Comox Valley REGIONAL DISTRICT

Agenda

Notice of Meeting #5 of the
LIQUID WASTE MANAGEMENT PLAN
JOINT TECHNICAL AND PUBLIC ADVISORY COMMITTEES (TACPAC)
Friday, February 8, 2019
CVRD Boardroom, 600 Comox Road
Commencing at 9:00 am – 12:00pm

ITEM, TIME	DESCRIPTION	OWNER
5.1 9:00	Call to Order	Allison Habkirk
5.2 9:00-9:10	Review of Minutes of Meeting #4	Allison Habkirk
5.3 9:10-9:20	LWMP Process From Here • What happens with the long list • What happens with the short list • The decision(s) on preferred options • The LWMP report • Calendar of dates	Paul Nash
5.4 9:20-9:40	Discussion on Using Reclaimed Water • Context from Sustainability Strategy and Regional Growth Strategy • How and where can it be used within the CVRD? • Quick brainstorming exercise on potential uses and users • Results to be part of conceptual study for reclaimed water	Paul Nash
5.5 9:40 – 10:00	Feedback from Public Session #3 – Presenting the Long List Options	Kris La Rose
5.6 10:00 –10:20	Long List Options – Conveyance • Review conceptual conveyance options • Discussion • Additions? • Deletions • Finalize list for conceptual study ***Make a recommendation to the Comox Valley Sewage Commission on long list of conveyance options for conceptual study***	WSP
Break		
5.7 10:30-10:50	Long List Options – Treatment • Review conceptual treatment options • Discussion • Additions? • Deletions • Finalize list for conceptual study ***Make a recommendation to the Comox Valley Sewage Commission on long list of treatment options for conceptual study***	WSP

5.8
10:50-11:10
	Long List Options – Resource Recovery
	• Presentation of conceptual resource recovery options
	  o Resource types - water, heat, etc.
	  o Potential resource users
	• Discussion
	• Additions?
	• Finalize list for conceptual study
	Make a recommendation to the Comox Valley Sewage Commission on long list of conveyance options for conceptual study
		WSP

5.9 11:10-11:30	Technical Update #4 • Understanding conveyance hydraulics • Understanding Class D cost estimates	WSP
5.10 11:30-11:50	Design Data Projections • Population, • Flow and loads • How they are used	WSP
5.11 11:50-12:00	Preview of TACPAC #6, Thursday, March 21, 2019 • Review of conceptual studies of long list options • Run the options through the evaluation systems • Finalizing the short list(s) for detailed study • Recommendation of short list(s) to Comox Valley Sewerage Commission.	Paul Nash
5.12 12:00	Adjournment	Allison Habkirk

Attachments

1. Minutes of TACPAC Meeting #4, January 24, 2019

Comox Valley REGIONAL DISTRICT | Minutes

Minutes of the meeting of the Liquid Waste Management Plan (LWMP) Joint Technical and Public Advisory Committees (TACPAC) Meeting #4 held on Thursday, January 24, 2019 at the Comox Valley Regional District (CVRD) Boardroom, commencing at 9:00am.

PRESENT:

A. Habkirk, Chair and Facilitator	
P. Nash, LWMP Project Coordinator	
K. La Rose, Senior Manager of Water/Wastewater	CVRD
M. Imrie, Manager of Wastewater Services	CVRD
J. Boguski, Branch Assistant – Engineering Services	CVRD
A.Idris, Engineering Analyst	CVRD
A. Gibb	WSP
N. Tousi	WSP
W. Bayless	WSP
K. Grant, Town of Comox Councillor	PAC
W. Cole-Hamilton, City of Courtenay Councillor	PAC
C. McColl, K'ómoks First Nation	PAC/TAC
T. Ennis, Comox Valley Conservation Partnership	PAC
A. Munro, BC Shellfish Growers Association	PAC
S. Wood, Comox Business Improvement Association	PAC
A. Gower, Comox Valley Chamber of Commerce	PAC
S. Carey, Courtenay Resident Representative	PAC
T. Serviz, Courtenay Resident Representative	PAC
J. Beks, Courtenay Resident Representative	PAC
K. vanVelzen, Comox Resident Representative	PAC
D. Jacquest, Comox Resident Representative	PAC
R. Craig, Comox Resident Representative	PAC
M. Holm, Area B Resident Representative	PAC
M. Lang, Area B Resident Representative	PAC
A. Pitcher, City of Courtenay Engineering (observer)	
R. O'Grady, City of Courtenay Engineering	TAC
S. Ashfield, Town of Comox Engineering	TAC
A. Bissinger, Department of National Defence Engineering	TAC

ITEMS:

ITEM	DESCRIPTION	OWNER
4.1	Call to Order Allison called the meeting to order ay 9:00am	Allison Habkirk
4.2	Review of Minutes of Meeting #3 There were no alterations to the minutes	Allison Habkirk
4.3	Turning the Goals into an Evaluation System - Treatment Component (continuation of unfinished agenda item from Meeting #3) The committee engaged in a discussion about how to finalize the weightings of the treatment goals. Each category was reviewed separately • **Technical:** It was agreed that the goal of "Provides Asset Life and Capacity Beyond the Planning Horizon" was not a meaningful goal. The 10 per cent of the 30 per cent for technical was redistributed by adding five per cent	Paul Nash

ITEM	DESCRIPTION	OWNER
4.3	each to "Resiliency to External Factors" and "Resiliency to Internal Factors". This kept the technical category at 30 per cent of the total. • **Affordability:** With the wide variation in weighting from the PAC (26 per cent), TAC (43 per cent) and public (14 per cent) it was agreed to take the middle and assign 30 per cent to this category, with all of it being on the minimize life cycle costs category. • **Economic Benefits:** It was agreed that this category remain at zero weighting. • **Social Benefits:** The scores varied from the PAC (22 per cent) TAC (13 per cent) and public (21 per cent) and it was proposed by the Project Coordinator to have this category at 20 per cent. In discussion by the TACPAC, two further changes were made to this category. a. It was agreed that odour control should be done to industry best practice, regardless of the treatment option chosen. Thus it is elevated to become a mandatory requirement and is no longer a weighted evaluation criteria. b. The 10 per cent weighting for the odour control goal was redistributed by giving five per cent to Environmental Benefit and leaving Social Benefit at 15 per cent. c. It was decided to leave the Social Benefit category as one non-specific goal, to be evaluated by the PAC. • **Environmental Benefits:** The original weighting for this category was PAC (20 per cent) TAC (13 per cent) and public (27 per cent) It was proposed to have this category at 20 per cent with the split being 10 per cent for "Quality of Treatment Exceeds Current Standards" and five per cent each for "Remove Artificial (Emerging) Contaminants" and "Mitigate Climate Change Impacts". It was decided that the five per cent being added from the Social Benefit category should be applied to the "Quality of Treatment Exceeds Current Standards" goal to bring that criteria to 15 per cent, and the total for the Environmental Benefits category to 25 per cent. The TACPAC reached a consensus decision, with the categories summarized below, and the goal weightings as detailed in Attachment No.1 "Finalized Goals and Evaluation – Treatment"	Paul Nash

Component: Treatment				
Category	**Initial PAC Ranking (%)**	**Initial TAC Ranking (%)**	**Public Ranking (%)**	**Final TACPAC Ranking (%)**
Technical	32	30	40	**30**
Affordability	26	44	14	**30**
Economic Benefit	0	0	0	**0**
Environmental Benefit	20	13	25	**25**
Social Benefit	22	13	21	**15**
Total	100%	100%	100%	**100%**

ITEM	DESCRIPTION	OWNER
4.3	Motion: that the TACPAC recommends the LWMP Goals and Evaluation for Treatment to the Comox Valley Sewerage Commission for consideration. Moved: R. O'Grady CARRIED	Paul Nash
4.4	Turning the Goals into an Evaluation System – Resource Recovery Component (continuation of unfinished agenda item from Meeting #3) The committee engaged in a discussion about how to finalize the weightings of the Resource Recovery goals. Each category was reviewed separately. It was noted that there were some discrepancies in the category scores as some of the goals that were voted on were actually end uses, rather than true goals. These goals were removed from the list and the remaining scores re-scaled to get to 100 per cent. There were also some differences in the goals as presented and ranked by the public. For each category, a finalized set of goals and weightings were proposed by the project coordinator as being the best representation of the various goals and rankings, and the TACPAC discussed potential changes from that basis. • **Technical:** This category had initially been weighted as 14 per cent (PAC), 17 per cent (TAC) and 30 per cent (public). It was proposed to have this category as 25 per cent, with goals being "Commercially Available Technology" (10 per cent), "Anticipate Future Demand for Resources" at five per cent, and "Improve Performance of Treatment Plant" at 10 per cent. "Resiliency to Internal Factors" had no initial weighting. After discussion, the TACPAC agreed to redistribute five per cent from "Improve Performance" to "Resiliency to Internal Factors" (operational simplicity, reliability and minimizing risk of spills), with the Technical category remaining at 25 per cent. • **Affordability:** With the wide variation in weighting from the PAC (71 per cent), TAC (64 per cent) and public (20 per cent) it was proposed to have this at 50 per cent. The high rankings for the PAC and TAC are due to re-scaling. The ideas put forward on how and where to use reclaimed water and heat are potential actions, but are not actually evaluation criteria. Removing these from the total left the affordability goals with a high proportion of the remaining votes. The reasons why the public score was much lower is that their ranking system was different from that used by the TACPAC, and that it made it impossible to assign such a high ranking. The TACPAC agreed with the proposal to assign 50 per cent to this category, in recognition that the main factor is that an option is worth it. Within the goals, it was decided to remove the goal "Cost Neutral as a Minimum", and re-allocate its 10 per cent weighting to the "Minimize Lifecycle Costs" goal. This was in recognition that a cost neutral requirement may eliminate many or even all options, and some benefits are social rather than revenue based. In removing this goal, it was agreed that there be a specifically identified revenue component of the life cycle cost calculation. • **Economic Benefits:** Even though the PAC and TAC scored this at zero, the public scored it at eight per cent, and it was agreed that there is merit to having some score in this category, recognizing that the use of reclaimed	Paul Nash

ITEM	DESCRIPTION	OWNER
4.4	water for agriculture has the potential to grow the local economy, as has been done at several other BC towns. This category was assigned five per cent • **Environmental Benefits:** The original weighting for this category was PAC (14 per cent) TAC (eight per cent) and public (22 per cent) It was proposed to have this category at 15 per cent with the split being five per cent each for "Energy Efficiency and GHG Reductions", "Habitat Restoration or Enhancement" and "Displacement of Potable Water Use" and these weightings were accepted by the TACPAC. • **Social Benefits:** This category originally contained a goal of "Public Health Issues Considered for any Reclaimed Water" and it was noted that this is effectively a mandatory requirement, not an evaluation criteria. The remaining goal within the social category was "Ability to Maintain Irrigation of Public Parks and Gardens during Water Restrictions". After some discussion it was agreed to re-word this to "Ability to Maintain Irrigation of Critical Public infrastructure during Drought Conditions" and assign a score of five per cent to this goal. The TACPAC reached a consensus decision, with the categories summarized below, and the goal weightings as detailed in Attachment No.2 "Finalized Goals and Evaluation – Resource Recovery"	Paul Nash

Component: Resource Recovery				
Category	**Initial PAC Ranking**	**Initial TAC Ranking***	**Public Ranking****	**Final TACPAC Ranking**
Technical	14	17	25 (31)	**25**
Affordability	71	65	33 (20)	**50**
Economic Benefit	0	0	7 (8)	**5**
Environmental Benefit	14	8	18 (22)	**15**
Social Benefit	1	10	17 (20)	**5**
Total	100 per cent	100 per cent	100 per cent	**100 per cent**

*The sum of the scores for the TAC rankings as presented was 102 due to round-off errors, which are corrected here.
**The initial scores presented to the TACPAC for the public rankings had an arithmetic error, whereby the affordability category did not have two of the four goals in the summation, which led to it being undervalued. The corrected numbers are shown here, with the original presented numbers in parentheses.

Finally, in evaluating the resource recovery options, it is not like conveyance and treatment where a preferred option must be selected and implemented. Processing of biosolids in some manner is mandatory, so this resource recovery action happens regardless of cost or desirability. For the other options, resource recovery is entirely discretionary, so it could be that none, or several of the options are selected. The evaluation criteria is intended to determine whether it is worth it, based on the balance of costs and benefits. Noting that there can be some overlap between treatment and resource recovery options, it may be that some costs or benefits are not captured completely by the resource recovery evaluation, or that a change in treatment process achieves or enables certain options by default. These factors will be considered during the options evaluation.

ITEM	DESCRIPTION	OWNER
4.4	Motion: that the TACPAC recommends the LWMP Goals and Evaluation for Resource Recovery to the Comox Valley Sewerage Commission for consideration. Moved: R. O'Grady CARRIED	Paul Nash
	Break	
4.5	Operational Update - Wet Weather Flows in December and January. Mike Imrie explained that there were high flows during the winter period, though not at the level that would cause an overflow in the system. Even so, the operators are always worried during wet weather high flow, as the loss of a pump could lead to capacity limitations. He also addressed some confusion relating to a media story about the CVRD needing to deploy a "standby pump" – this was related to the potable water system and was not a wastewater issue.	Mike Imrie
4.6	Technical Update - Understanding Dry and Wet Weather Flows for Wastewater Planning. Al gave a presentation about wet and dry weather flows and how these factor into planning for conveyance and treatment upgrades. The target ratio for wet to dry weather flow is 2:1 and the CVRD currently sits at about 3:1. It is difficult to reduce these wet weather flows, and the responsibility for that lays with the municipalities, not the CVRD. Most communities in coastal BC are over 2:1. The hydraulic components of the conveyance and treatment systems must be sized to handle the present and future peak wet weather flows.	Al Gibb, WSP
4.7	Review of the Options Study and Evaluation Process In the interests of time, this agenda item was passed over and not presented	Paul Nash
4.8	Long List Options – Treatment Al presented the four conceptual treatment options which are detailed in Attachment No.3 "Long List Options – Treatment". 1. Secondary treatment of flows up to 2xADWF (Average Dry Weather Flow) 2. Secondary treatment of all flows 3. Advanced treatment of flows up to 2xADWF 4. Advanced treatment of all flows The difference between "flow up to 2xADWF" and "all flow" is that excess flow above 2xADWF bypasses the biological part of the treatment process and are re-combined before disinfection. In the "all flow" configuration, there is no bypass, and the biological and advanced treatment trains must be designed to handle all flows. All options included the addition of UV disinfection, but in discussion it was noted that there are other means of disinfection and there has been no decision yet on the type of disinfection. Alex Munro, representing the BC Shellfish Growers Association, raised the question about disinfection of norovirus, a human virus that can infect shellfish farms. While most disinfection is based on measurements of fecal coliforms and E.Coli, there are no specific requirements relating to viruses. The question of disinfection efficacy for norovirus will be looked into as part of the conceptual study of treatment options.	Al Gibb, WSP

ITEM	DESCRIPTION	OWNER
4.8	It was explained that while there are many different specific treatment technologies, they can all fall within one of the four conceptual options, and there is no need to go into further detail at this stage. With the one change noted for disinfection, the TACPAC approved this Long List to go to public review.	Al Gibb, WSP
4.9	Long List Options – Resource Recovery Al presented the conceptual resource recovery options which are detailed in Attachment No.4 "Long Lost Options – Resource Recovery". 1. Reclaimed water 2. Heat recovery 3. Production of biogas (from anaerobic digestion) 4. Beneficial use of treated biosolids 5. Extraction of nitrogen and phosphorus for fertilizer pellets (struvite) 6. Hydro-electric energy recovery It was highlighted that some of these options – particularly biogas and struvite – are scale dependent, and need a population larger than the CVRD to be technically and economically practical. However, the evolution of new technologies may change this. It was noted in discussion that hydro-electric energy recovery is unlikely to be cost effective, given that there is no significant head drop available at the plant. There was a question about the refining of bio-plastics from the wastewater. Paul Nash explained that this is being done in Europe, but only at plants that serve more than two million people. The processes can only be done at very large scale. Noting these caveats, the TACPAC approved this long list to go to public review	Al Gibb, WSP
	Lunch Break	
4.10	Long List Options – Conveyance Walt presented the conceptual conveyance options, detailed in Attachment 5 "Long List Options – Conveyance", which fall into six broad categories. 1. Estuary alignment – a new forcemain within or along the Comox Estuary foreshore, but then over Lazo hill to the Comox Valley Water Pollution Control Centre (CVWPCC). There are three variations in this category. 2. Overland alignments through Comox, and away from the estuary. These involve high pressure upgrades to the pump stations. There are two variations in this category. 3. Tunneling alignments, using "micro-tunneling" to go through the hills instead of over them. The intention is to minimize pumping head and avoid high pressure upgrades. There are three variations in this category. 4. North side concept – a new forcemain from Courtenay around the north side of Comox to the CVWPCC, and a new, separate forcemain from Comox/Jane Place to the CVWPCC. 5. Decentralized treatment – a new treatment plant in Courtenay and conveyance of the treated effluent to the Cape Lazo outfall. Conveyance routes are similar to options one, two, and four. 6. Deep marine concept – all new subsea forcemain located on the sea floor in the deepest part of the estuary, continuing out into deep water in the Salish Sea to avoid Willemar Bluffs, and coming back onshore to the CVWPCC.	Walt Bayless, WSP

ITEM	DESCRIPTION	OWNER
4.10	After explaining all the options, Walt stated that WSP's view is that option five is not cost effective due to the cost of building a new treatment plant, conveyance of the treated effluent, and the increased costs of operating two treatment plants. WSP's view is also that option six, the deep marine concept, is not technically viable due to the seafloor topography. WSP recommend that conveyance options five and six be dropped from the long list and not be studied further. Noting WSP's recommendation, the TACPAC approved this list, as presented, to go to public review, with explanation given to the public as to why options five and six are being dropped.	Walt Bayless, WSP
4.11	Preview of TACPAC #5, Friday, February 8, 2019 A quick look at the purpose of meeting # 5; a) To review public feedback on the long list options. b) Consider any additions or deletions and finalize the list. c) Recommendation of long list(s) to Comox Valley Sewerage Commission.	Paul Nash
4.12	Round Table Discussion. In the interests of time, there was no round table discussion	
4.13	Adjournment – the meeting was adjourned at 2:55pm	

Attachments

1. Finalized Goals and Evaluation – Treatment
2. Finalized Goals and Evaluation – Resource Recovery
3. Long List Options – Treatment
4. Long List Options – Resource Recovery
5. Long List Options – Conveyance

Attachment 1: Treatment Goals and Evaluation

Treatment- Consolidation of Goals

Category	Grouping (edited)	PAC %	TAC %	Proposed Revised Goals	Public %	Final% as voted	Description, Comment
Technical	Plan for future – climate change			Resilience to External Factors	10	10	Includes climate change, natural disasters, seasonal impact
	Minimize risk of failures/spills	15	14	Resilience to Internal Factors	0	15	Operational simplicity and reliability, minimize risk of failure/spills
				Maximize use of existing infrastructure and road ROW's	5	0	This is not an end goal in itself, but an action to achieve other goals, such as reducing capital cost and project complexity
				Flexibility to accommodate future changes	9	5	Technical Consultants to elaborate
	Plan for future - population	17	16	Provides asset life and capacity beyond the planning horizon	16	0	Some elements may have very long design lives, but they must all meet the minimum design horizon. Any benefits beyond that are captured in the life cycle cost analysis
Technical Total		**32%**	**30%**		**40%**	**30%**	
Affordability	Minimize lifecycle costs	12	17	Minimize Lifecycle Cost and Asset Management Needs	6	30	Net present value of capital, operational and replacement cost, period is to the planning horizon
	Asset management	1	11			0	Included in life cycle cost as "replacement"
	Allocation of costs between existing and new users	3	8			0	This applies regardless of the treatment solution being implemented, and is part of the financial analysis.
	Maximum opportunity for grants	10	8	Attract Grant Funding	8	0	This is an action to offset capital cost, and is included in the life-cycle cost analysis. But the LWMP guideline require that it be calculated and presented separately, for a grant and "no-grant" scenario.
Affordability Total		**26%**	**44%**		**14%**	**30%**	
Economic Benefits		0	0			0	External economic benefits are not a focus for treatment
Economic Total		**0%**	**0%**		**0%**	**0%**	
Environment Benefits	Public awareness about what" not to flush"	0	0				This is a management/education issue, regardless of treatment Options
	Maximize effluent quality	20	13	Quality of treatment exceeds current standards	9	15	Degree to which BOD and TSS removal is better than regulatory standards
				Remove artificial contaminants (e.g. pharmaceuticals, microplastics)	8	5	Neither of these are regulated I effluent, and are not likely to be for at least another decade, but can be removed with available technology
				Mitigate climate change impacts (Energy, and GHG's)	8	5	Most energy reductions reduce GHG's, but not all GHG reductions reduce energy.
Environment Total		**20%**	**13%**		**25%**	**25%**	

Social Benefit	Reduce odour from plant	12	9	Minimize noise and odour in long term operation	8	0	Elevated to a mandatory requirement for all treatment options to include odour control to industry best practice
	Maximize opportunity for partnership	4	2	Partnership Opportunity	7	0	If partnerships are desired, they can be pursued independently of Options, but Proponents can also be encouraged to bring them forward
	Maximize opportunity for community amenity at plant	6	2	Maximize opportunity for community amenity at/around plant	6	0	Could be education or even quasi-recreation facilities, such as an external viewpoint over the plant.
	General social benefit			Specifics intentionally left undefined		15	The TACPAC replaced the partnership and community amenity goals with this one general goal, which could include any type of social benefit
Social Total		**22%**	**13%**		**21%**	**15%**	
Grand Total		**100 %**	**100%**		**100%**	**100%**	

Final Goal and Evaluation Matrix – Treatment

Category	Goals	Weighting%
Technical	Resilience to External Factors	10
	Resilience to Internal Factors	15
	Flexibility to accommodate future changes	5
Technical Total		**30%**
Affordability	Minimize Lifecycle Cost	30
Affordability Total		**30%**
Economic Benefits	None	0
Economic Total		**0%**
Environmental Benefits	Quality of treatment exceeds current standards	15
	Remove artificial contaminants	5
	Mitigate climate change impacts	5
Environmental Total		**25%**
Social Benefit	General social benefit	15
Social Total		**15%**
Grand Total		**100%**

Attachment 2: Resource Recovery Goals

Resource Recovery – Consolidation of Goals

Category	Grouping (edited)	PAC %	TAC %	Proposed Revised Goals	Public %	Final% as voted	Description, Comment
Technical	Like Cranbrook, focus on technologies that are reliable	10	3	Commercially available technology	8	10	Want to avoid "inventing" something, but some RR technologies may still require pilot testing
	Meet provincial regulatory requirements	1	13				A pass/fail criteria as far as RR is concerned
	Anticipate future demand for recovered resources	3	1	Anticipate future demand for resources	8	5	Part of the "market study" for the RR opportunities
				Resiliency to internal factors		5	Operational simplicity and reliability, minimize risk of failure/spills
				Improve performance of treatment plant	9	5	Some reclaimed water treatment processes may help achieve other performance goals
Technical Total		**14%**	**17%**		**25%**	**25%**	
Affordability	to be cost neutral as a minimum	2	10	Maximize revenue or cost offset	8	0	Revenue to be incorporated as a specific line item of life cycle cost
	Use life cycle costs/NPV	22	27	Minimize life cycle cost	8	30	Net present value of capital, operational and replacement cost, and revenue, period is to the planning horizon
	Grant Funding eligibility	19	13	Potential for Grant Funding	9	10	Will require a detailed assessment of current and likely grant opportunities, to then assess Options
	Build capacity for options and partnerships to recover costs in future	28	15	Potential for external partnerships	8	10	The partner is more than just a pay-for product customer, they may contribute to the capital cost of the project.
Affordability Total		**71%**	**65%**		**33%**	**50%**	
Economic Benefits		0	0	Grow the local economy	7	5	Recognition that use of reclaimed water for agriculture can grow the local economy
Economic Total		**0%**	**0%**		**7%**	**5%**	
Environment Benefits	Reduce GHG/carbon neutrality	14	8	Energy efficiency and GHG reductions	9	5	Most energy reductions reduce GHG's, but not all GHG reductions reduce energy.
	Habitat Restoration or enhancement			Habitat restoration or enhancement	9	5	Use of reclaimed water for this purpose
				Displacement of potable water		5	Only achievable where there is specific displacement of existing uses
Environment Total		**14%**	**8%**		**18%**	**15%**	

Social Benefit	Public health issues considered for any reclaimed water	1	10		10		Is a specification that any reclaimed water option must meet, so not an evaluation criteria
				Ability to maintain irrigation of critical public infrastructure during drought conditions	7	5	A definite community benefit if it prevents damage to playing fields, perennial gardens etc
Social Total		**1%**	**10%**		**17%**	**5%**	
Grand Total		**100%**	**100%**		**100%**	**100%**	

Final Goal and Evaluation Matrix – Resource Recovery

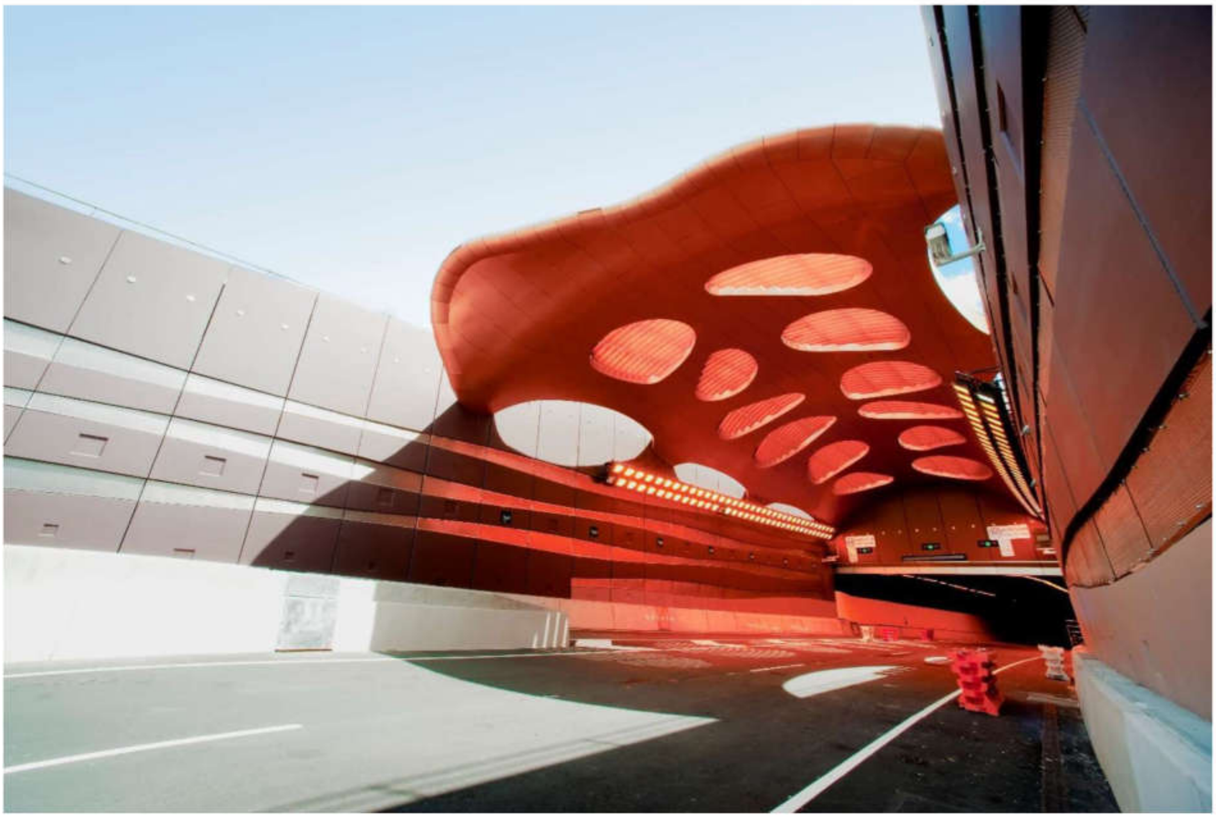
Category	**Goals**	**Weighting%**
Technical	Commercially available technology	10
	Resiliency to internal factors	5
	Anticipate future demand for resources	5
	Improve performance of treatment plant	5
Technical Total		**25**
Affordability	Maximize revenue or cost offset	10
	Minimize life cycle cost	20
	Potential for Grant Funding	10
	Potential for external partnerships	10
Affordability Total		**50**
Economic Benefits	Grow the local economy	5
Economic Total		**5**
Environmental Benefits	Energy efficiency and GHG reductions	5
	Habitat restoration or enhancement	5
	Displacement of potable water	5
Environmental Total		**15**
Social Benefit	Ability to maintain irrigation of critical public facilities during drought conditions.	5
Social Total		**5**
Grand Total		**100%**

Attachment 3

PRELIMINARY WASTEWATER TREATMENT LONG LIST OPTIONS
FOR DISCUSSION ONLY

COMOX VALLEY REGIONAL DISTRICT LIQUID WASTE MANAGEMENT PLAN

JANUARY 18, 2019



WASTEWATER TREATMENT OPTIONS

Overview

The wastewater treatment options presented here are based on the level of treatment to be implemented (i.e., the effluent quality that will be produced). This 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, and Canadian Forces Base Comox.

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.

Location and Number of Treatment Facilities

In some LWMPs, sites for one or more new treatment facilities must be selected. 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 swimming beaches and shellfish beds are not impacted. 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 (e.g. 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 mentioned earlier, a single existing wastewater treatment facility (located at Brent Road near Cape Lazo) and outfall serves the communities of Courtenay and Comox as well as CFB Comox. 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 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 possibility will be explored in the Resource Recovery part of the LWMP.

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 purposes of the LWMP, it is important to carefully consider the capital and O&M 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 costs, which are not eligible for grant funding and fall entirely on local taxpayers.

Emerging Contaminants

Emerging Contaminants have been defined as *"Constituents, which have been identified in water, that are considered for regulatory action pending the development of additional information on health and environmental impacts"* (from Metcalf & Eddy, 2014). Examples of Emerging Contaminants may include pharmaceutically active compounds (e.g., antibiotics), endocrine disrupting compounds that affect natural hormones in animals and humans, personal care products, and disinfection byproducts. Many of these products are known to be potentially harmful, but much remains to be learned about their behavior in the environment, and potential methods of treatment. As it stands, domestic wastewater treatment plants are not specifically designed to remove this type of contaminant, although some may be degraded or transformed in the treatment processes, and some may be incorporated into the waste solids.

According to Water Research Foundation Fact Sheet (2016): *Detecting a compound in water does not mean that adverse health effects will occur or are likely. In general, no relationships have been established between pharmaceuticals in water at environmental levels and adverse effects in human Strategies for preventing endocrine disrupting compounds (EDCs) and pharmaceuticals and personal care products (PPCPs) from entering water supplies include improved wastewater treatment and other source water protection strategies. Once EDCs and PPCPs have entered a utility's water supply, no single treatment process can remove them all due to their wide range of physicochemical properties. In general, both conventional and advanced water treatment systems have the capability to reduce the concentration of EDCs and PPCPs in water to some degree, though removal by conventional treatment processes is limited. Advanced treatment processes such as nanofiltration, reserve osmosis, and activated carbon are more effective but can be expensive and energy-intensive.*

Metals may also be a concern where they accumulate to toxic concentrations. Domestic wastewater treatment plants are not designed to remove metals from the wastewater stream. However, it has been shown that many of the so-called "heavy metals" tend to associate with solid particles in water. Thus removal of suspended solids from wastewater will result in at least partial removal of these associated metals as well (the solids must also be dealt with but are much less in volume than the wastewater stream).

Microplastics have recently been identified as a concern as well. According to Water Research Foundation (2018): *Studies have found that WWTPs removed between 90-99% of microplastics (<0.5 cm), with most being captured in the sludge. However, when dealing with large volumes of effluent, even a small concentration of microplastics being released can result in a significant contribution to the environment. Current research indicates that the microplastics in the environment has not caused adverse effects on aquatic wildlife as opposed to macroplastics, which can cause physical harm to fish-eating birds, aquatic mammals, reptiles and fish. If it is shown that microplastics should be removed from effluent, filtration is likely the best treatment, though more research on removal of microplastics, particularly for sizes smaller than 300 um, is needed.*

Options for Treatment

For the purposes of Stage 1 of the LWMP, four options for treatment were identified for discussion with the TAC/PAC. The four options are based on the effluent quality to be produced as stated at the beginning of this discussion, and are presented as concepts for planning of future expansions and/or upgrades. 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 on the following pages. Note that Option 2 describes the current configuration of the CVWPCC, with the addition of disinfection.

Long-List Option No. 1	Meet Regulatory Discharge Standards

Description

Option 1 would meet federal and provincial regulatory requirements for secondary treatment with discharge to open marine waters (the CVWPCC outfall extends 2,825 metres from shore at Cape Lazo into the Strait of Georgia and the discharge diffuser is 60 metres below water at low tide). 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. If the EIS did not identify any additional requirements beyond what is required to meet the secondary treatment discharge standards set out in the B.C. Municipal Wastewater Regulation (MWR) and the Canada Wastewater Systems Effluent Regulations (WSER), the following treatment and discharge standards 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)

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's or study's measures.

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 does not cause the combined effluent to exceed the WSER discharge standards for BOD_5 and TSS

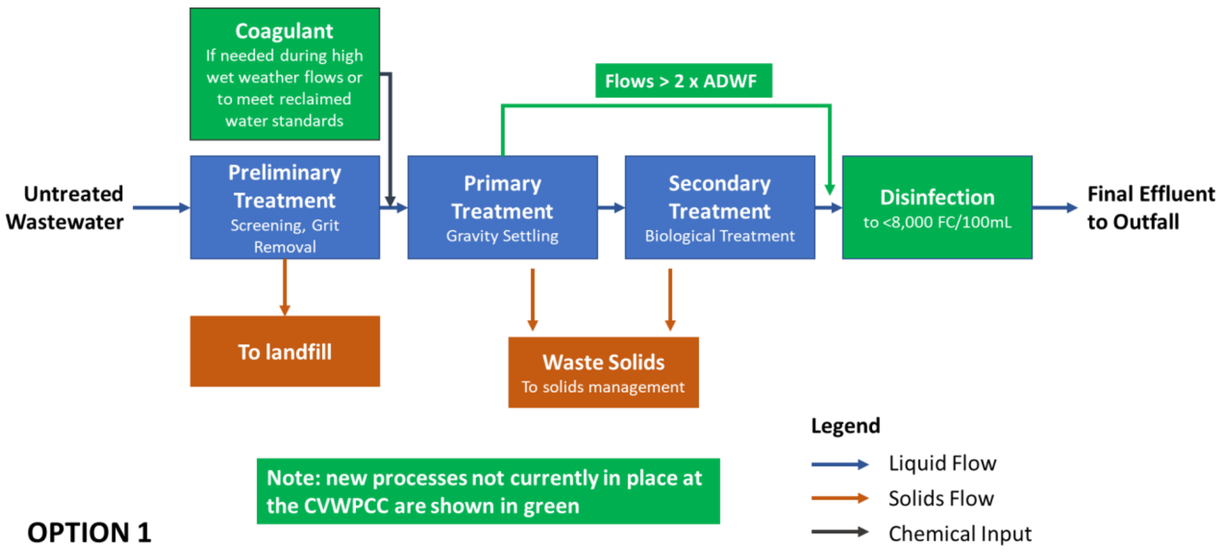
An EIS was completed for the CVWPCC discharge in 2010; this showed that disinfection of the effluent to achieve a fecal coliform count of less than 8000/100 mL in the CVWPCC discharge would be required to protect local shellfish resources outside the initial dilution zone (IDZ). Disinfection to this standard was assumed for Option 1.

Note that plant data from 2013 to 2017 show that the number of days when flows exceeded 2xADWF ranged from 0 days (2013) to 31 days (2015) – over the 5 years of record, flow exceeded 2xADWF on a total of 58 days (the total volume of flow greater than 2xADWF represented only about 1% of the total plant flow over that period)

Advantages	Disadvantages
• meets regulatory requirements for discharge to open marine waters • avoids the cost of subjecting relatively infrequent high wet weather flows to secondary treatment	• flows in excess of 2xADWF would bypass secondary treatment and so would not receive biological 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	

Process Schematic for Option 1



Long-List Option No. 2	Provide Secondary Treatment for all Flows

Description

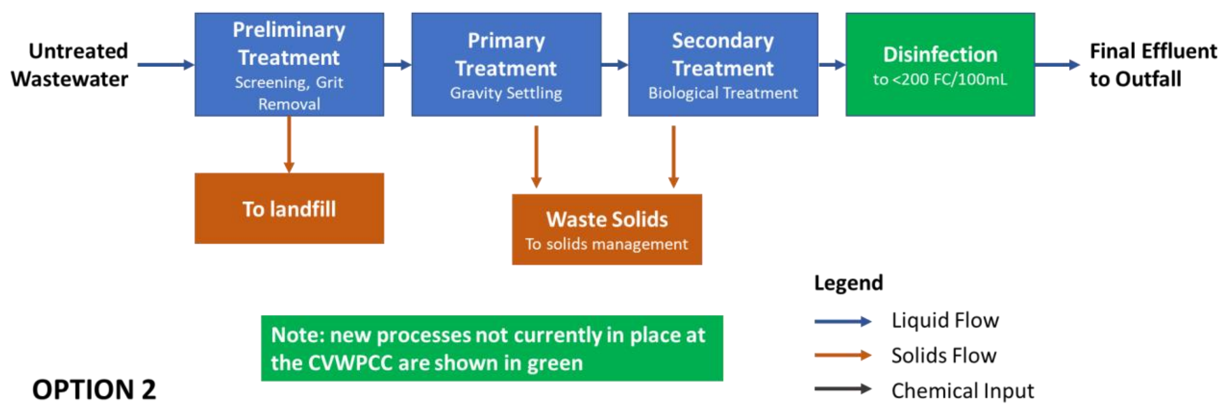
Option 2 is similar to Option 1, except that there would be no wet weather bypass of flows in excess of 2xADWF around secondary treatment. For Option 2, the entire plant influent flow would pass through secondary treatment (this is the current configuration of the CVWPCC). As with the other options, 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. For Option 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. The following treatment and discharge standards would apply to Option 2.

Secondary treatment for the entire plant flow:

- 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 not to exceed 200 FC/1900 mL

Advantages	Disadvantages
• 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	• secondary treatment must be sized accommodate all wet weather flows, increasing capital and operating costs compared to Option 1

Process Schematic for Option 2



Long-List Option No. 3	**Advanced Treatment for up to 2xADWF**

Description

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 for lower exposure potential (i.e. 200 FC/100 mL) in the undiluted (combined) effluent. The following treatment and discharge standards would apply to Option 3.

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

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

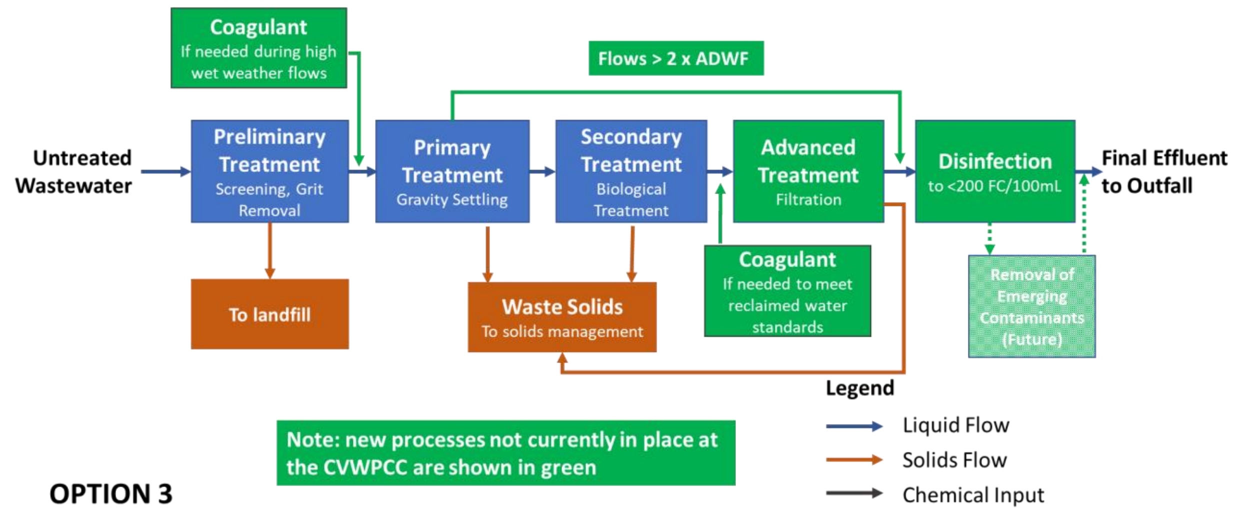
- 5-day Biochemical Oxygen Demand (BOD_5): max. day 130 mg/L
- total suspended solids (TSS): max. day 130 mg/L
- note that if flows are > 2xADWF during a storm or equivalent snowmelt event with a less than 5-year return period, a discharger must (have a liquid waste management plan or specific study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

Disinfection of combined effluent - fecal coliforms not to exceed 200 FC/100 mL

note that plant data from 2013 to 2017 show that the number of days when flows exceeded 2xADWF ranged from 0 days (2013) to 31 days (2015) – over the 5 years of record, flow exceeded 2xADWF on a total of 58 days (the total volume of flow greater than 2xADWF represented only about 1% of the total plant flow over that period)

Advantages	**Disadvantages**
• 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 • combined effluent meets standards for reclaimed water use for lower exposure potential • ability to increase coagulation and disinfection to meet standards for moderate or greater exposure potential	• higher capital and operating costs than Options 1 and 2 • flows > 2xADWF do not pass through advanced treatment • higher operational costs if treating reclaimed water to greater exposure potential standard

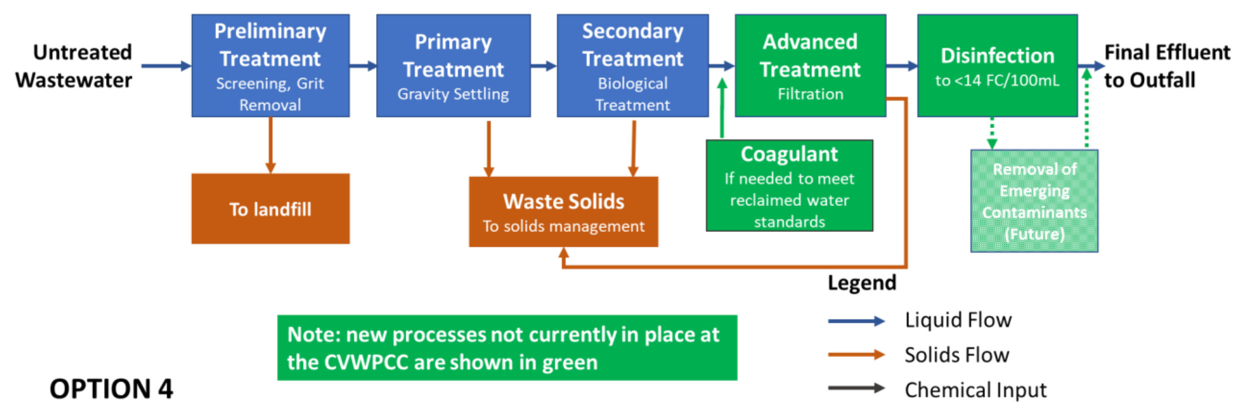
Process Schematic for Option 3



Long-List Option No. 4	Advanced Treatment for all Flows
Description	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 not to exceed 14 FC/100 mL • future addition of processes that are proven for removal of emerging contaminants at municipal wastewater plants

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

Process Schematic for Option 4

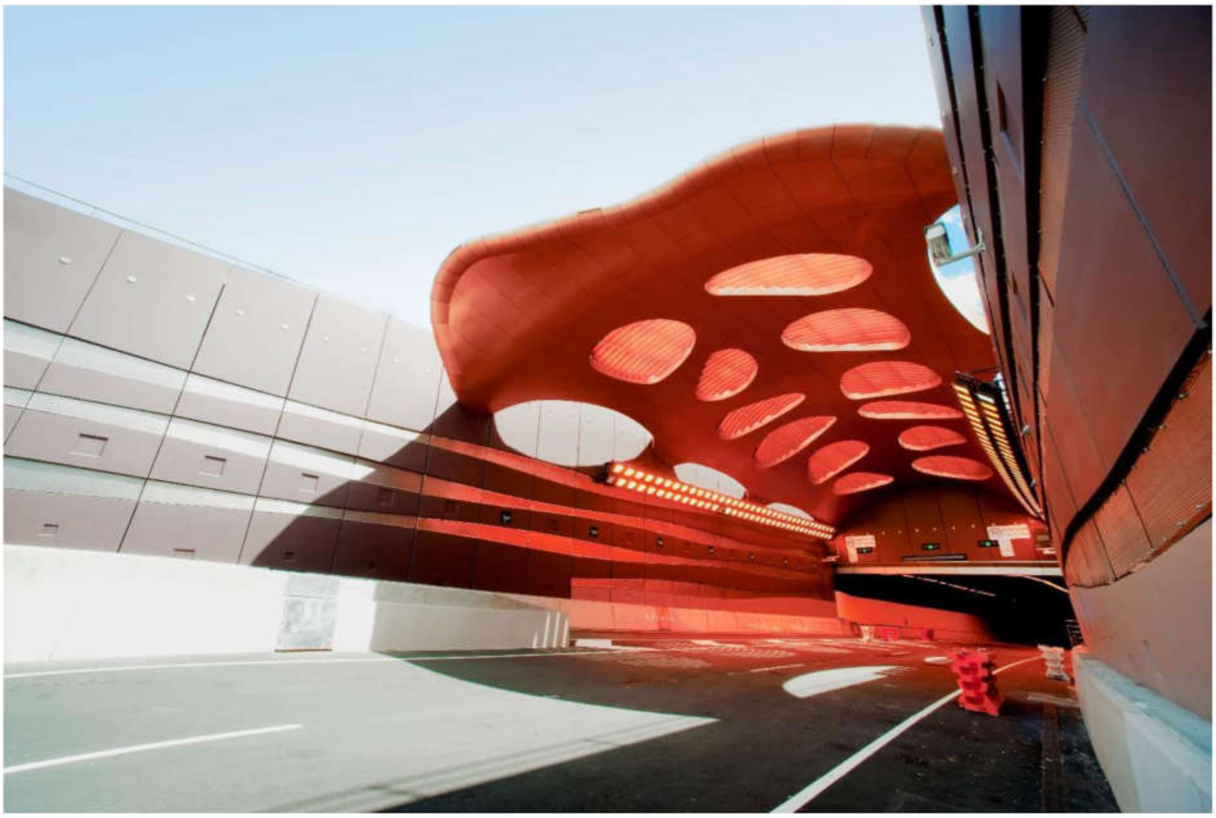


Attachment 4

PRELIMINARY RESOURCE RECOVERY LONG LIST OPTIONS
FOR DISCUSSION ONLY

COMOX VALLEY REGIONAL DISTRICT LIQUID WASTE MANAGEMENT PLAN

JANUARY 18, 2019



RESOURCE RECOVERY OPTIONS

Overview

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 during 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.

Reclaimed Water

Some of the wastewater treatment options (namely Options 3 and 4) are designed to produce effluent quality that meets the requirements for use of reclaimed water. For Options 1 and 2, if one or more uses for reclaimed water are 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 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 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.

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. Use of this type of system can be considered for incorporation into future upgrades at the CVWPCC.

If a potential user or users of heat is located near the pumping station or 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).

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. Anaerobic digestion is not currently practiced at the CVWPCC, and economies of scale mean that it would not be economical at present. This may be considered in future as a possible resource recovery strategy when the plant service population increases.

Beneficial Use of Treated Solids

Where digestion of waste solids is practiced at wastewater treatment plants, the solids product of digestion can be used as a solid conditioner and natural fertilizer, proved 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 that 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 compost help to offset operating costs for solids handling. This is a sustainable strategy for beneficial use of treated wastewater solids as long as the local market can absorb the compost.

Extraction of Nitrogen and Phosphorus 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 (e.g., water produced as a result of dewatering digested waste solids or waste biological solids from biological nutrient removal processes). 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. This 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.

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 (i.e., the land section of the outfall has a steep downward slope), it is possible to install a small hydroelectric turbine to generate electricity. In our experience, this is not cost-effective at smaller plants, even if there is a large head loss available on the discharge to drive the turbine. 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.

Summary

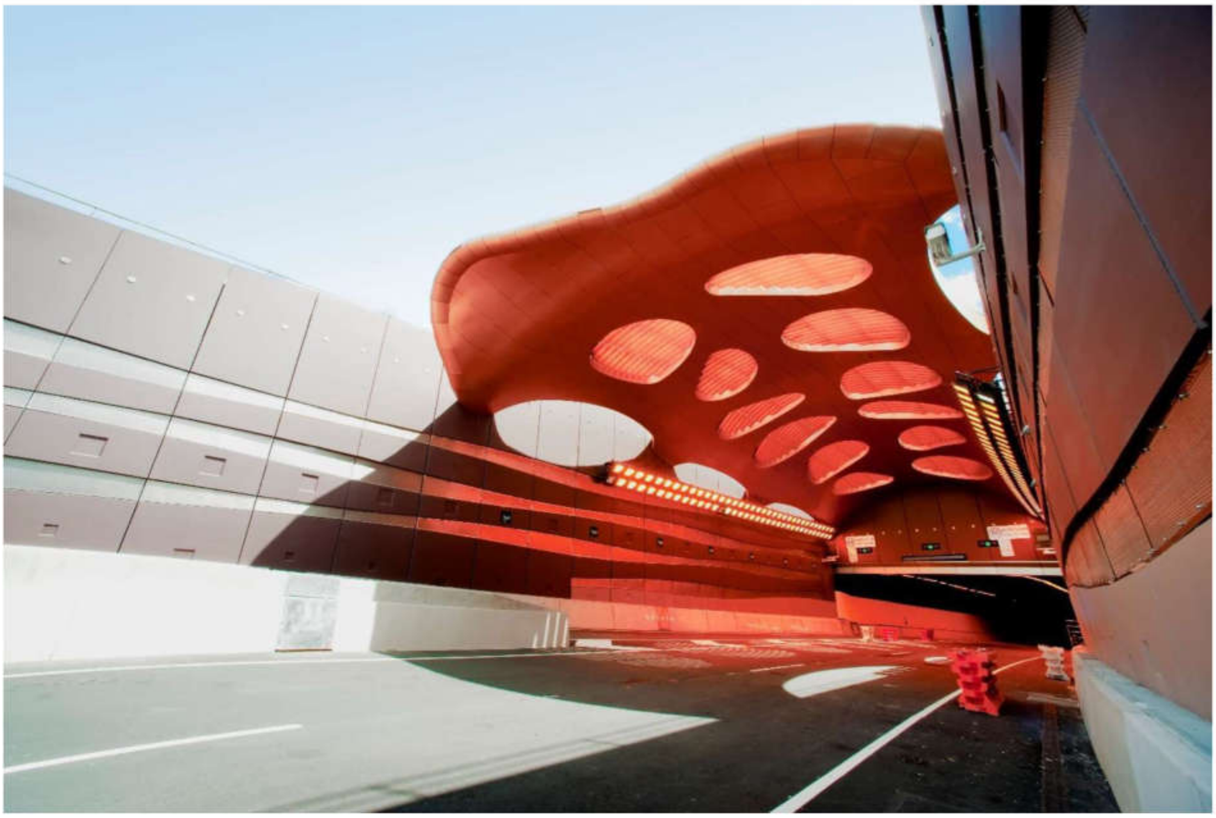
In general, the most cost-effective resource recovery option for the LWMP is likely to be ongoing (and possibly expanded) use of reclaimed water for non-potable applications at the CVWPCC, and potentially for offsite use as well, if one or more users can be identified. In future when upgrades to the treatment facilities are undertaken, the addition of other resource recovery processes can be considered; this may include extraction of heat from the effluent for space heating (and cooling), struvite crystallization for fertilizer production, and eventually anaerobic digestion for generation of biogas when the service population grows to make this economically feasible or new technologies make this economically viable for smaller plants. Technologies for treatment of wastewater and waste solids are continually evolving, and research and development are ongoing. Design of future upgrades at the CVWPCC should be undertaken with this in mind, so that new facilities for resource recovery can be added to the plant without major disruptions or modifications to the existing facilities at that time.

Attachment 5

PRELIMINARY CONVEYANCE LONG LIST OPTIONS
FOR DISCUSSION ONLY

COMOX VALLEY REGIONAL DISTRICT LIQUID WASTE MANAGEMENT PLAN

JANUARY 18, 2019



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CONVEYANCE OPTIONS

Overview

The conveyance options presented here were brainstormed based on the location of the existing infrastructure, environmental and regulatory limitations, existing hydraulics of the Comox Valley Sewer System (CVSS) and typical hydraulic constraints associated with sewerage pumping. This is the level of analysis that is appropriate for Stage 1 of a Liquid Waste Management Plan (LWMP). More detailed engineering conceptual analysis such as a feasibility study is then undertaken for the shortlisted options as part of Stage 2 LWMP, to enable selection of the preferred option. After the LWMP, predesign studies are carried out to size and design the components of the infrastructure comprising the system that optimizes conveyance in the CVSS.

The CVSS serves the Town of Comox, the City of Courtenay, and the Canadian Forces Base Comox. It consists of the Comox Valley Water Pollution Control Centre (CVWPCC), six pump stations of varying size and criticality, and the associated piping network. Two sewer main systems discharge at the CVWPCC:

- North Side System consisting of
  - Hudson Trunk
  - Greenwood Trunk
  - CFB Comox gravity main
  - CFB Comox Pump Station
  - Colby Road Pump Station
- Foreshore System consisting of
  - Courtenay Pump Station
  - K'omoks First Nation Pump Station
  - Jane Place Pump Station
  - Foreshore forcemain along Comox Harbour
  - HMCS Quadra Pump Station and forcemain
  - Foreshore forcemain along Willemar Bluffs

Recent upgrades to the North Side system include the design and installation of the Hudson Trunk and Greenwood Trunk. These gravity sewer mains service the northwest corner of the CVSS and tie-in to the existing CFB Comox gravity sewer main.

The foreshore system is currently at capacity and the section of the sewer main along Willemar Bluffs requires abandonment/removal. The objective of the Conveyance Component of this LWMP is to identify the optimal relocation and upgrade plan for the entire Foreshore System for long-term planning purposes.

Existing Infrastructure Capacity and Condition

The existing Courtenay and Jane Place Pump Stations are approaching their hydraulic capacities and are also reaching the end of their useful life due to aging infrastructure.

As such, regardless of the conveyance option selected, there will likely be a need for renovation and capacity expansion at these two pump stations. However, if the selected alignment has significantly higher discharge pressures than at present, it will trigger a conversion of Courtenay and/or Jane Place PS to high pressure pumping stations. This brings additional design and cost considerations over and above renovation and capacity expansion, and may lead to a complete replacement pump station, rather than a renovation.

For the purpose of the LWMP, it is essential to consider the above, as even a low-pressure conveyance system will require some renovations and equipment upgrades to the existing pump stations, however these works would likely be achieved within the existing structure.

Options Boundaries and Limiting Factors

The location and number of pump stations depend on the location of the wastewater treatment plant and outfall, which are both fixed, and the hydraulics of the system, which is limited by the topography of the service area.

There are two high elevation sections within the Foreshore system of the CVSS; one at Comox Road, and one at Lazo Road, as shown on the figure below. For the purpose of the LWMP, any overland conveyance option will need to overcome the two high elevation locations within the CVSS. The overland routes are defined as any option not in the estuary or along the shoreline of the estuary. The hydraulics of the conveyance system will depend on the alignment selected. As such, multiple alignment alternatives are discussed within each option that may significantly vary in hydraulic requirements.

A sub-category of the overland routes involves the use of tunnels to convey the sewer through the hills rather than over them, and thus minimize the elevation of the pipe, compared to conventional overland forcemains. Tunneling alignment also have the advantage of being independent of surface features and road alignments. These options are referred to as "Tunneling Options" and two types have been considered, one using the tunnels as forcemains, and the second using the tunnels as gravity flow tunnels, or combinations of the two.

Source: Google Earth

Long-List Option No. 1	Estuary Alignment

Description

This alignment would involve installation of a new forcemain within or along the Comox harbour foreshore. The forcemain would transition to an overland pipe between Comox and the Lazo Road height of land. To convey the sewage over the Lazo Road height of land the following options are suitable:

A. The forcemain from Courtenay PS would continue directly to the CVWPCC such that there is no in-line pump station; however, a tunnel through the Lazo Road height of land would be used to reduce the required pressures in the system. Pending the tunnel elevation, a new pump station may be required in the general vicinity of the existing Jane Place PS. In which case, the existing Jane Place PS would be repurposed as a small subdivision pump station.

Advantages	Disadvantages
Potentially limited hydraulic changes to existing pump stations hydraulics subject to tunnel elevation. Minimizes construction of a forcemain through Comox. Only involves 2 large pump stations.	Involves work along and potentially in the estuary, including environmentally and archaeologically sensitive areas. Elevated maintenance and risk management needs due to proximity to marine environment. Elevated construction and operational risk associated with a tunnel.

B. The forcemain from Courtenay PS would continue directly to the CVWPCC such that there is no in-line pump station. In order to overcome the Lazo Road height of land, Courtenay PS would be upgraded to ensure the forcemain pressure is sufficiently high. As a result, the existing Jane Place PS would not be able to cope with this higher hydraulic requirement and therefore a new high head pump station would be required in the general vicinity of the existing Jane Place PS. This new facility would convey raw sewage into the forcemain between Courtenay PS and the CVWPCC. The existing Jane Place PS would be repurposed as a small subdivision pump station.

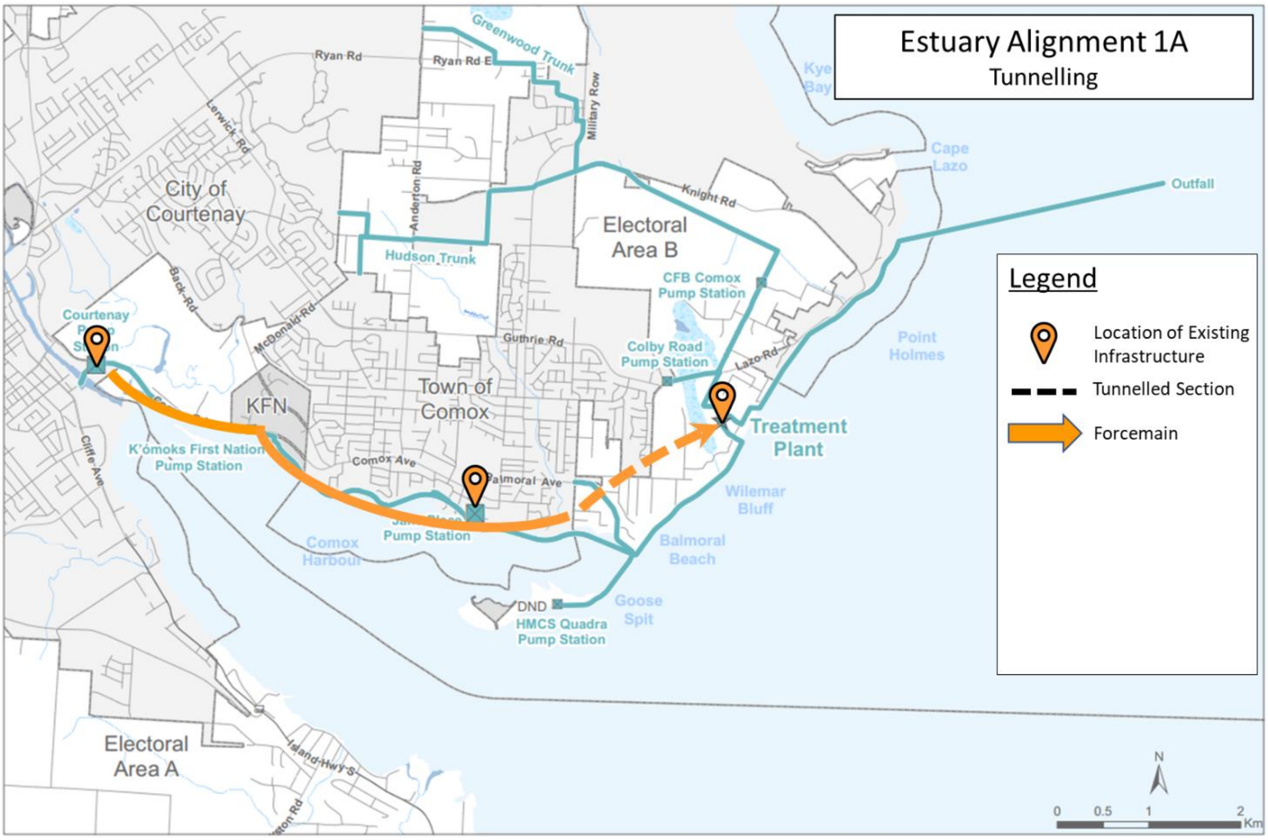
Advantages	Disadvantages
Minimizes construction of a forcemain through Comox. Only involves 2 large pump stations (Jane Place PS repurposed as local facility only).	Involves work along and potentially in the estuary, including environmentally and archaeologically sensitive areas. Elevated maintenance and risk management needs due to proximity to marine environment.

C. A new pump station facility located somewhere between Comox and the Lazo Road height of land. This would be an inline facility which receives raw sewage from the Courtenay PS discharge forcemain. The new pump station would pump the sewage over the Lazo Road height of land and the sewage would flow to the CVWPCC. The Jane Place pump station would tie-in to the Courtenay PS discharge forcemain at a location upstream of the new pump station. The elevation of the new pump station would have to be low enough to permit the Jane Place PS to hydraulically connect.

Advantages	Disadvantages
Minimize hydraulic changes to existing Courtenay and Jane Place PSs. Maximize useful life of existing foreshore forcemain. Minimizes construction of a forcemain through Comox.	Pump in series and single point of complete failure of sewage conveyance system. Involves operation and maintenance of 3 large pump station, one of high criticality.

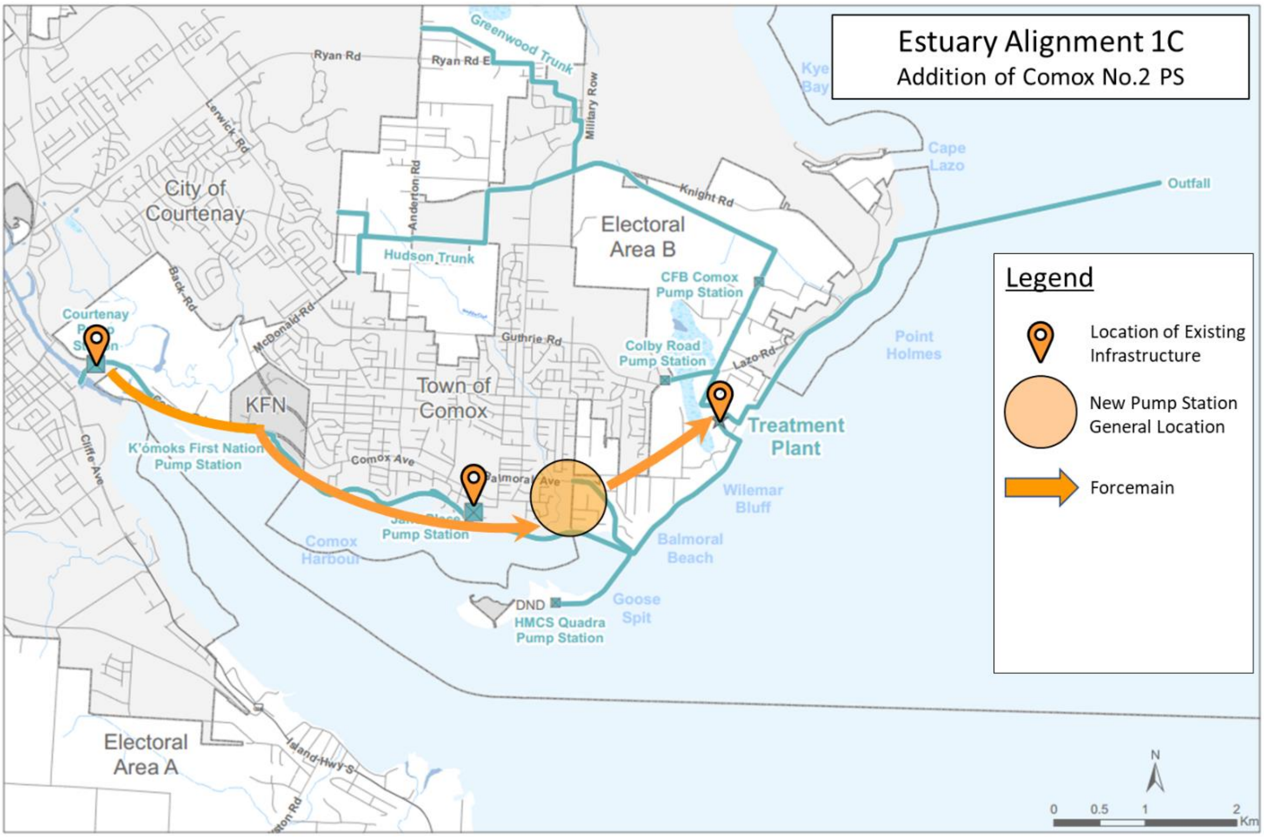
			Involves work along and potentially in the estuary, including environmentally and archaeologically sensitive areas. Elevated maintenance and risk management needs due to proximity to marine environment.

Option 1A



Option 1B

Option 1C



Long-List Option No. 2	Overland Alignments

Description

This alignment would involve installation of a new forcemain overland from Courtenay pump station towards the CVWPCC. This forcemain would pass over the Comox Road hill. Due to the change in discharge pressure a significant upgrade or rebuild would be required at the Courtenay Pump Station. Several routing options are available including:

A. The forcemain from Courtenay PS would continue directly to the CVWPCC such that there is no in-line pump station. In order to overcome both the Comox Road hill and the Lazo Road height of land, the Courtenay PS would be upgraded to ensure forcemain pressure is sufficiently high. As a result, the existing Jane Place PS would not be able to cope with this higher hydraulic requirement and therefore a new high head pump station would be required in the general vicinity of the existing Jane Place PS. This new facility would convey raw sewage into the forcemain between Courtenay PS and the CVWPCC. The existing Jane Place PS would be repurposed as a small subdivision pump station.

Advantages	Disadvantages
No pipe in the estuary mitigating environmental and archaeological risks. All pipe and structures on-land to maximize maintenance accessibility. Only involves 2 large pump stations (Jane Place PS repurposed as local facility only).	Significant hydraulic changes to the Courtenay PS and Jane Place PS. Construction of new conveyance system through an area with significant existing infrastructure.

B. The forcemain from Courtenay PS would convey raw sewage over the Comox Road hill and down into a new pump station, connected in series, somewhere between the Glacier View Drive/Comox Road and Lazo Road heights of land. The elevation of the new pump station would need to be at an elevation to suit the existing discharge pressures from the Jane Place PS. From the new pump station the raw sewage would be conveyed over the Lazo Road height of land to the CVWPCC.

Advantages	Disadvantages
No pipe in the estuary mitigating environmental and archaeological risks. All pipe and structures on-land to maximize maintenance accessibility. Minimize hydraulic changes to existing Jane Place PS.	Pump in series and single point of complete failure of sewage conveyance system. Involves operation and maintenance of 3 large pump station, one of high criticality. Significant hydraulic changes to the Courtenay PS. Construction of new conveyance system through an area with significant existing infrastructure.

Option 2A

Option 2B

Long-List Option No. 3	Tunnelling Alignments

Description

This alignment would involve installation of a combination of new forcemains and gravity sewer mains overland from the Courtenay pump station towards the CVWPCC. The tunnel alignments would be selected to either minimize pumping requirements or where possible, utilize gravity sewer mains. The primary areas where tunnelling would be appropriate are under the Comox Rd. and Lazo Rd heights of land. Several combinations of forcemain/gravity sewer mains are described below.

A. Sewage would be pumped from the Courtenay PS to an elevation where a tunnel would be constructed through the Comox Road hill. The forcemain would transition to an open cut installation through Comox and back to a tunnel to pass under the Lazo Road height of land and down to the CVWPCC. The Jane Place pump station could connect to the forcemain. To avoid major modifications to the Jane Place PS the tunnel elevations would have to be selected to suit the existing hydraulics of the Jane Place PS.

Advantages	Disadvantages
No pipe in the estuary mitigating environmental and archaeological risks. Reduces pressures at the existing pump stations. Significantly alleviates the high head requirements for the Courtenay PS and Jane Pl PS as compared to other overland options.	Elevated costs and risks due to tunneling. Construction of new conveyance system through an area with significant existing infrastructure.

B. A new open cut forcemain would be installed from Courtenay PS and would continue directly to the CVWPCC such that there is no in-line pump station. To reduce pressures a tunnel would be used for the forcemain to pass through the Lazo Road height of land. The existing Jane Place PS would likely not be able to cope with this higher hydraulic requirement and therefore a new high head pump station would be required in the general vicinity of the existing Jane Place PS. This new facility would convey raw sewage into the forcemain between Courtenay PS and the CVWPCC. The existing Jane Place PS would be repurposed as a small subdivision pump station. If the tunnel elevation is sufficiently low, the existing Jane Place PS would be suitable.

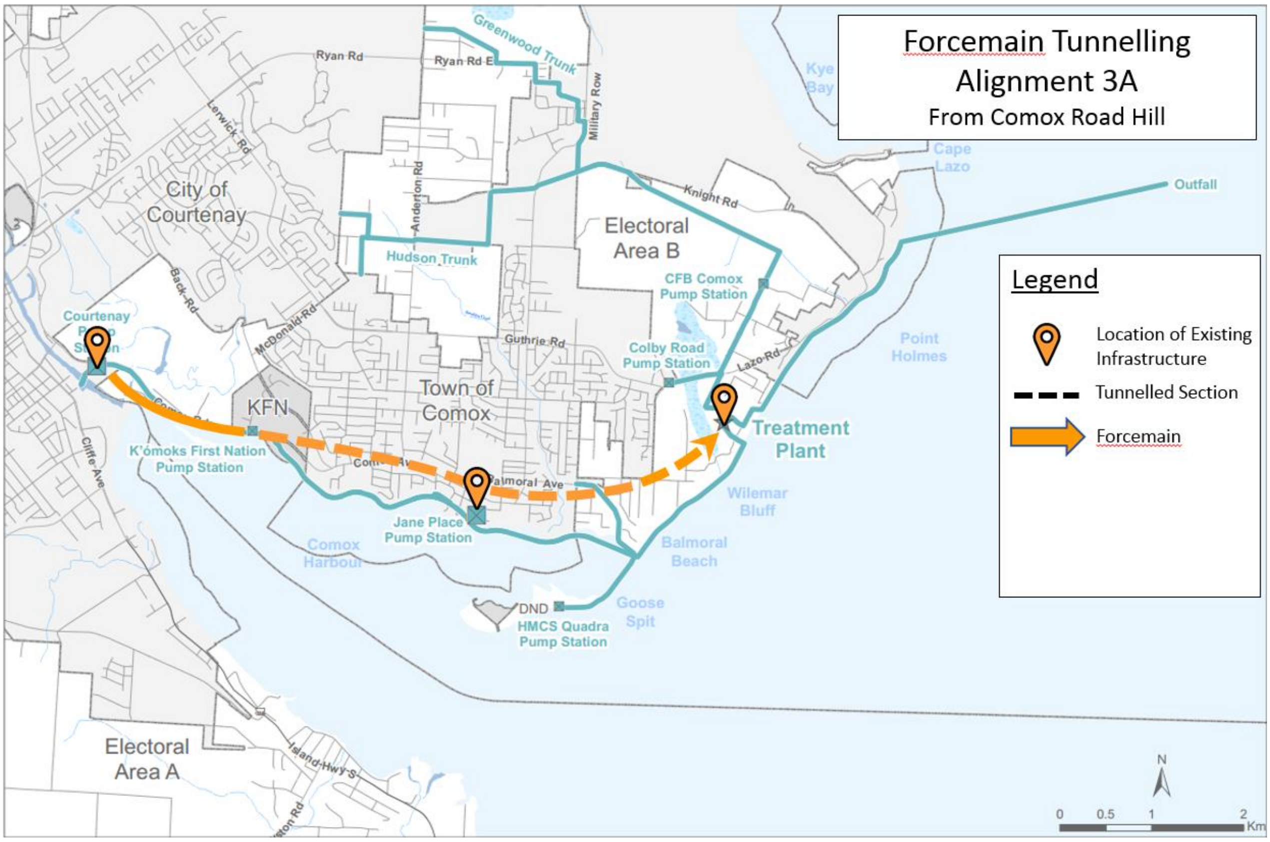
Advantages	Disadvantages
No pipe in the estuary mitigating environmental and archaeological risks. All pipe and structures on-land to maximize maintenance accessibility. Alleviates some of the high head requirements as compared to other overland options.	Construction of new conveyance system through an area with significant existing infrastructure. Higher upgrade requirements at the Jane Place PS as compared to the other tunnel options.

Description

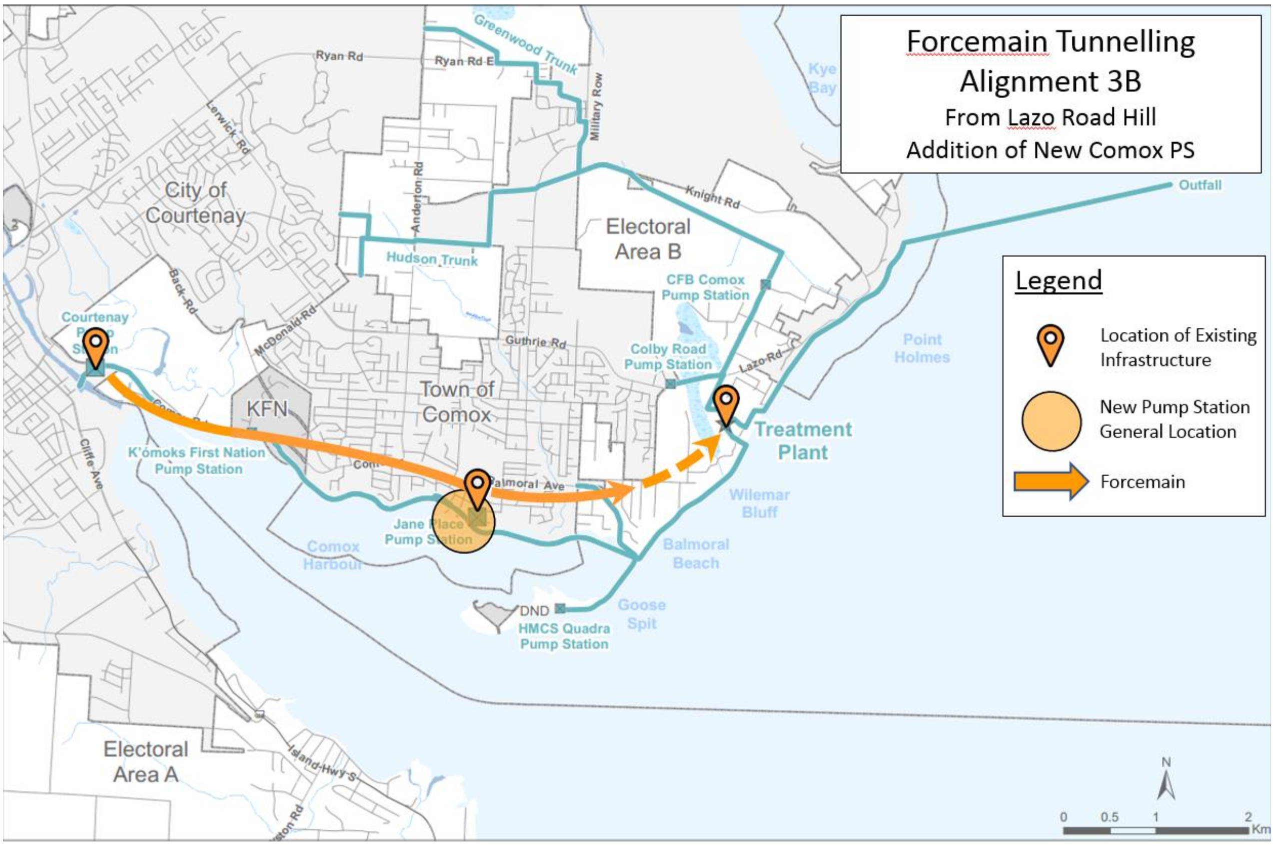
C. A new open cut forcemain would be installed from Courtenay PS and would continue directly to the CVWPCC such that there is no in-line pump station. To reduce pressures a gravity sewer main tunnel would be used to pass through the Lazo Road height of land. Depending on the tunnel elevation the existing Jane Place PS may not require replacement to a high head pump station. The alignment options for the gravity sewer main would be restricted to those which accommodate the required slope. The Jane Place pump station would connect to the gravity sewer main through a new forcemain. The tie-in location would be governed by the gravity sewer main alignment.

Advantages	Disadvantages
No pipe in the estuary mitigating environmental and archaeological risks. All pipe and structures on-land to maximize maintenance accessibility. Alleviates some of the high head requirements for the Courtenay PS and most of the high head requirements for the Jane Place PS as compared to other overland options.	Construction of new conveyance system through an area with significant existing infrastructure. Gravity sewer main alignment must follow a specific slope which is dependent on the topography. Gravity sewer mains are larger diameter as compared to forcemains for the same flow.

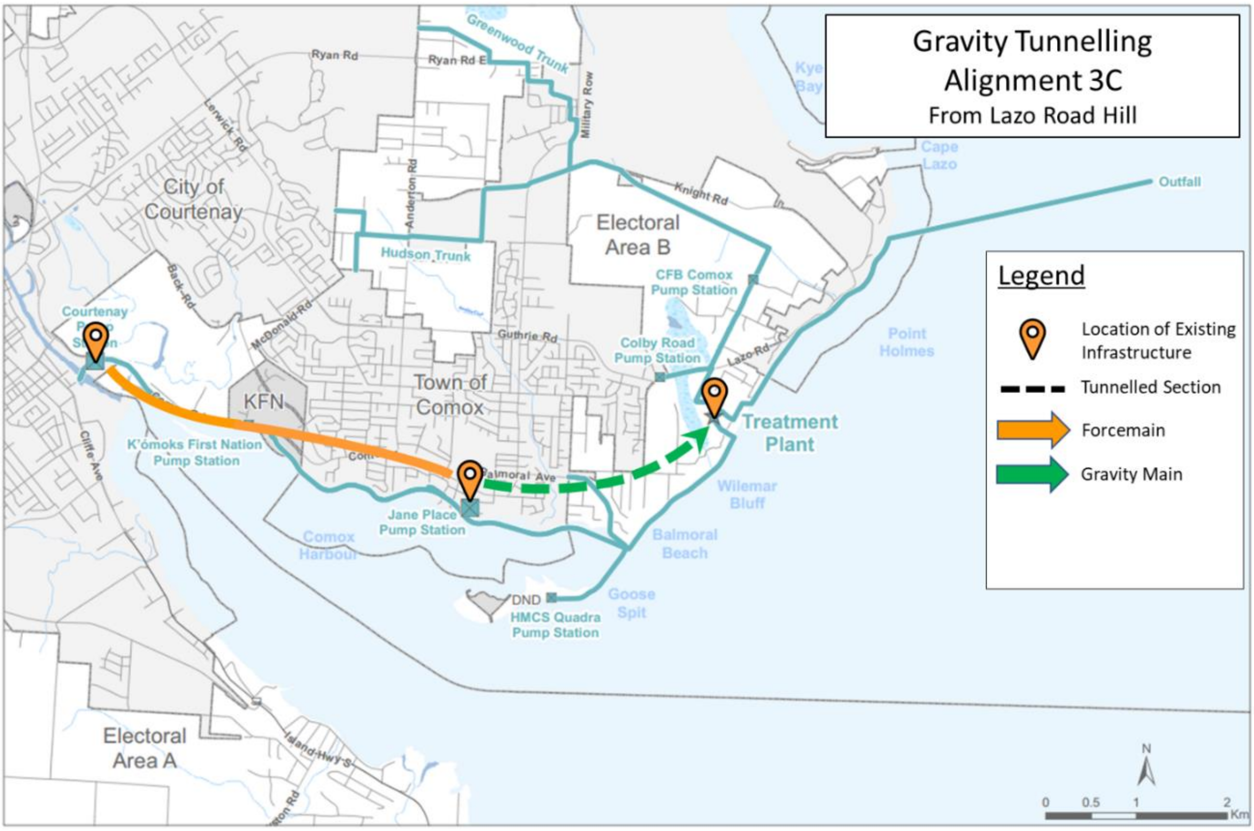
Option 3A



Option 3B

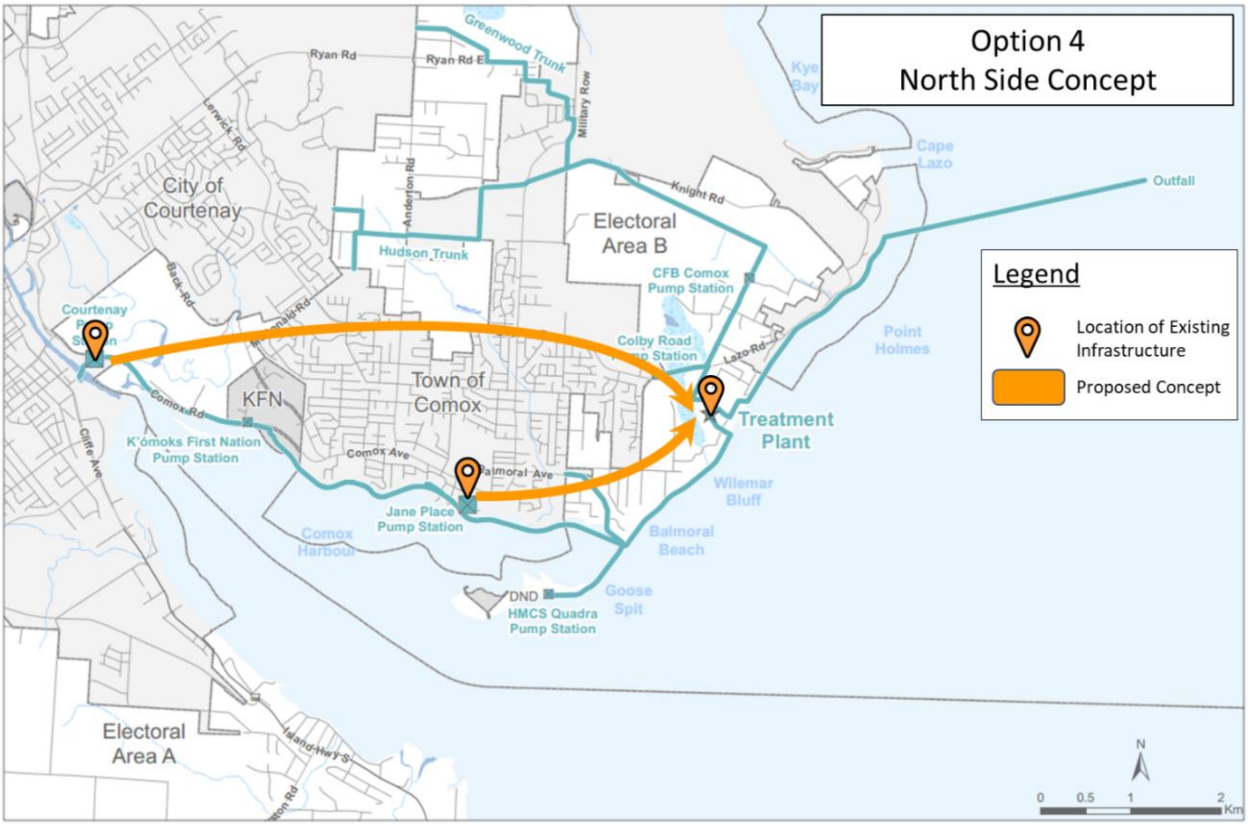


Option 3C



Long-List Option No. 4	North Side Concept
Description	In this concept, raw sewage would be pumped from the location of the existing Courtenay PS along the north side of the CVSS, and directly from the location of the existing Jane Pump Station to the CVWPCC. Courtenay PS would potentially be required to pump sewage to the CVWPCC over the highest elevation of East Courtenay hill (El. 73 m) in a forcemain. Jane Place PS would be required to pump sewage to the CVWPCC over the Lazo ill (El. 51 m) in a forcemain. The two forcemains will combine west of the Lazo hill and one common forcemain will convey the raw sewage to the CVWPCC. Alternately, the two alignments can continue separately over Lazo hill to the CVWPCC. Regardless of the alignment over Lazo hill, this option would trigger a high head upgrade at both the Courtenay and Jane PS, leading to the requirement for a rebuild of both pump stations.
Advantages	Disadvantages
Only involves 2 large pump stations (Jane Place PS repurposed as local facility only) Pump Stations operating in parallels as opposed to in series, minimizing need for a sophisticated control system. Avoids construction in areas with significant infrastructure development. No pipe in the estuary mitigating environmental and archaeological risks. All pipe and structures on-land to maximize maintenance accessibility.	Construction for the linear assets required along two separate alignments within the CVSS, increasing construction disturbance. Operating two partially separate high pressure forcemain networks. The North Side of Glacier View Drive is at a significant higher elevation than that of the South Side (73 m vs 39 m).

Option 4



Long-List Option No. 5	Decentralized Treatment Concept
Description	In this option, an additional wastewater treatment plant would be constructed in close proximity to the location of the existing Courtenay PS to treat the sewage collected and currently conveyed by the Courtenay PS. Due to the location of the outfall, the effluent of a decentralized wastewater treatment plant would have to be conveyed to the location of the existing outfall for discharge. Alignments for the conveyance of the effluent discharge are similar to those discussed within Options 1, 2, and 4, and include estuary, overland, tunnelled, and north side alignments. The sewage collected at the Jane PS will be conveyed to the existing CVWPCC for treatment using an overland or tunnelled option. Overland options would still require a new pump station for the Jane Place PS, and subject to the length and depth of the tunnelled option a new pump station in Comox maybe required.

Advantages	Disadvantages
Eliminates the need for conveyance of Courtenay's raw sewage through the CVSS to the CVWPCC. Alleviate capacity-driven upgrade requirements at the CVWPCC.	Requires the need for conveyance of the decentralized WWTP effluent to the outfall using a new pumping and conveyance system. Significant operational burden with two wastewater treatment plants. Significant cost associated with the construction of a new wastewater treatment plant, and maintenance and operation of two plants. Still requires conveyance of raw sewage overland from Comox.

Option 5

Long-List Option No. 6	Deep Marine Concept
Description	In this option, raw sewage would be pumped from the location of the existing Courtenay and Jane Pump Station to the CWPCC. The forcemain will be sited in deep water, placed on the sea-floor and only buried where there is less than 3m water depth at low tide. This option would require a deeper marine forcemain from Courtenay PS to the CVWPCC, with a forcemain from the Jane PS connecting into the forecemain in the estuary.

Advantages	Disadvantages
Minimizing pumping head and system pressure No new overland piping. Eliminate sewage pipes in the Comox Harbour foreshore.	Challenging constructability and maintenance. Environmental risk in case of a spill as sewage pipes are still in the estuary. Requires pipe from Jane PS to tie-in within the estuary which passes through sensitive environmental, ecological, and archaeological habitat. Difficult repair and maintenance as pipe is submerged.

Option 6