 to guide the next upgrade at the CVWPCC. This and following upgrades should be configured to allow future addition of tertiary and/or alternative secondary biological treatment processes (e.g., tertiary effluent filtration, ozonation for oxidation of CECs), and additional solids treatment processes such as anaerobic digestion, without requiring significant modifications to the plant layout and hydraulic profile.

Table 7-4: Summary of Wastewater Treatment Level Options

	OPTION 2	OPTION 3	OPTION 4
	Secondary Treatment w/ Disinfection Base Case	**Advanced Treatment for 2xADWF**	**Advanced Treatment for Entire Flow**
Sub-Total CVWPCC Upgrade Capital Costs[1]	$ 29,700,000	$ 38,000,000	$ 40,300,000
Subtotal Reclaimed Water (Option 5)	$850,000	$750,000	$750,000
Total	**$30,550,000**[1]	**$38,750,000**[1]	**$41,050,000**[1]

	OPTION 2	OPTION 3	OPTION 4
Benefits	— Upgrade path to meet capacity and regulatory requirements for the next 20 years — Secondary treatment removes 90% of organic material and solids on average (note that the CVWPCC currently achieves greater than 95% removal of TSS and greater than 93% removal of $cBOD_5$) — Secondary treatment removes 80-95% of microplastics on average — Disinfection to meet shellfish standards — Reclaimed water can be incorporated. — Design can incorporate space for installation of disk filters if required in the future. — Typical CVWPCC effluent quality for daily $cBOD_5$ consistently less than 20 mg/L and TSS less than 25 mg/L, with average values less than 10 mg/L.	— Base case secondary treatment upgrades apply — Advanced treatment (filtration) for up to 2xADWF accounts for approximately 99% of the annual flow being treated to advanced standards. — Addition of advanced treatment filtration removes 96% of organic material and solids on average, a marginal increase of 6% over secondary treatment — Addition of disk filters removes 95-97% of microplastics on average, a marginal increase of 15-17% over secondary treatment — Large scale effluent reuse can be implemented — Disk filters can be implemented in the future once a user for reclaimed water is identified — Typical effluent quality for up to 2xADWF for daily $cBOD_5$ and TSS consistently less than 10 mg/L, with average values less than 5 mg/L.	— Base case secondary treatment upgrades apply — Addition of disk filters removes 96% of organic material and solids on average, a marginal increase of 6% over secondary treatment — Addition of advanced treatment filtration removes 95-97% of microplastics on average, a marginal increase of 15-17% over secondary treatment — Large scale effluent reuse can be implemented — Disk filters can be implemented in the future once a user for reclaimed water is identified — Typical effluent quality for entire flow for $cBOD_5$ and TSS consistently less than 10 mg/L, with average values less than 5 mg/L.
Risks	— Capital costs are dependent on condition assessment and outcome of a Pre-design study.	— Cost premium of approximately $8.2M for addition of disk filters to treat 2xADWF — Advanced treatment to the level provided by disk filters is not a regulatory requirement — Without a user for the reclaimed water, costs may not be justified at this point in time	— Cost premium of approximately $10.5M for addition of disk filters to treat the full flow — Advanced treatment to the level provided by disk filters is not a regulatory requirement — Without a user for the reclaimed water, costs may not be justified at this point in time

[1] Costs do not include replacement of the outfall (estimated at $24.4M). Cost estimates are in $2019 CAD and include an allowance of 45% of estimated construction costs for engineering and contingencies. Estimates are appropriate for the purposes of comparing option but should not be used for budgeting purposes.

A detailed master planning study for the wastewater treatment plant is underway at the time of writing, to inform expansion and upgrading of the facilities. The purpose of this study is as follows:

- detail the suitability of reusing existing infrastructure and identify any repairs that should be carried out before re-using;
- create a process model for the treatment plant to identify if there are any modifications that can be done to the existing system to increase performance and capacity as plant loads increase;
- evaluate existing structures and geotechnical conditions considering post-disaster seismic standards required by the B.C. Building Code (BCBC);
- evaluate plant-wide odour control systems and necessary upgrades;
- provides a detailed, staged expansion plan, site layout and hydraulic profile for the CVWPCC for the next 50 years and beyond;
- undertake a complete hydraulic assessment of the plant systems;
- review the plant electrical, controls, and SCADA systems; and
- complete detailed composite sampling to confirm loading in the influent and primary effluent.

A staged approach to upgrading the treatment plant would provide the greatest flexibility and assurance to the CVRD that the appropriate measures have been taken for the decisions that will be made regarding the future of the plant. The staging plan would involve completing a condition assessment first to assess the possibility of re-using certain assets and identifying their anticipated life expectancy. A pre-design study can then be completed, knowing the specific condition of assets and creating a process model to identify and evaluate upgrade options so that the best path and site layout is selected.

8 RESOURCE RECOVERY OPTIONS

In recent years, there has been an increasing emphasis on recovery of resources that can be extracted from the wastewater stream or that can be produced as a by-product of treatment. In British Columbia, the success of applications for grant funding assistance from senior government for design and construction of wastewater conveyance and treatment facilities often depend in part upon inclusion of resource recovery, which may include the following:

— use of reclaimed effluent for irrigation or other purposes;
— installation of heat exchangers in the wastewater stream for heating and cooling of buildings;
— production of biogas (methane) through treatment of waste solids, which can be used in combustion facilities designed for cogeneration of electrical power and heat or in boilers for hot water heating systems;
— use of digested waste solids as a natural solid conditioner/fertilizer, and/or use of waste solids as a feedstock to produce compost for household or commercial use;
— production of mineral pellets rich in nitrogen and phosphorus (struvite) for use as fertilizer; and
— use of hydroelectric turbines to generate electrical power from the outfall discharge.

The feasibility of the various resource recovery option must be carefully evaluated. The design and installation of resource recovery facilities can add substantially to the capital and operating costs of wastewater treatment facilities. If there are no potential customers for the recovered resources or if those customers are located far from the recovery location, investment in resource recovery may be inadvisable. Each situation must be evaluated on its own merits, beginning with identification of potential uses and users of the reclaimed resources. Brief discussions of each resource recovery option in the context of the CVRD LWMP are presented below.

Details of each of the Stage 1 resource recovery long-list options are provided in the memorandum entitled "*Resource Recovery Options Discussion*" in Appendix L.

8.1 OPTION 1: RECLAIMED WATER

Some of the wastewater treatment options discussed in Section 7 of this report (namely Options 3 and 4) are designed to produce effluent quality that meets the requirements for use of reclaimed water. For Option 2, if one or more uses for reclaimed water can be identified, the appropriate amount of secondary treated effluent can be diverted to a dedicated filtration and disinfection system to produce reclaimed water. As set out in the Municipal Wastewater regulation, it is required to maintain a chlorine residual in the reclaimed water at the point of use unless the addition of chlorine will detrimentally impact flora or fauna, (or at the point of use if fecal coliforms remain below levels set in municipal effluent quality requirements for reclaimed water, and users are adequately informed regarding appropriate use of the reclaimed water). Disinfection of reclaimed water and maintenance of a chlorine residual in the distribution piping is normally accomplished through the addition of sodium hypochlorite (bleach).

Production of reclaimed water adds to the cost of treatment, so it is important to identify the potential market for this resource. It is normally cost effective to use a portion of the treated effluent for non- potable applications within the treatment plant itself (e.g., for equipment sprays, washdown water, landscape irrigation, etc.). This typically represents a relatively small portion of the total wastewater flow, but it does offset use of potable water at the plant. A small amount of reclaimed effluent is currently used at the CVWPCC for washdown in enclosed areas. Opportunities for expanding use of reclaimed water within the plant should be considered during design of future upgrades.

Offsite applications may represent opportunities for use of larger amounts of reclaimed water (irrigation, industrial use, or stream and wetlands augmentation). The economics of offsite use depend heavily on the distance from the reclaimed water production facility to the user. Other factors include the seasonal pattern of demand for water, the cost of alternative water sources, and the water quality requirements of the potential user.

In cases where a significant potential user of reclaimed water has been identified but the distance between the main wastewater treatment plant and the user makes the project unfeasible for economic reasons, it may be possible to locate a relatively small water reclamation plant near the user and divert some of the untreated wastewater to that location for treatment and use. The feasibility of this will depend on the amount of reclaimed water to be produced and other local factors.

A TACPAC meeting was held in February 2019 to evaluate potential uses for reclaimed water (see Section 2). A large number of potential locations for effluent reuse were identified. Detailed studies would be required for each potential location, to assess water quality requirements, capital and operating costs for pumping and conveyance of reclaimed effluent from the CVWPCC to the site, revenue potential to offset costs, additional treatment requirements, environmental impacts, and other site-specific factors. As noted earlier, the conveyance distance is a very important factor, since capital and operating costs rise significantly as distance increases; this will be the primary limitation for many of these options.

Future upgrades at the CVWPCC should be designed with the potential for reclaimed water production in mind, so that additional levels of treatment can be added if and when users are identified, without costly reconfiguration of the treatment facilities.

8.2 OPTION 2: HEAT RECOVERY

Extraction of heat from the wastewater stream at pumping stations and treatment facilities for space heating of buildings is becoming more common (the same system can also be used for cooling in summer). As with reclaimed water, heat recovery for use onsite at wastewater treatment facilities is generally the most feasible from a cost standpoint.

If a potential user or users of heat is located near a pumping station or the wastewater treatment plant, it may be feasible to expand the system to export heat to a nearby specific user (an example of such a system is in place at the Saanich Peninsula wastewater treatment plant, where heat is extracted from the effluent for use at an adjacent municipal swimming pool). In some cases, if there is high density development near the treatment plant, it may be feasible to install a District Heating System that circulates recovered heat through a heating loop for use by multiple customers. Due to the cost involved in installing a District Heating System, it is preferred if there is a year-round demand for the recovered heat (e.g., swimming pool, commercial laundry).

Potential users for reclaimed heat were evaluated at the February 2019 TACPAC meeting. A small number of existing potential users were identified, some within 2 km of the CVWPCC. As with reclaimed water, the distance between the facility where the heat is recovered (CVWPCC or pump station) and the user will have a significant impact on the economics of heat recovery.

Future upgrades at the CVWPCC (and at major pumping stations) should be designed with the potential for future heat recovery for use within the treatment plant and/or for export to offsite users in mind, so that the required facilities can be added if and when users are identified, without costly reconfiguration of the existing facilities. A detailed study to evaluate the feasibility, costs and benefits of heat recovery is recommended prior to implementing a heat recovery system.

8.3 OPTION 3: PRODUCTION OF BIOGAS

At larger wastewater treatment plants (service population of at least 50,000 to 100,000 people), it may prove economical to install anaerobic digestion facilities for treatment of waste solids. Anaerobic digesters reduce the amount of solids and produce methane gas that can be scrubbed and then used in cogeneration engines for production of combined heat and electrical power for use at the treatment plant, or the gas may be cleaned to the required standard for sale to the local natural gas utility as renewable natural gas (RNG). This may be considered in future as a possible resource recovery strategy for biogas use within the plant (heating and for power generation) or upgrading of the biogas for sale to the utility as Renewable Natural Gas (RNG) when the CVWPCC is next upgraded.

In addition to generation of biogas, the reduction in mass of waste solids resulting from anerobic digestion would reduce the operating cost of the CVRD’s composting operation, preserve capacity at the composting facilities, and reduce the amount of compost to be marketed. A business case analysis should be conducted prior to making any decisions regarding implementation of anaerobic digestion at the CVWPCC. It is notable that the price for sale of RNG has been increasing significantly, and this will likely continue as generation of sustainable green energy becomes more prevalent. All of these factors should be incorporated into the business case analysis, using the latest cost and revenue information available at the time of the upgrade.

8.4 OPTION 4: BENEFICIAL USE OF TREATED SOLIDS

Where digestion of waste solids is practiced at wastewater treatment plants, the solid product of digestion (referred to as biosolids) can be used as a solid conditioner and natural fertilizer, provided that it meets all of the required regulatory standards. Land spreading of treated biosolids to fertilize agricultural land, for reforestation, and for reclamation of disturbed sites is commonly practiced in British Columbia; however, this can be a costly undertaking, depending on the transportation distance to the biosolids use site and the topography of the site. In some cases, there has been public resistance to land spreading of biosolids, due mainly to concerns over odours and the presence of potentially harmful substances.

The CVWPCC dewaters waste solids and transports the dewatered cake to a nearby site for use as a composting feedstock. This does not require digestion prior to composting, and it produces a product called SkyRocket that is much more marketable than dewatered biosolids. Production of Class A compost (SkyRocket) as practiced by the CVRD allows sale of the compost product to householders and commercial users. Proceeds from the sale of the compost help to offset operating costs for solids handling.

Future improvements with the next CVWPCC upgrade may include addition of digesters (see Section 8.3 above). Digestion of biosolids would reduce the solids stream to composting, which would reduce the loading on the composting facilities and reduce the overall amount of compost produced.

Composting is a sustainable strategy for beneficial use of treated wastewater solids at the CVWPCC as long as the local market can absorb the compost; this may be enhanced if anaerobic digestion is implemented in future.

8.5 OPTION 5: EXTRACTION OF NITROGEN AND PHOSPHOROUS FOR FERTILIZER PELLETS

Depending on the treatment processes used, some wastewater treatment plants produce relatively low-volume side streams of high-strength wastewater that would normally be routed back to join the plant influent wastewater for treatment. For these high-strength side streams it is in some cases economical to extract nitrogen and phosphorus in a small treatment reactor that causes precipitation of a mineral called magnesium ammonium phosphate, commonly referred to as struvite. The struvite pellets can be marketed as a commercial fertilizer, offsetting the production and use of chemical fertilizers.

Production of struvite from wastewater nitrogen and phosphorus would not be feasible at the CVWPCC at present, due to economies of scale and the treatment processes currently in use; however, it could be considered for use in future, particularly if anaerobic digestion were implemented.

8.6 OPTION 6: HYDROELECTRIC TURBINE FOR GENERATION OF ELECTRICAL POWER AT OUTFALL

In some cases where there is a large elevation difference between the treatment plant and the receiving water, it is possible to install a small hydroelectric turbine to generate electricity.

In the case of the CVWPCC where there is minimal head loss under certain tidal conditions and effluent pumping is required, this type of energy recovery is unlikely to be a viable option.

9 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and accompanying recommendations (where applicable) are based on the findings of this Stage 1 and 2 LWMP Report.

1 The effluent discharge from the Comox Valley Water Pollution Control Centre (CVWPCC) reflects a very high performing secondary wastewater treatment facility, with effluent quality parameters well within regulatory requirements. However, the volume of the discharge chronically exceeds the allowable daily maximum of 18,500 m^3/d specified in the plant Discharge Permit No. 5856 by more than 10%; this means that a permit amendment will not be granted by the Ministry of Environment and Climate Change Strategy (MECCS). The CVRD should begin the process of applying for an Operational Certificate (OC) under the LWMP in Stage 3 of the LWMP. Effluent quality should meet the requirements of both the provincial Municipal Wastewater Regulation and the federal Wastewater Effluent Regulations (WSER).

An updated Stage 2 Environmental Impact Study (EIS) based on the applicable discharge flow and effluent quality will be required to support the application for an Operational Certificate; this and other required supporting information is listed in the Information Requirements Table Issued by the MECCS. Since the Stage 2 EIS will be based on the proposed maximum day discharge contained in the OC, it is prudent to consider using a discharge flow projected well into the future, at least to the year 2030 (45,000 m^3/d) and possibly to 2040 (51,000 m^3/d); this will avoid having to re-do the EIS for an increase in flow prematurely. To avoid paying excessive permit discharge fees in the near term, and to avoid repeated revisions to the OC to accommodate increasing flows, it may be possible to include a table in the OC that ties allowable maximum day discharge to system service population; this should be discussed with MECCS when the draft OC is developed in Stage 3 of the LWMP.

2 There has been consideration of the impacts and costs of additional wastewater flows that would result from future addition of the South Region in Electoral Area A (planned K'ómoks First Nation (KFN) Development, Royston and Gartley, Kilmarnock, and Union Bay), to the service area of the Comox Valley Sewerage System (CVSS). Should the South Region eventually be included in the CVSS in the future, upgrades to the conveyance system and the CVWPCC should include accommodation of these additional flows and loads based on the most up-to-date information available at the time of design. Servicing of the South Region will be subject to fair and equitable formal agreements with the system users. In the event that the South Region is not connected to the CVSS within the design horizon, this additional capacity designed into the system will extend the horizon for the next expansion of the system.

3 Several of the unit processes at the CVWPCC are operating at or in excess of design capacity, and a plant expansion will be needed in the near future. As detailed in this Stage 1 and 2 LWMP Report, the recommended level of treatment for the next CVWPCC expansion is to maintain the current level of treatment (i.e., secondary treatment for the entire plant flow) with the addition of effluent disinfection.

A Facility Master plan is currently being completed to develop the basis of design for the plant expansion, and to develop the best site layout for long-term future expansions and upgrades to optimize the use of space on the site, considering current and future treatment requirements, odour control requirements, addition and integration of new processes in future (e.g., waste sludge digestion, advanced treatment such as effluent filtration for removal of residual suspended solids, ozonation for future removal of currently unregulated contaminants, resource recovery facilities), energy efficiency, and operational simplicity/robustness. The master planning process is considering production of reclaimed effluent for non-potable use within the treatment plant, and the future addition of other resource recovery facilities such as reclaimed effluent for offsite use (e.g. irrigation) and heat recovery from the wastewater stream for in-plant and possibly offsite use.

Before detailed design of the expansion is undertaken, the following studies should be considered:

a. Undertake a business case analysis for implementation of anaerobic digestion of waste solids at the CVWPCC, incorporating potential revenue for scrubbing and sale of biogas to the local utility or cogeneration of electrical power for use within the treatment plant, as well as savings resulting from the reduced mass of solids sent to the composting facility and potential revenue from generation of fertilizer pellets from high-strength side streams associated with digestion (this could be a component of the study described above in item a). This study should also include consideration of emerging technologies designed to enhance the efficiency of anaerobic digestion (e.g., a pre-treatment step to solubilize solids in the waste sludge stream and release nutrients to solution).
b. Site investigation and seismic modelling to determine if ground improvements are needed for new facilities to meet current BC Building Code requirements for post-disaster facilities.
c. Asset condition assessments to determine which assets can continue in use for the long term (major equipment, concrete structures and tanks, buildings).

4. The selected approach for upgrading the wastewater conveyance infrastructure between the Courtenay Pump Station and the CVWPCC is to undertake the project in a single phase. This approach will include the following infrastructure components:

   a. Abandon the existing Courtenay Pump Station and replacement with a new Courtenay Pump Station;
   b. Upgrades to the existing KFN IR1 Pump Station and new return forcemain to the new Courtenay Pump Station;
   c. A new forcemain from the Courtenay Pump Station to the Town of Comox using cut and cover installation;
   d. New forcemain through the Town of Comox using cut and cover installation;
   e. Upgrades to the existing Jane Place Pump Station and a new forcemain connection;
   f. New forcemain from the Town of Comox to the CVWPCC using primarily trenchless installation.

   This approach has been selected to address the project key issues including replacing the section of forcemain along Willemar Bluff, addressing capacity constraints in the Courtenay and Jane Place Pump Stations, and reducing pumping head and energy consumption over the long-term by using trenchless sections. It is recommended that the conveyance infrastructure be brought to the CVWPCC at the highest possible elevation to improve CVWPCC and outfall hydraulics.

5. In February 2021, the Comox Valley Sewage Commission approved the ‘breaking out’ of the wastewater conveyance scope from the LWMP process to fast track its implementation. The CVRD entered an Alternate Approval Process (AAP) to obtain authorization for borrowing to finance the conveyance infrastructure upgrades described in Item 4 above. The AAP was conducted between May and July 2021, and borrowing was approved on July 8, 2021.

6. The effluent outfall from the CVWPCC was originally constructed in 1982, making it nearly 40 years old. The marine section of the outfall is a steel pipe encased in concrete in areas where it is not buried in the sea bed. Inspections of the outfall have revealed surface corrosion and some areas where the concrete encasement has separated from the pipe. The capacity of the outfall is a concern during high tide/high wastewater flow conditions. An effluent storage basin and pumping station are currently in use to prevent overflows, but there are concerns that increasing wastewater flows may lead to overflows. Upgrading or replacement of the outfall will be required by the year 2030. An assessment of outfall upgrade options carried out during the Stage 1 and 2 LWMP shows that an outfall pipe sized to handle all effluent flows by gravity to a design horizon of the year 2060 would not be economical, and that a new outfall pipe (larger than the existing) with pumped assistance and/or temporary storage to deal with peak flows and high tide conditions is the recommended solution.

7. Once this draft Stage 1 and 2 LWMP Report has been finalized, the CVRD should submit the report to the MECCS for review and approval to proceed with Stage 3 of the LWMP.

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