COMOX VALLEY REGIONAL DISTRICT
REPORT NUMBER: 18P-00276-00

LIQUID WASTE MANAGEMENT PLAN

SEWER EXTENSION SOUTH ADDENDUM REPORT

AUGUST 06, 2025

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COMOX VALLEY REGIONAL DISTRICT

FINAL (R8)

PROJECT NO.: 18P-00276-00.
DATE: AUGUST 06, 2025

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EXECUTIVE SUMMARY

Establishing a regional wastewater service in the communities of Royston and Union Bay has long been a topic of discussion. Wastewater is currently managed by private onsite septic systems within these communities, and evidence indicates problems with the effectiveness of these systems due to system age, environmental constraints, lot size and density. The environmental impact on Baynes Sound is of particular concern given that the area produces 70 per cent of BC's cultured oysters and is a significant economic driver for the region. Baynes Sound is a prized natural feature of the Comox Valley and has important environmental, cultural, and recreational value for the community.

In 2018, the Comox Valley Sewage Commission agreed in principle to the concept of receiving wastewater flows from portions of Baynes Sound – Denman/Hornby Islands (Electoral Area A) and K'ómoks First Nation (K'ómoks) and in 2020 the Sewage Commission supported several recommendations to allow for the future receipt of Electoral Area A and K'ómoks wastewater into the Comox Valley Sewer System.

Expansion of the area serviced by the Comox Valley Sewer Service will provide sewage services to existing developed areas in the south region, including Royston and Union Bay. The service expansion will also facilitate future sewer servicing for K'ómoks development lands in the south and Union Bay Estates, a comprehensive development area anticipated to include almost 3,000 future dwelling units and commercial, institutional, recreational and resort facilities. The servicing of these areas is anticipated to proceed in phases.

The intention of this addendum is to include consideration of the Sewer Extension South Project within the context of the Comox Valley Sewerage Service Liquid Waste Management Plan (LWMP). The Sewer Extension South LWMP Addendum is combining Stages 1 and 2 due to the considerable body of past planning work that has been completed for the area.

This addendum describes the decision-making process to achieve the following priorities for the Comox Valley Sewer Service LWMP:

- Facilitate a decision on the required phasing of the Sewer Extension South Project.
- Develop the design of options for the pump stations, forcemains and collection systems for Phase 1A and 1B of the project.
- Advance solutions within a rigorous framework of stakeholder and rightsholder consultation to inform each stage of decision making.

Throughout each stage of the Addendum process, decision making was advanced through the Technical and Public Advisory Committee (TACPAC), Steering Committee, and Comox Valley Sewage Commission, along with consultation with K'ómoks and other First Nations, and public engagement events.

1 INTRODUCTION

1.1 BACKGROUND

The unincorporated Electoral Area A communities of Royston, Union Bay, and surrounding neighbourhoods, referred to as the south region, border the waters of Baynes Sound south of the City of Courtenay. Baynes Sound produces 70 per cent of BC's cultured oysters and is a prized natural feature of the Comox Valley that holds important cultural, economic, environmental, and recreational value. There is no centralized sewage collection system in the area, and privately owned onsite septic systems are utilized for wastewater management. These systems are reported to have a history of failures with the potential to negatively impact the environment and public health.

1.1.1 PRIOR LIQUID WASTE PLANNING

The Comox Valley Regional District (CVRD) has commissioned a sizeable number of studies and investigations over the last 30 years on the wastewater management needs of the south region. In 2014, the CVRD retained Associated Engineering to complete a Stage 1 and 2 LWMP for the south region. The objective of the LWMP was to evaluate wastewater management alternatives to establish a firm direction for a sewage collection, treatment, and disposal system for the area. The LWMP eventually focused on the implementation of the South Sewer Project, which included construction of a new collection system, treatment facility, and conveyance infrastructure which would transport treated wastewater to the CVRD's regional Comox Valley Water Pollution Control Centre for discharge through the existing outfall off Cape Lazo. The concept of a new outfall into Baynes Sound was not supported by the LWMP Public and Technical Advisory Committees.

The LWMP development process was paused in 2015 and in 2016 there was an unsuccessful referendum on the South Sewer Project, causing the loss of grant funds that had been allocated to the project, thus curtailing progress towards a wastewater solution for the area. Refer to TACPAC Meeting #1 Discussion Paper #1 (Appendix A) for further information on the history of wastewater planning in the area.

1.1.2 PROPOSED REGIONAL SOLUTION

Continuing impacts from aging septic systems in Royston and Union Bay present ongoing environmental and human health concerns. Following the 2016 referendum on the South Sewer Project, investigations into alternate wastewater management solutions identified a partnership with the Comox Valley Sewer Service as the most viable option for treating wastewater from the south region. In 2018, the Comox Valley Sewage Commission agreed in principle to the concept of receiving wastewater flows from portions of Electoral Area A and K'ómoks, subject to the resolution of governance, terms of service, financial impact and regulatory considerations. In 2020, the Sewage Commission supported several recommendations to allow for the future receipt of Electoral Area A and K'ómoks wastewater into the existing Comox Valley sewer system.

Expansion of the area serviced by the Comox Valley Sewer Service as shown in **Figure 1** will provide sewage services to existing developed areas in the south region, including Royston and Union Bay. The service expansion will also facilitate future sewer servicing for K'ómoks development lands in the south and Union Bay Estates, a

comprehensive development area anticipated to include almost 3,000 future dwelling units and commercial, institutional, recreational and resort facilities. The servicing of these areas is anticipated to proceed in phases.

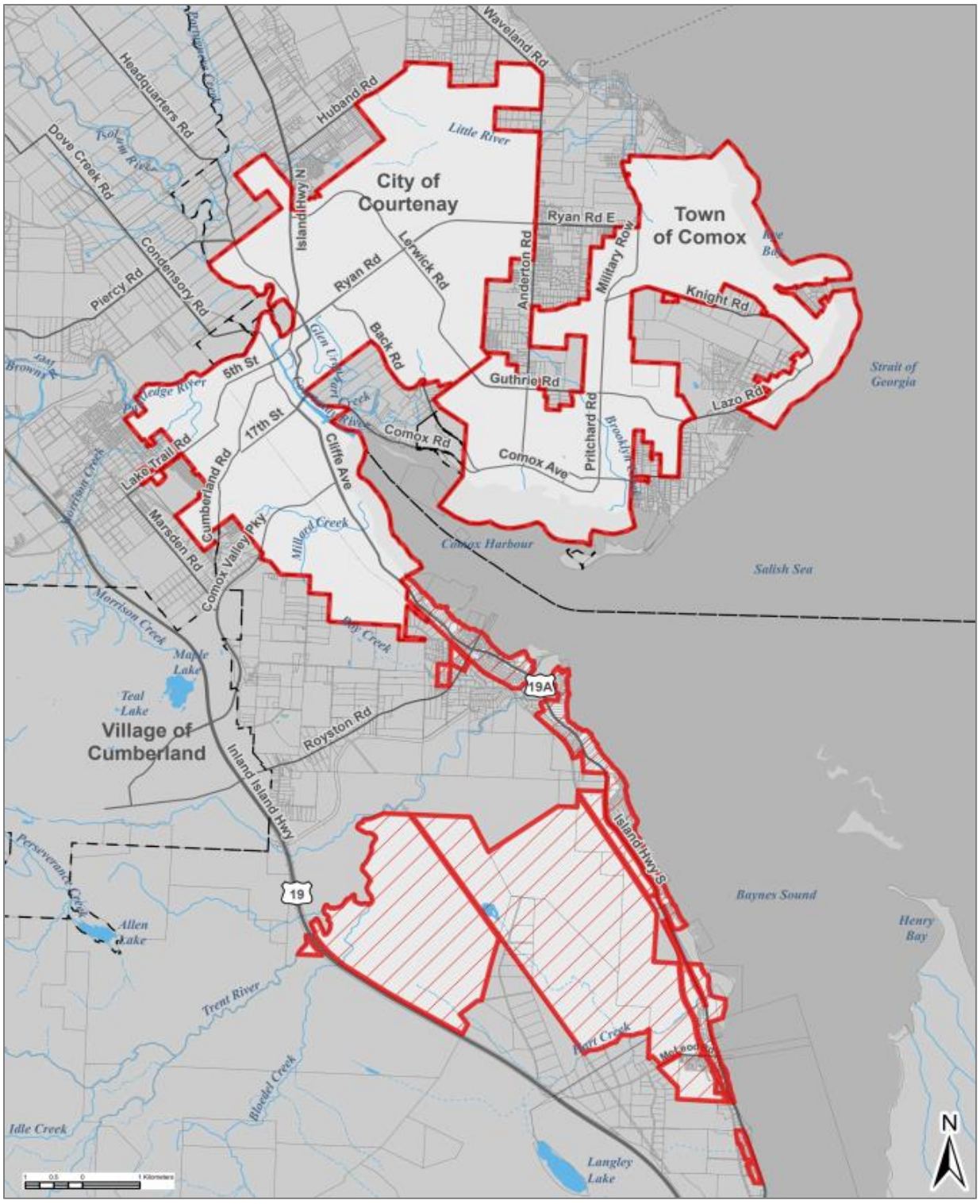

Figure 1: Comox Valley Sewer Service Area Expansion Map

Currently, wastewater is conveyed from the City of Courtenay, Town of Comox, K'ómoks, and the Department of National Defence to the Comox Valley Water Pollution Control Centre, where it receives secondary treatment followed by discharge to open marine waters in the Strait of Georgia near Cape Lazo. The Comox Valley Water Pollution Control Centre which was largely constructed in the 1980s, discharges an average daily flow of about 17,000 m^3 of treated effluent to the Strait of Georgia 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 existing plant infrastructure. To appropriately consider regional, long-term liquid waste management planning questions for the service, the CVRD is preparing a LWMP. The plan aims to:

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 to achieve effluent quality targets and resource recovery options.
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 TACPAC, consultation with K'ómoks, and public consultation meetings.

The layout of the system is illustrated in **Figure 2** below. The figure also includes the illustration of the proposed Sewer Extension South Project, indicating how the south region could tie into the Comox Valley Sewer Service.

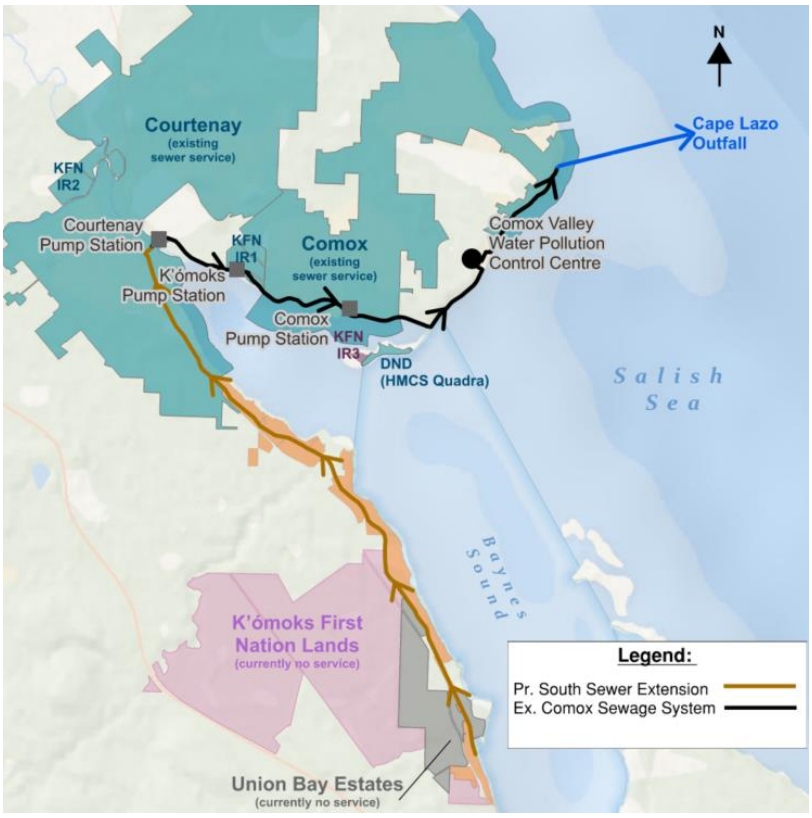

Figure 2: System Overview

1.2 ADDENDUM PROCESS

The intention of the addendum is to include consideration of the Sewer Extension South Project within the context of the Comox Valley Sewer Service LWMP. The LWMP addendum will summarize the work completed to date for the Sewer Extension South Project, advance the preliminary design of the wastewater collection and conveyance system, and complete a Stage 1 Environmental Impact Study. The development of the addendum follows provincial LWMP guidelines, including the involvement of the TACPAC, further public engagement, and consultation with First Nations. **Figure 3** below illustrates how the Sewer Extension South LWMP Addendum fits within the overall Comox Valley Sewer Service LWMP process.

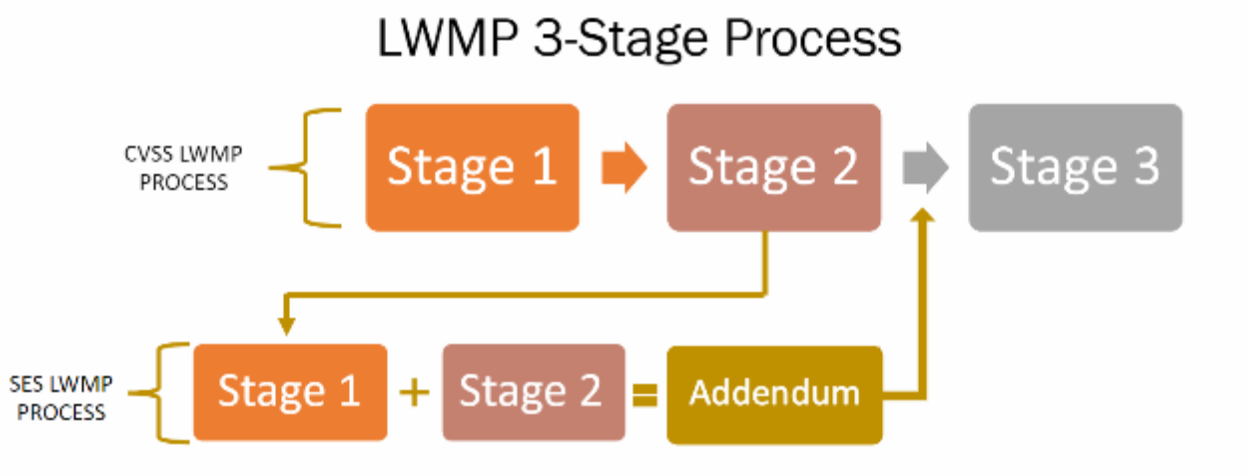

Figure 3: LWMP 3-Stage Process

Provincial LWMP guidelines describe a three-stage planning process, each involving meaningful public, stakeholder, and rightsholder consultation, and with Ministry of Environment and Climate Change Strategy review after each stage. The stages are often combined to make use of prior investigations and past planning work. The Comox Valley Sewer Service LWMP currently underway, has combined Stages 1 and 2 in the planning process. The Sewer Extension South LWMP Addendum is also combining Stages 1 and 2 due to the considerable body of past planning work that has been completed for the area.

1.3 SCOPE OF WORK

The following tasks were completed during Stage 1 and Stage 2 of the LWMP Addendum:

- review background information, including past studies, record drawings and GIS;
- define south region plan area, regulatory requirements, and design criteria;
- evaluate conveyance and collection system options and develop conceptual design and cost estimates;
- develop system overview and phasing;
- develop the preliminary design of the Sewer Extension South Project and associated Class C cost estimates for wastewater collection and conveyance;

- hold TACPAC and Steering Committee meetings at strategic points to present material and obtain committee feedback and input;
- complete public engagement to obtain input from the community at large; and
- First Nations consultation.

1.4 ACKNOWLEDGEMENTS

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.

- Darry Monteith, Manager of Liquid Waste Planning
- Vince Van Tongeren, Environmental Analyst
- Marc Rutten, General Manager of Engineering Services
- Russell Dyson, Chief Administrative Officer (retired 2023)
- James Warren, Chief Administrative Officer
- Kris La Rose, Senior Manager of Water/Wastewater Services
- Reid Sellentin, Manager of Wastewater Services
- Christianne Wile, Senior Manager of Strategic Initiatives
- Michael Briggs, Branch Assistant – Engineering Services
- Allison Habkirk, Facilitator

The members of the TACPAC are acknowledged for their dialogue, guidance, and recommendations throughout this process:

- Melanie Mamoser, Ministry of Environment and Climate Change Strategy
- Lindsay Johnson, Ministry of Health
- Thom O'Dell, Ministry of Agriculture and Food
- Gabrielle Kosminder, Fisheries and Oceans Canada
- Nancy Clements, Island Health
- Ella Derby, Island Health
- Chris Davidson, City of Courtenay
- Shelley Ashfield, Town of Comox
- Marvin Kamenz, Town of Comox
- Daniel Arbour, Electoral Area A Director
- Melanie Hewson, Association for Denman Island Marine Stewards
- Nico Prins, BC Shellfish Growers Association
- Malcolm Cowan, BC Shellfish Growers Association
- Andrew Gower, Comox Valley Chamber of Commerce
- Caitlin Pierzchalski, Comox Valley Conservation Partnership

- Ian Heselgrave, Comox Valley Schools
- Mike Atkins, Underwater Harvesters Association
- Ian Munro, Alternate Electoral Area A Director
- Norm Prince, resident representative
- Rosanne Steinke, resident representative
- Tabitha Donkers, resident representative
- Ken Newman, resident representative
- Jim Elliot, resident representative
- Ryan Lymburner, resident representative

2 PUBLIC, RIGHTSHOLDER, AND STAKEHOLDER CONSULTATION

2.1 ADVISORY COMMITTEE MEETINGS

The Technical Advisory Committee and Public Advisory Committee were established in September 2022 to provide technical and public input to the LWMP Addendum process. The Terms of Reference for each of these committees is included in TACPAC Meeting #1 Discussion Paper #1 in Appendix A.

The Technical Advisory Committee consists of eight agencies and stakeholders, including the Ministry of Environment and Climate Change Strategy (MoECCS), Ministry of Health, Island Health, Department of Fisheries and Oceans Canada, City of Courtenay, Town of Comox, and the Ministry of Agriculture and Food.

The Public Advisory Committee consists of Electoral Area A Director, Comox Valley Conservation Strategy Community Partnership, Comox Valley Chamber of Commerce, BC Shellfish Growers Association, Association of Denman Island Marine Stewards, Comox Valley Schools (SD71), and resident representatives from neighbourhoods in the Royston and Union Bay areas.

Similar to the Comox Valley Sewer Service LWMP, the public and technical advisory committee meetings have been held as joint meetings. A total of six TACPAC meetings were held at regular intervals throughout the planning process. Refer to Appendix A, B, C, D, E, and F for each of the meeting's minutes.

2.1.1 TACPAC MEETING NO. 1 – SEPTEMBER 21, 2022

Presentations and Discussions:

- Overview of LWMP Addendum objectives, purpose, and process
- Summary of prior LWMP work in Electoral Area A
- Overview of population projections and wastewater flows
- Summary of Comox Valley Sewer Service Stage 1 and 2 LWMP, including treatment objectives and provisions for flows from Electoral Area A

Outcomes and Decisions:

- Committee understanding of prior LWMP work in Electoral Area A and Comox Valley Sewer Service area
- Committee support for Technical Advisory Committee and Public Advisory Committee terms of reference

2.1.2 TACPAC MEETING NO. 2 – NOVEMBER 23, 2022

Presentations and Discussions:

- Review of Island Health septic system records
- Introduction of regulatory options for septic systems

– Sewer Extension South Project details – forcemain, collection systems, pump stations and phasing

Outcomes and Decisions:

– Committee consideration of septic system maintenance requirements
– Committee understanding of Sewer Extension South Project

2.1.3 TACPAC MEETING NO. 3 – DECEMBER 12, 2022

Presentations and Discussions:

– Draft Environmental Impact Study
– Overview of sewer service structure
– Project cost estimates
– Committee process

Outcomes and Decisions:

– Motions passed supporting proposed forcemain alignment and Royston pump station location
– Motions passed seeking further information on cost equity between phases, and lifecycle cost comparisons between septic systems and sewer servicing

2.1.4 TACPAC MEETING NO. 3.5 – MARCH 14, 2023

Presentations and Discussions:

– Septic systems – cost comparison with sewer, regulatory program options and deferral program options
– Kilmarnock collection system
– Project phasing
– Value Planning

Outcomes and Decisions:

– Committee support for a septic regulatory program, including an enforcement component
– Committee support in principle for a septic deferral program for properties with newer septic systems
– Committee support for a hybrid gravity/low pressure sewer collection system
– Committee support for project phasing as proposed
– Committee interest in further information from the school district on possibility of including Royston Elementary School in first phase of the project
– Committee adoption of a policy statement seeking cost equity between project phases

2.1.5 TACPAC MEETING NO. 4 – NOVEMBER 22, 2023

Presentations and Discussions:

– Update on public engagement summary report, and upcoming engagement events

- Overview of draft addendum report
- Update on project cost estimates
- Collection system and project phasing considerations
- Septic deferral program and septic maintenance program updates

Outcomes and Decisions:

Support for proceeding with next steps in Addendum development

2.1.6 TACPAC MEETING NO. 5 – MARCH 14, 2024

Presentations and Discussions:

- Final report on public engagement
- Overview of final Environmental Impact Study
- Overview of final addendum report
- LWMP Stage 3 - Public and Technical Advisory Committees

Outcomes and Decisions:

- Support for advancing the addendum report to the Steering Committees
- Committee request to include discussion on hydrological impacts from the loss of septic water prior to the addendum report being finalized.

2.2 CONSULTATION WITH THE K'ÓMOKS FIRST NATION

The CVRD acknowledges that Indigenous peoples are entitled to safe access to shellfish for food, social and ceremonial purposes and to protect the productive capacity of their lands (as per Article 29 of United Nations Declaration on the Rights of Indigenous Peoples) and that this right is threatened by the existing environmental risk in Baynes Sound.

K'ómoks has expressed concern about the health of Baynes Sound and related environmental and economic impacts, including its aquaculture businesses and planned future development of K'ómoks Southlands.

K'ómoks owns several fee simple parcels in the Royston and Union Bay area and may acquire significant additional lands through the treaty settlement process. The development of the K'ómoks Southlands is key to K'ómoks' economic independence and foundational to their success post treaty. Should treaty be ratified, K'ómoks Southlands will be connected to the regional sewer pipe.

K'ómoks is an important partner for the Sewer Extension South Project and has been actively engaged with the CVRD since project conception through a previously established process by both parties.

- Discussions on a regional solution for sewer began in 2020 as part of consultation for the Comox Valley Sewerage Service Liquid Waste Management Plan and Comox Valley Sewer Conveyance Project. CVRD elected officials and staff met regularly with K'ómoks Chief and Council and staff to discuss partnership opportunities to address environmental concerns in Baynes Sound and ensure service of K'ómoks Southlands south of Courtenay should treaty be ratified.

- In February 2021, K'ómoks and the CVRD ratified a Community Benefit Agreement that committed both parties to work together collaboratively on a regional solution for sewer. The agreement intended to provide needed upgrades for Comox and Courtenay sewer infrastructure, while supporting the growth and economic development plans of the K'ómoks community, resulting in the concept for the Sewer Extension South Project.
- From 2021 through 2023, K'ómoks and the CVRD together confirmed their support and partnership through joint lobbying of the province to fund the Sewer Extension South Project. In April 2023, the province announced a commitment of $30 million in funding towards the project.
- CVRD and Treaty Team staff attended community information sessions in Royston and Union Bay in June 2023 and January 2024 to share information about the project and how it will enable development of Treaty K'ómoks Southlands should treaty be ratified.

In 2024, the CVRD and K'ómoks continue to meet at the elected official and staff level and are working together to establish a process to move forward on a formal partnership agreement.

2.3 PUBLIC CONSULTATION

A successful LWMP requires extensive public consultation, which has been a key part of planning for this project. The Union Bay/Royston communities have been actively involved in wastewater planning for many years, and this involvement is carrying through in the LWMP Addendum process, with public consultation happening at all critical steps in the process. The extensive consultation, phased through the development of the Addendum, ensures the community can help determine the plan ahead as it is created.

2.3.1 ENGAGEMENT PLANNING

With the official launch of the LWMP Addendum process, a comprehensive engagement plan was created to outline plans for the years ahead. This plan includes four phases, indicates specific objectives, highlights the audiences, and makes clear what tools will be used moving forward.

2.3.2 PHASE 1: PROJECT INITIATION + FUNDING ANNOUNCEMENT

In June 2022, residents in the affected area were advised of the decision to move forward with an LWMP Addendum process through a direct mail letter. This also included updated content on the project page to share information about the addendum process.

In September 2022, a public advisory committee was formed to review this process. To encourage public advisory committee recruitment, a backgrounder was included with the June direct mail letter, providing information about the committee, its role and how to become involved. Between September 2022 and March 2023, the Joint Technical and Public Advisory Committee (TACPAC) completed five successful meetings.

On April 14, 2023, a project update was distributed via news release: the announcement of $30 million for the project in provincial grant funding. In addition to a news release, an email was distributed to the project email list and webpage content was updated to reflect the funding announcement.

2.3.3 PHASE 2: PHASING, COLLECTION SYSTEMS, PUMP STATIONS

In June 2023, the CVRD rolled out the second phase of public engagement for the project. The focus of this stage was to inform residents about the urgency of the project, as well as to provide more details about the LWMP Addendum process and how the community will be consulted. Its objective was also to highlight decisions made to date, including:

- Estimated costs per household;
- Project phasing;
- How wastewater will be collected in each community; and
- Design/location of the pump stations.

To facilitate engagement, the CVRD introduced a range of tools. In particular, this stage included the kick-off of an online engagement hub and the first public events.

A project page was created on the CVRD's public engagement portal to keep the community informed and to gather input moving forward. This page includes a key topics section, interactive map (with address availability) and a Q&A section where the public can post questions publicly and receive responses from the project team. Twenty-nine questions were posted and responded to in this phase.

The public events included two in-person events in the communities of Royston and Union Bay, and one online webinar. At these events there was information available for takeaway, including: a project backgrounder offering more information on cost options and a mock-up tax bill. Feedback forms were available to submit both online and in-person. Following the webinar, a video of the event was posted to encourage viewing for those who couldn't attend or watch live. Promotion for these events included:

- News Release
- Postcard invitation distributed to over 900 homes via Canada Post direct mail
- Notice to 294 project email list subscribers
- Social media posts to CVRD's Facebook and Twitter accounts
- Advertisement in Down by the Bay community newsletter

In July 2023, a 'What We Heard Report' was drafted (Appendix H), summarizing this public engagement period. It was officially released for public review in November 2023 on the engagement portal.

Since the project start in June 2022, a phone/email log has also been kept to record questions and comments that are submitted to the project team outside of events or the online consultation forum. The complete log will be shared in the final addendum.

2.3.4 PHASE 3: DEVELOPMENT OF DRAFT ADDENDUM

In November 2023, a TACPAC meeting was held to review the first draft of the addendum report and to discuss updated project plans. A recording of all TACPAC meetings, and the agendas are available at comoxvalleyrd.ca/sewerextension.

Following this meeting, the engagement portal was updated to reflect revised project timing, and an update was sent out to portal subscribers/project email list to share:

- the June 2023 ‘What We Heard’ Summary Report
- summary of the TACPAC meeting
- notice of upcoming January 2024 public open houses

In January 2024, the draft addendum report was shared with the public by posting a summary to the engagement portal and hosting public open houses. Invitations were direct-mailed to over 900 homes in Royston and Union Bay, advising of both ways to participate. An infosheet was also provided in the mailout, summarizing project information to date.

The community open houses included events in Royston and Union Bay, and one online webinar. At these events, attendees got to see how their feedback was incorporated into plan updates on components like collection system design and costs to residents. The events garnered participation from approximately 150 residents. All event materials were shared to the engagement portal, including information boards, project backgrounders and the webinar recording.

2.3.5 PHASE 4: REVIEW/APPROVAL

In mid-March 2024, there was a TACPAC meeting, where committee members reviewed a second ‘What We Heard’ report, summarizing feedback from the January 2024 engagement. Following this, the ‘What We Heard’ report will be distributed to the public, along with next steps for submission of the draft addendum to the province. The draft addendum will then be considered by the Steering Committee before it is forwarded to the province in mid-2024.

2.4 OTHER FIRST NATION CONSULTATION

In addition to K'ómoks First Nation, 13 First Nations that identify land and/or marine territory in all, or parts of Courtenay, Comox, Royston, Union Bay, and Baynes Sound (Fanny Bay, Denman Island and Hornby Island) were identified through the Consultative Area Database in 2022.

Land and marine territory including Royston, Union Bay, and Baynes Sound

- Wei Wai Kum First Nation
- We Wai Kai Nation (Cape Mudge Band)
- Homalco First Nation
- Tla’amin Nation
- Qualicum First Nation
- Stz’uminus First Nation

Marine territory including Baynes Sound

- Ts’uubaa-asatx Nation (formerly Lake Cowichan First Nation)
- Penelakut Tribe
- Lyackson First Nation
- Cowichan Tribes

- Halalt First Nation
- Snaw'naw'as First Nation
- Snuneymuxw First Nation

The CVRD identified a consultation timeline for the Sewer Extension South Project from summer 2022 to winter 2023 to meet with interested Nations (either with staff or Chief and Council as advised) and to engage with the community if requested.

The project timeline below shows completed and next steps for consultation. Additional information can be found in the **First Nations Engagement Consultation Framework** attached as Appendix G.

2.4.1 PROJECT TIMELINE

Sewer Extension South Project Initiation (Summer 2022)
Initiate LWMP Addendum Process with the Province. Initiate First Nations consultation. Recruit for Public and Technical Advisory Committee. Conduct Community Outreach (Royston and Union Bay residents).
Develop Draft Addendum and Share Stage 1 and 2 LWMP (Fall 2022 – Winter 2023)
Continue First Nations consultation. Hold Public and Technical Advisory Committee meetings. Identify preferred option (system components, technology, design, and phasing). Hold community open houses. Develop draft Sewer Extension South Project Addendum. Share Comox Valley Sewerage Service Stage 1&2 draft LWMP.
Finalize Draft Addendum (Spring 2024)
Submit draft Addendum to the province. Share summary of draft Addendum with First Nations in parallel with provincial review. Continue to work with Nations to address any feedback or concerns through the remainder of 2024.
Submit Draft Stage 3 LWMP (Late 2024/Early 2025)
Share summary of draft Stage 3 plan with First Nations and the community. Submit draft Stage 3 plan and final First Nations Consultation Report to province for approval.
Provincial Approval of Stage 3 LWMP (late 2025/ early 2026)
Sewer Extension South Project System Construction (2026/2027)
Sewer Extension South Project System Completion (2028)

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

3.1 SERVICE AREA

The service area of the Sewer Extension South Project, shown in **Figure 4**, is located south of the City of Courtenay and includes the following areas:

- Royston
- Gartley Point
- Kilmarnock
- Union Bay
- New development areas (Union Bay Estates and K'ómoks)

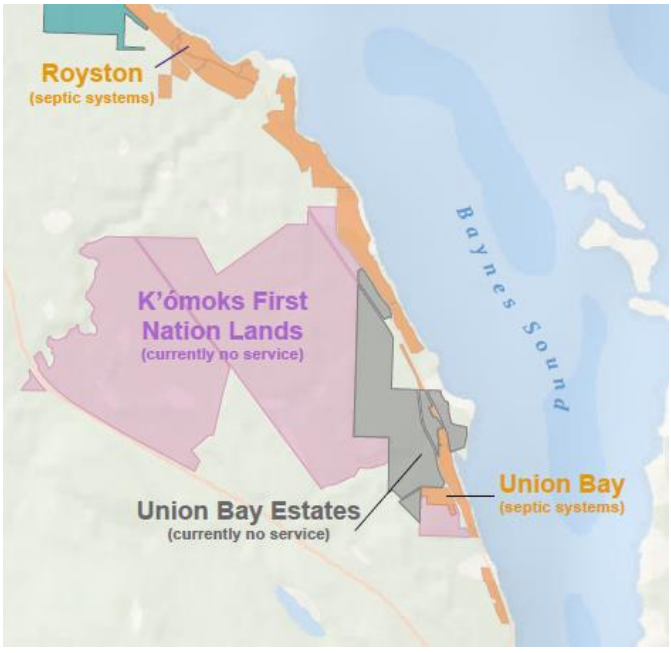

Figure 4: Service Area

3.2 DEVELOPMENT AND OFFICIAL COMMUNITY PLANS

As outlined in Section 3.2 of the Comox Valley Sewer Service Stage 1 and 2 LWMP report, it is necessary to project future land use and populations within the Plan area to properly plan for wastewater facilities.

The CVRD established the Comox Valley Regional Growth Strategy Bylaw No. 120 in 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 Official Community Plans (OCPs) to align with the Regional Growth Strategy and its supporting policies, and to ensure that related policies are incorporated. In order to plan for future growth, the Regional Growth Strategy identified the following three land use designations in the south region area that target varying housing, amenity, and development densities and intensities:

- Settlement Nodes – These are areas, not contiguous with Municipal Areas, where there is planned growth through a balance of new development, and intensification of existing development, supported by the provision of appropriate public infrastructure and services;
- Settlement Expansion Areas – Areas of potential future growth, contiguous with Municipal Areas, that will occur in a phased and orderly manner, subject to a public planning process to determine the appropriate scale and form of development. Existing development scale and form is to remain in place until such time as the area is incorporated into a municipality through a boundary extension; and
- Rural Settlement Areas – Land within the electoral areas outside of Core Settlement Areas that are not otherwise designated as Agricultural Areas, Resource Areas, or Provincial Parks. New development must maintain the rural character of its surroundings and support the function of a working rural landscape.

Figure 5 illustrates land use designations for the Sewer Extension South Project area. The Royston area is designated as a settlement expansion area and is therefore identified as an area for future phased growth in accordance with applicable Regional Growth Strategy policies. The Gartley Point and Kilmarnock areas are rural settlement areas where new development must maintain the rural character. Union Bay is a settlement node which has been identified for densification and intensification of existing and newly developed areas.

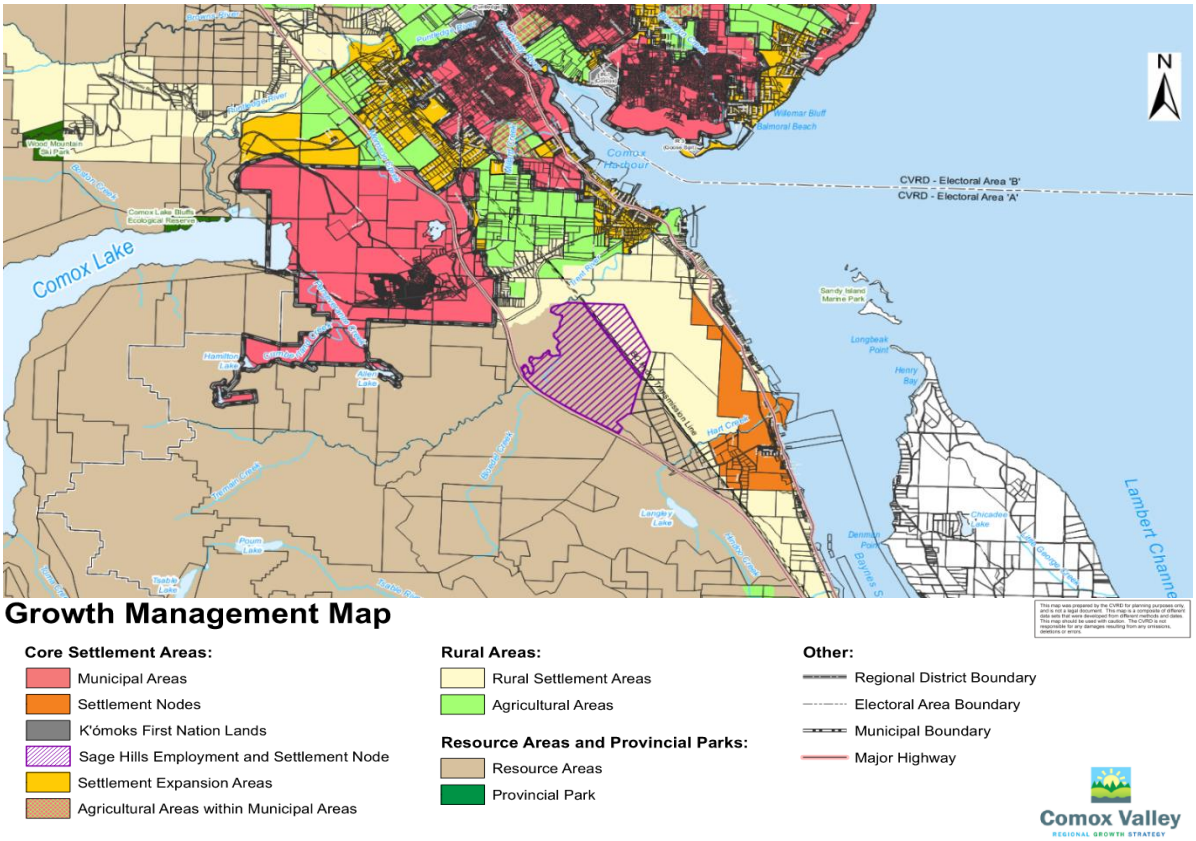

Figure 5: Growth Management Map Illustrating Growth and Land Use Designations in the CVSS Service Areas (CVRD RGS, 2010)

3.3 SEWER EXTENSION SOUTH POPULATION PROJECTIONS

Per the provincial LWMP guidelines, a LWMP process is an effective tool in areas where there is considerable growth and development, or where there are known problems with existing liquid waste infrastructure. As a forward-looking planning document, an LWMP is intended to anticipate a community's future liquid waste management needs. As a key input into this work, it is necessary to consider potential future growth and development within the community and translate this into population projections.

3.3.1 SEWER EXTENSION SOUTH POPULATION

The population growth projections of existing and future development were completed for the area contemplated to be serviced by the Sewer Extension South Project. Development projections in the area are varied and changing, with multiple residential development projects proposed, which creates uncertainty for future build-out populations. According to the information supplied by the CVRD, the proposed developments are either in the planning and/or design/construction phase. The comprehensive development area of Union Bay Estates will be developed in phases

with civil works construction underway in the anticipated first phase area. Development of K'ómoks lands had not commenced at the time of writing this report. Plan area population projections are summarised in **Table 1** below.

Table 1: Population Projections

YEAR	ROYSTON	GARTLEY	KILMARNOCK	UNION BAY	NEW DEVELOPMENT AREAS	TOTAL
2020	986	372	593	819	0	**2,770**
2025	1,011	381	608	839	258	**3,098**
2030	1,037	391	623	861	1,548	**4,460**
2035	1,063	401	639	882	2,488	**5,473**
2040	1,090	411	655	905	3,428	**6,489**
2045	1,117	421	672	928	6,258	**9,396**
2050	1,146	432	689	951	9,088	**12,305**
2055	1,175	443	706	975	9,488	**12,787**
2060	1,204	454	724	1,000	9,888	**13,270**
2065	1,235	465	742	1,025	10,288	**13,755**
2070	1,266	477	761	1,051	10,688	**14,243**

Notes:

- The number of dwellings in the existing developed areas was obtained from the 2017 CVRD South Regional Sewer Service Map.
- The residential density of 2.1 persons/property from the 2021 Census for the CVRD for Electoral Area A was used for determining the population in 2017.
- The growth rate for the existing developed areas was 0.91 per cent for the years 2017-2019 from the 2016 Census for the CVRD for Electoral Area A. From 2020 onwards, a medium growth scenario was assumed with a growth rate of 0.5 per cent.
- Union Bay Estates (UBE) assumes a growth rate consistent with McElhanney's Kensington Union Bay Estates Sanitary Master Plan (2019).
- The K'ómoks development is assumed to begin in 2025 with 80 persons. A medium growth scenario was used, this corresponded to a population growth rate of 80 persons per year with a residential density of 2.1 persons per unit.

3.3.2 CVSS LWMP PROVISIONS

During the development of the Stage 1 and 2 LWMP for the Comox Valley Sewer Service, population and sewage flow estimates were developed for the south region based on 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 development, as well as planned development in existing developed areas of the south region were included in the evaluation.

The existing developed areas under consideration for servicing include Royston, Union Bay, and the neighbourhoods between. It was assumed that development in existing south region neighbourhoods would be limited given existing lot densities. 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 Electoral Area A. As of 2019, the estimated population of the south region was estimated at 2,756 people.

A medium growth scenario was used in the Stage 1 and 2 LWMP, resulting in a service population for the south region of approximately 9,100 people by the year 2060.

Table 2 below provides the population provisions that were made for in the Comox Valley Sewer Service LWMP.

Table 2: Projected South region population

YEAR	EXISTING	NEW DEVELOPMENT AREAS	TOTAL
2019	2,756	0	2,756
Projected			
2020	2,770	67	2,837
2030	2,912	1,217	4,129
2040	3,061	2,737	5,798
2050	3,217	4,207	7,424
2060	3,382	5,677	**9,059**
2070	**3,555**	**7,147**	**10,702**

At the time of the development of the Stage 1 and 2 LWMP, limited information was available on the expected population growth and development in the south region. With the assistance of the CVRD the estimated population and development projections have been updated with regards to the populations and flows, as shown in **Table 1** above. As information, such as master planning documentation, Census and development plans are updated, these assumptions can be refined, and the future projections will have a higher degree of accuracy.

The differences between the Comox Valley Sewer Service LWMP population projections (**Table 2**) and the more recent Sewer Extension South population projections (Table 1) are shown in **Table 3** below.

Table 3: Population differences

YEAR	CVSS LWMP	UPDATED PROJECTION	DIFFERENCE
2020	2,837	2,770	-67
2030	4,129	4,460	331
2040	5,798	6,489	691
2050	7,424	12,305	4,881
2060	9,059	13,270	4,211
2070	10,702	14,243	3,541

For the next 20 years (2040), the difference in projected populations is negligible between the two reports. The difference of 691people in 2040 is less than 11 per cent. Such a small variance will not have a large impact on the flows and loads of the entire system and is acceptable for planning purposes. On the entire system contributing to the Comox Valley Water Pollution Control Centre, the difference in population is less than 1.2 per cent. As more studies and planning are done for the south region, population figures will be updated.

4 REGULATIONS AND GUIDELINES

4.1 GUIDELINES 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. I&I is discussed in detail in Section 4.4 of the Comox Valley Sewer Service LWMP Stage 1 and 2 Report.

As outlined in the introduction, the Sewer Extension South area is currently serviced by septic systems and has no existing local sanitary sewer collection systems. The project proposes new collection systems, which will initially contribute minimal I&I to the system. I&I is a larger concern for older collection systems as sewer pipes and manholes develop defects such as cracks and leaking joints over time.

As the proposed system ages, proactive policies should be adopted to help address I&I and minimize deleterious effects, including policies addressing:

- Regularly scheduled camera inspection programs of the sanitary sewers to identify pipe defects;
- Annual rehabilitation programs targeting prioritized pipe defects identified in the system; and
- Homeowner responsibilities for regular inspections/cleaning of LPS systems on private property.

4.1.1 VOLUME REDUCTION

To reduce wastewater volumes discharged into the sanitary system, a number of measures can be incorporated into future sewer use bylaws regulating connection to the system. Water service connections for all properties in the proposed sewer servicing areas are metered and are charged a tiered rate based on metered water consumption for individual properties. This key water demand management measure also results in a reduction in wastewater volumes discharged into the sewer system.

Other measures that should be incorporated in a sewer use bylaw to limit discharges include:

- not permitting high volume discharges by property owners unless they have first obtained a permit and it complies with the code of practice for that type of waste; and
- not permitting any stormwater discharges without authorization.

An additional method to reduce wastewater volumes is to continuously educate homeowners on the impact of Inflow and Infiltration and the importance of water conservation.

4.1.2 SOURCE CONTROL

Existing land use in the proposed sewer servicing area is largely residential. As development unfolds on Union Bay Estates and K'ómoks lands, additional commercial and institutional development is anticipated. Source control measures, appropriate to anticipated future land use, should be included in future sewer use bylaws, and could include the following:

- Educating homeowners on products that aren't appropriate for putting down the drain and proper disposal alternatives for them;
- Producing "Prohibited Waste" and "Restricted Waste" lists to control the discharge of non-domestic waste from commercial and industrial units;
- Producing codes of practice for different sectors, such as food services, which outlines the requirements and conditions for preventing or limiting the discharge of prohibited or restricted wastes; and
- Requiring waste discharge permits for commercial and industrial businesses with significant non-domestic discharge.

4.2 SEPTIC SYSTEMS

Septic systems are an important wastewater treatment option where connection to a sanitary sewer collection system is unavailable. When septic systems are working properly, they provide an economical and environmentally friendly option. Failing or poorly functioning systems can cause environmental and public health hazards by polluting the ground water or surface water with pathogenic bacteria, viruses, and nitrate (Payne Engineering Geology, 2009).

Septic systems in BC are regulated through the *Sewerage System Regulation* under the *Public Health Act*. Septic system design and installation guidelines are provided in the BC Sewerage System Standard Practice Manual, and land use guidelines for land development in areas to be serviced by septic systems are provided in Island Health's Subdivision Standards.

Maintenance is critical for the function of septic systems and becomes further critical for more complex systems. Proper maintenance protects public and environmental health and can prevent costly septic system repairs or premature replacements. The *Sewerage System Regulation* outlines requirements to minimize the risk of health hazards by identifying who is authorized to design, construct, and maintain the systems as well as specifying that a registered onsite wastewater practitioner or professional must provide a letter to the Health Authority certifying the work.

The complexity of the system depends on property constraints. This includes the set back distances from wells, surface water and property lines, onsite soil conditions and lot size. Island Health recommends a minimum lot size of 1 Ha for properties with private well water or 0.2 Ha for properties connected to a community water system, assuming appropriate slope and native soil depth conditions.

According to Island Heath, the typical lifespan of a septic system is 15 to 40 years. As outlined in the BC *Sewerage System Regulation*, there are three types of septic systems:

- Type 1 – treatment by septic tank only;
- Type 2 – treatment that produces an effluent consistently containing less than 45 mg/L of total suspended solids and having a 5-day biochemical oxygen demand of less than 45 mg/L; and
- Type 3 – treatment that produces an effluent consistently containing less than 10 mg/L of total suspended solids and having:
  (i) a 5-day biochemical oxygen demand of less than 10 mg/L, and
  (ii) a median fecal coliform density of less than 400 Colony Forming Units per 100 mL.

There are long-standing concerns with failing septic systems in the Royston and Union Bay areas. A number of studies have been carried out over the past 15 years on the current septic systems in operation in the south region.

Payne Engineering Geology completed a study on the effects of the septic systems on water quality in 2009, finding an overall failure rate of 25 per cent, however it varied between neighbourhoods, with the highest failure rate of 50 per cent in Union Bay. The study found the failures were the result of a combination of the following:

- Small lots (<0.2 Ha);
- Shallow winter water tables (shallower than 45 cm in some areas);
- Inappropriate designs including drainfield trenches set deeper than the water table;
- Undersized septic systems;
- Lack of maintenance; and
- Aging systems in need of repair or upgrade (some are 50 years old).

A feasibility study on the continued use of private septic systems as a primary wastewater strategy in the south region was completed by Associated Engineering in 2015. The study included the review of previous studies, existing regulation and the costs associated with septic systems. The report concluded that due to biophysical constraints, potential health hazards, and environmental impacts of poorly functioning septic systems, continued use of septic systems was not considered a suitable long-term wastewater management option for the area.

The 2015 Associated Engineering study also included a comparison of costs to upgrade, operate and maintain septic systems with costs to construct, operate and maintain the proposed South Sewer Project. An update of this cost comparison was completed in 2023 for the Sewer Extension South Project; over a 50-year timeframe, septic costs averaged just over $3,000 per year compared to sewer costs of approximately $2,000 per year.

In 2021, a review of Island Health septic records for neighbourhoods in the Royston and Union Bay areas was completed. Out of this review, it was determined that 70-95 per cent of lots are under the recommended minimum lot size of 0.2 Ha. This indicates that replacement and repairs of existing systems will be complex and expensive. 64 per cent of all recorded systems are 20 to 40+ years old which means that they are at or near the end of their service life. 30 per cent of all recorded systems are Type 2 or 3, which requires more frequent maintenance by an Authorised Professional. This increases the costs associated with maintenance. With no sewerage maintenance bylaw in place, Type 1 systems could have a lifespan as short as 10-15 years if not properly maintained by property owners.

4.2.1 SEPTIC REGULATORY BYLAW

Some local governments have produced their own bylaws to support the implementation of the *Sewerage System Regulation*. The Capital Regional District implemented Bylaw 3479 in 2008, requiring system maintenance and record keeping according to a specific schedule and providing enforcement powers to bylaw officers.

There is currently no formalized CVRD mandatory septic maintenance bylaw for on-site septic systems. The CVRD commits to exploring the development of a bylaw for septic system maintenance within the Sewer Extension South area, to be put in place in future phase neighbourhoods and in Phase 1A/1B neighbourhoods if sewer servicing does not proceed as planned. The CVRD also intends to explore implementation of the septic maintenance bylaw in other electoral area neighbourhoods outside the LWMP Addendum plan area.

5 PROJECT DESIGN

The proposed design involves the collection of sewage from neighbourhoods in the Royston and Union Bay area through new sewer collection systems to eight pump stations: seven neighbourhood pump stations and one regional pump station. It will then be pumped to the existing Courtenay River Siphon and conveyed to Comox Valley Sewer Service treatment works. The servicing of these areas is proposed to be completed in phases; this section outlines the short term (Phase 1A/B) design of the Sewer Extension South Project, including the pumps stations, forcemains and collection systems. The conveyance works for Phase 1A/B include the preliminary design of three pump stations: Royston Pump Station (also referred to as PS#1), Kilmarnock Pump Station (also referred to as PS#3) and Union Bay Pump Station (also referred to as PS#6). The forcemains included in this design are the forcemain connecting these pump stations to the Courtenay River Siphon. Three local collection systems, located in Royston, Kilmarnock, and Union Bay, are also included in the design. The Future phase and Ultimate Build Out phase will vary according to the master planning and the availability of funding for future phasing.

5.1 FLOWS, ORGANIC LOADS AND PROJECTIONS

The catchment areas, comprised of existing and future new development areas, for each of the seven pump stations are shown in **Figure 6**. **Table 4** summarizes the total area in hectares, for each of the seven collection system pump station catchment areas.

Table 4: Pump Station Contributing Areas

	AREA (HA)
Pump Station No. 1 (PS#1)	133
Pump Station No. 2 (PS#2)	81
Pump Station No. 3 (PS#3)	145
Pump Station No. 4 (PS#4)	169
Pump Station No. 5 (PS#5)	206
Pump Station No. 6 (PS#6)	163
Pump Station No. 7 (PS#7)	15
Total	**912**

Notes:

- The areas are the assumed contributing areas for 2070 flow.
- The contributing areas have been allocated to the pump stations due to proximity to the pump station and phasing as well as elevation and geography.

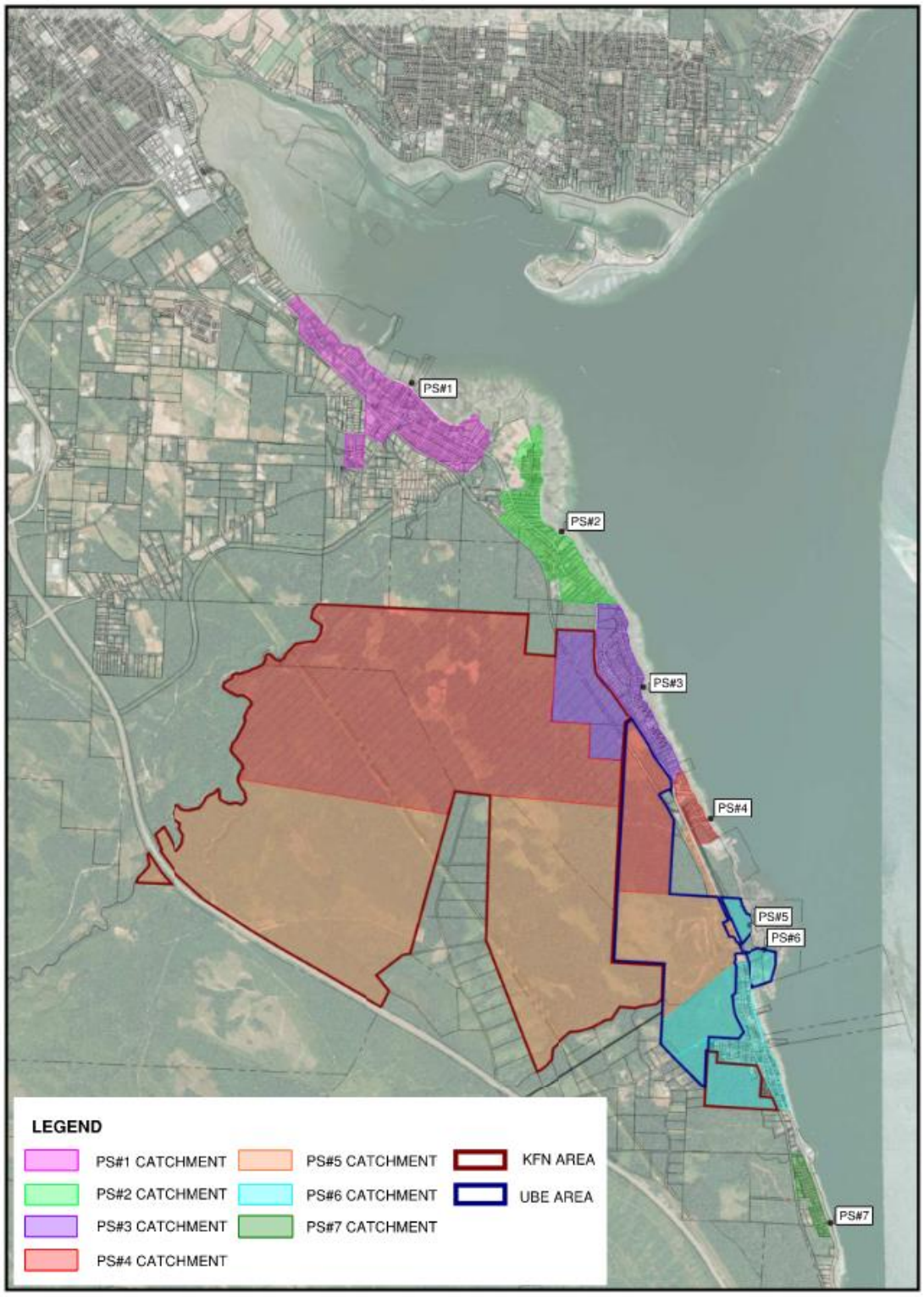

Figure 6: Pump Station Catchment Areas

5.1.1 FLOWS

Table 5 summarises the contributing Average Dry Weather Flow (ADWF), Peak Dry Weather Flow (PDWF) and Peak Wet Weather Flow (PWWF) for the projected populations in 2025 and 2070 for each pump station catchment. The ADWF represents the average daily sewage flow entering a sewage system with minimal infiltration. The PDWF is defined as the most likely peak sanitary flow during a typical dry weather day. The PWWF is obtained by adding inflow and infiltration to the peak dry weather flow.

Table 5: Pump Station Catchment Population, Area, and Flow

		PS#1 Catchment	PS#2 Catchment	PS#3 Catchment	PS#4 Catchment	PS#5 Catchment	PS#6 Catchment	PS#7 Catchment
2025	**Population**	1011	381	547	155	120	776	108
	Area (ha)	133	81	72	115	151	128	15
	Peaking Factor	3.2	3.2	-	-	-	-	3.2
	ADWF (L/s)	2.8	1.1	3.5	0.4	0.3	2.2	0.3
	PDWF (L/s)	9.0	3.4	11.2	1.4	1.1	6.9	1.0
	I&I (L/s)	8.0	4.9	4.3	6.9	9.1	7.7	0.9
	PWWF (L/s)	17.0	8.2	15.5	8.3	10.1	14.6	1.8
2070	**Population**	1266	477	2943	3111	4085	3615	135
	Area (ha)	133	81	145	169	206	163	15
	Peaking Factor	3.2	3.2	-	-	-	-	3.2
	ADWF (L/s)	3.5	1.3	20.9	8.6	11.3	11.8	0.4
	PDWF (L/s)	11.3	4.2	62.7	25.6	33.3	36.6	1.2
	I&I (L/s)	8.0	4.9	8.7	10.2	12.3	9.8	0.9
	PWWF (L/s)	19.2	9.1	71.4	35.8	45.6	46.4	2.1

Notes:

- 240 L/cap/day was used as specified in the 2022 MMCD Design Guidelines for ADWF.
- The peaking factor was calculated using the formula from the 2014 MMCD Design Guidelines of PF = 3.2/P0.105, where P is the population in thousands rounded to the nearest thousand.
- The ADWF rate includes commercial and industrial flows calculated based on the contributory area and the equivalent population/hectare flow, specified in the 2014 MMCD Design Guidelines.
- The inflow and infiltration (I&I) rate for all existing and proposed developments is 0.06 L/s/ha as specified in the 2014 MMCD Design Guidelines.
- The PWWF was calculated using the formula for design flow from the 2022 MMCD Design Guidelines, where the design flow, Q = population x per capita flow x peaking factor + I&I contribution

5.1.2 ORGANIC LOADS

The historical (2013 to 2019) Comox Valley Water Pollution Control Centre inflow data were used to determine the organic contribution of the South Region. The $cBOD_5$ and TSS data were taken from weekly composite samples. **Table 6** shows the historical per capita loads.

Table 6: 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. Assumed this data includes all return streams from the plant.

2 Population was obtained from BC Stats.

3 Refer to table 5-4: of the CVWPCC Stage 1-2 historical Loading, 2013 to 2019

4 Historical (2013 to 2019) CVWPCC influent 5-day Biochemical Oxygen Demand (BOD_5) and Total Suspended Solids (TSS) loadings were used to develop average per capita unit loading rates.

5 The $cBOD_5$ and TSS data were taken from weekly composite samples.

6 The TKN loading determined in ISL (2016) was based on 13 g/c/d typical for domestic sewage.

7 ISL (2016) also determined a peaking factor of 1.1 between average and max month loading.

The table below shows the projected organic loads contributed by the south region. These values are conservative as it is calculated by the combined organic load and no distinction has been made between industry and commercial effluent and domestic sewage. This indicates that the Influent Unit loading is based on a combination of industry and commercial effluent and domestic sewage, thus provision has been made for possible industry and commercial effluent from the south region.

Table 7: South Region Load Projections, 2020-2060 to the CVWPCC

	2020	**2030**	**2040**	**2050**	**2060**
Population Projections	2770	4460	6489	12305	13270
Average BOD_5 (kg/d)	219	352	513	972	1048
Max month BOD_5 (kg/d)	352	567	825	1565	1688
Average TSS (kg/d)	260	419	610	1157	1247
Max month TSS (kg/d)	393	633	921	1747	1884
Average TKN (kg/d)	36	58	84	160	173
Max month TKN (kg/d)	40	64	93	176	190

5.2 DESIGN CONSTRAINTS

WSP developed concepts for an overall system configuration that could accommodate the wide range of flows anticipated between the system initiation and the ultimate build-out projections. The design considerations and engineering principles accounted for during the development of the system configuration include:

- Minimum flushing velocity - Flow should achieve 0.75 m/s (MMCD, 2022) to ensure flushing velocities. If this velocity is not achieved, solids can accumulate along the bottom of the pipe and eventually reduce the pipe's capacity. Limited flow in the pipe could also create anaerobic conditions due to raw sewage stagnation, causing odour and buildup of H_2S gasses in the pipe and pump stations. Both accumulation of solids and H_2S gas can lead to operational issues including equipment corrosion, odour nuisance, and increased operations and maintenance costs.
- Wet well sizing – To mitigate low flows and velocities in pipes sized for future build-out conditions, incoming flows could be contained in the pump station wet well until sufficient volume has accumulated to facilitate pumping at the required higher flow rate required to meet flushing velocity criteria.
- System refinement, optimization, and phasing – The preferred approach to mitigating low flows is to refine the system configuration and forcemain sizing through development of an overall phased implementation strategy that considers the level of development at the initial stage as well as the ultimate build out scenario.
- Pump capability - Wastewater pumps need to be of a centrifugal type that can handle solids and abrasive grit in the wastewater.
- Transient pressures - Transient pressure is the changes in the flow in the forcemains, caused by valve closure and opening or pump speed changes, resulting in pressure surges which propagate along the pipe from the source. Higher operating pressures are attributed to the long forcemain lengths, velocity, and flow variance over the long planning horizon between 2025 and 2070, increasing transient pressure risk. The management of transient pressure will be implemented at the detailed design stage.

5.3 PHASING

The Process Flow Diagrams (PFD) shown in Figures 7 through 10 are used as an illustration to show the relationship between the major components of the south region conveyance system.

1. Phase 1A – PS#1 & PS#6 catchments (Short term)
2. Phase 1B – PS#3 catchment (Medium term)
3. Future phase – Regional Pump Station (Long term)
4. Ultimate build out phase – PS#2, 4, 5 & 7 catchments

This addendum focuses primarily on the proposed Phase 1A and 1B. The Future phase and Ultimate Build Out phase will vary according to the master planning and the availability of funding. The level of uncertainty at this stage of the project creates challenges in determining the flows and the sequencing of future phasing and is therefore subject to change. The proposed project phasing is further detailed in TACPAC Meeting #2 Discussion Paper #1 in Appendix B, including the design considerations and engineering principles accounted for during the development of the system phasing and PFDs. The phases are summarized in following subsections.

5.3.1 PHASE 1A

The proposed PFD for Phase 1A is shown in **Figure 7** below. Phase 1A includes two pump stations, PS#1 and PS#6 and two forcemains. The contributing sub catchments for PS#1 and PS#6 include:

- PS#1: Royston existing developed area, historic core sub-catchment
- PS#6: Union Bay central existing developed area, and future new development areas

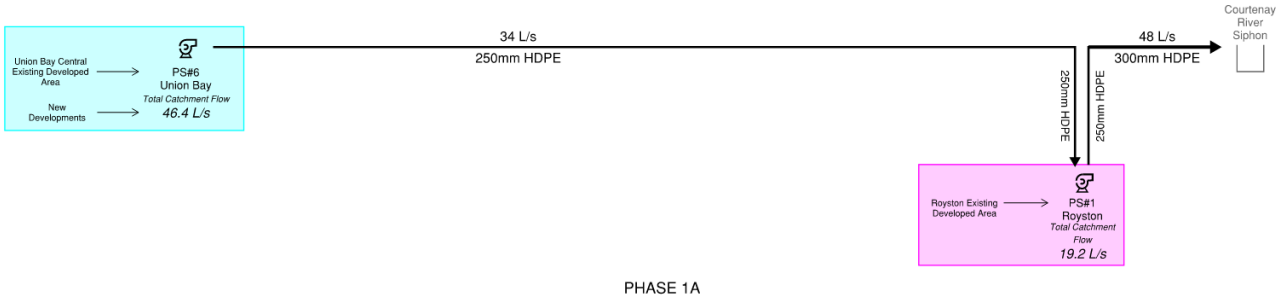

Figure 7: PFD – Phase 1A

5.3.2 PHASE 1B

The proposed PFD for Phase 1B is shown in **Figure 8** below. This phase includes the addition of PS#3 located between PS#6 and PS#1. The contributing sub catchments for PS#3 include the Kilmarnock North existing developed area and future new developments, thus accommodating flows from new developments that will be constructed within PS#3's catchment area.

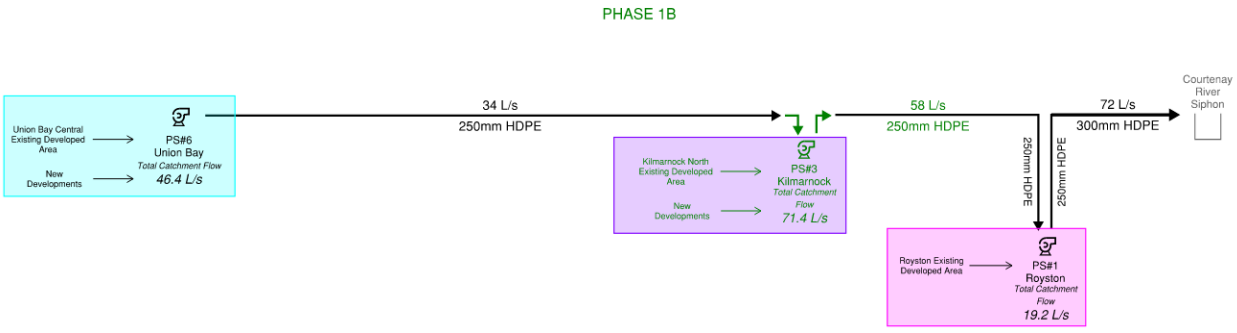

Figure 8: PFD - Phase 1B

5.3.3 FUTURE PHASE

The PFD for the Future Phase is shown in **Figure 9** below. The phase includes the addition of the future Regional Pump Station in Royston between PS#3 and Courtenay River Siphon. PS#3 will feed directly to the future Regional Pump Station, and the existing 250 mm HDPE forcemain from PS#1 to Highway 19A will instead connect to the future Regional Pump Station.

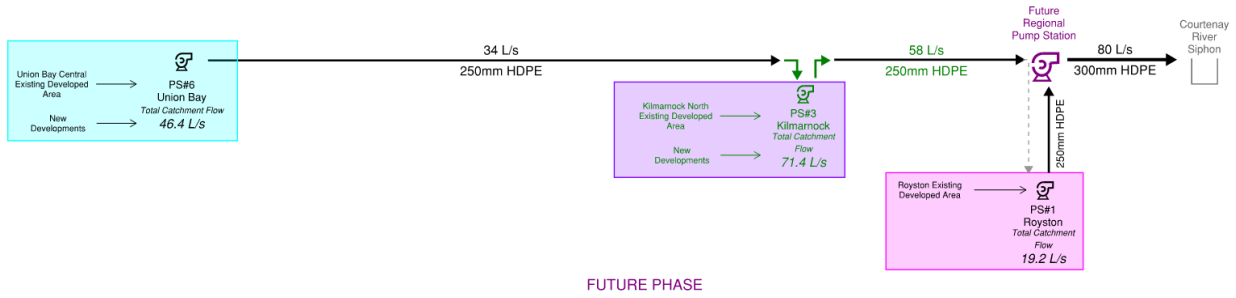

Figure 9: PFD - Future Phase

5.3.4 ULTIMATE BUILD OUT

The PFD for the Ultimate Build Out is shown in **Figure 10** below. In the Ultimate Build Out, all eight pump stations are in operation. This will connect PS#2, PS#4, PS#5, and PS#7 catchments to the system.

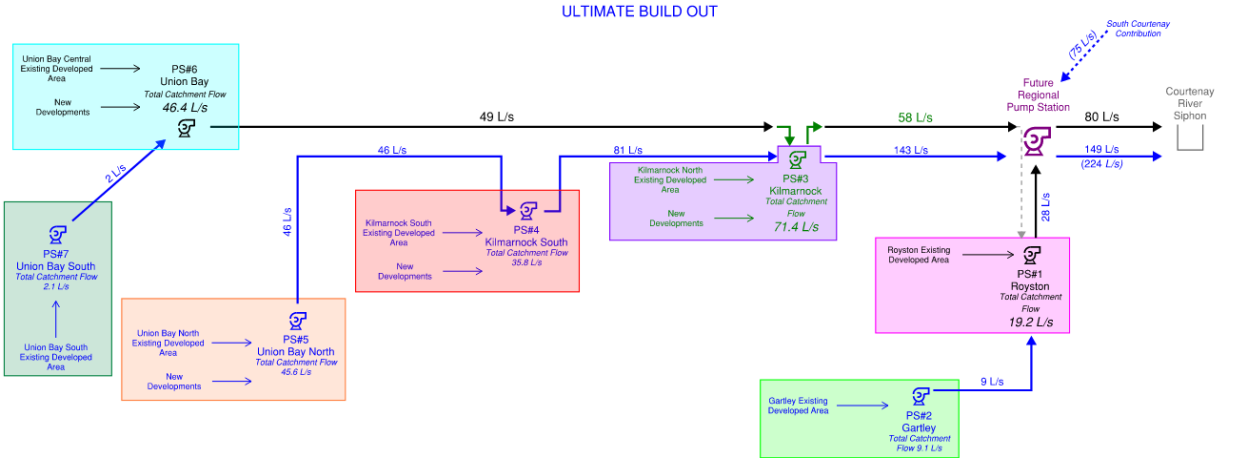

Figure 10: PFD – Ultimate Build Out

5.3.5 PHASING CONSIDERATIONS

These phases were selected based on technical, environmental, and financial considerations. The technical considerations have been summarized in Section 5.2 design constraints. These constraints determined the overall system configuration including pump station sizing, location and forcemain sizing. Environmental considerations included future flood risk along the shore due to predicted changes in climate. The phasing was updated to add a Regional Pump Station out of the flood risk area to mitigate this risk of flooding. Additional considerations for phasing were provided by the CVRD, taking in to account existing land use patterns and analysis of septic system records provided by Island Health. Phase 1A areas were identified as they have the highest dwelling density with a significant proportion of properties with septic system that are several decades old.

5.3.6 CATCHMENT SELECTION

As discussed in Section 5.3.1, Phase 1A of the project involves the construction of Royston Pump Station (PS#1) and Union Bay Pump Station (PS#6). Royston Pump Station will service the existing area of Royston. The catchment area for Union Bay Pump Station includes the existing development of Union Bay central and future developments of K'ómoks and Union Bay Estates.

The catchment for Royston Pump Station is shown in **Figure 11** below. The catchment area was selected based on proximity to the proposed pump station and discussions with the CVRD.

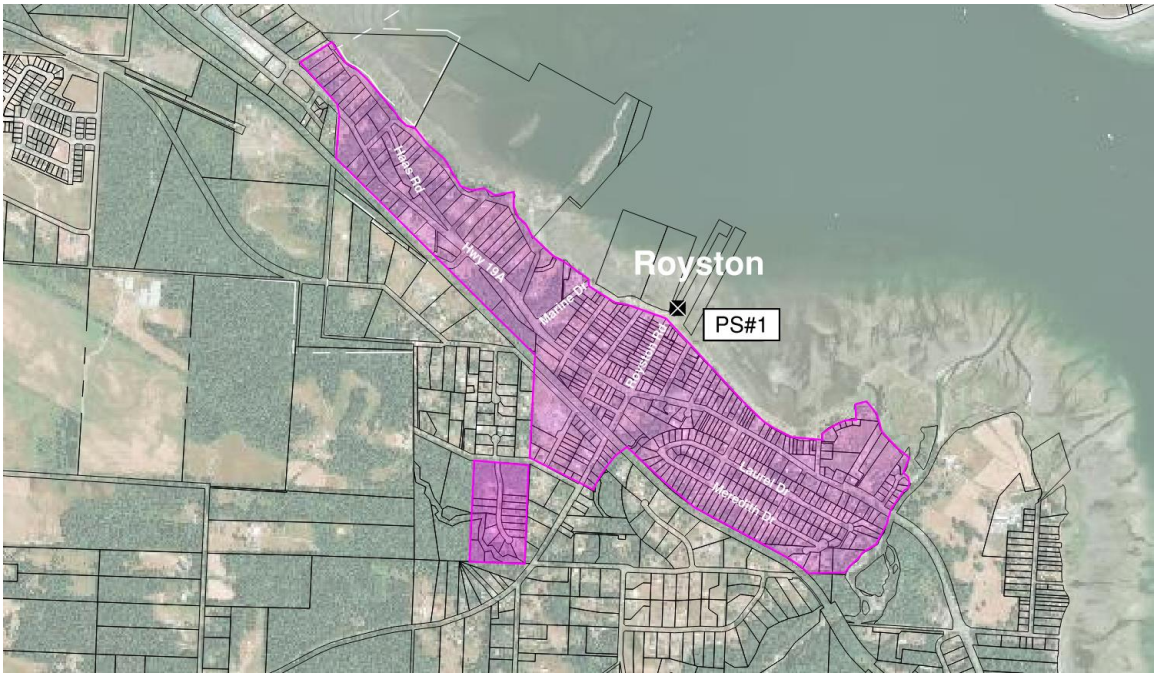

Figure 11: Royston Pump Station Catchment

The feasibility of implementing the collection system for the Royston Pump Station catchment area in phases rather than a full buildout at system onset was explored to provide flexibility to ensure per property costs remain reasonable. Sub-catchment areas were divided based upon areas with similar density composition, locations, and crossings required to carry out the servicing of each area, as shown in Figure 12.

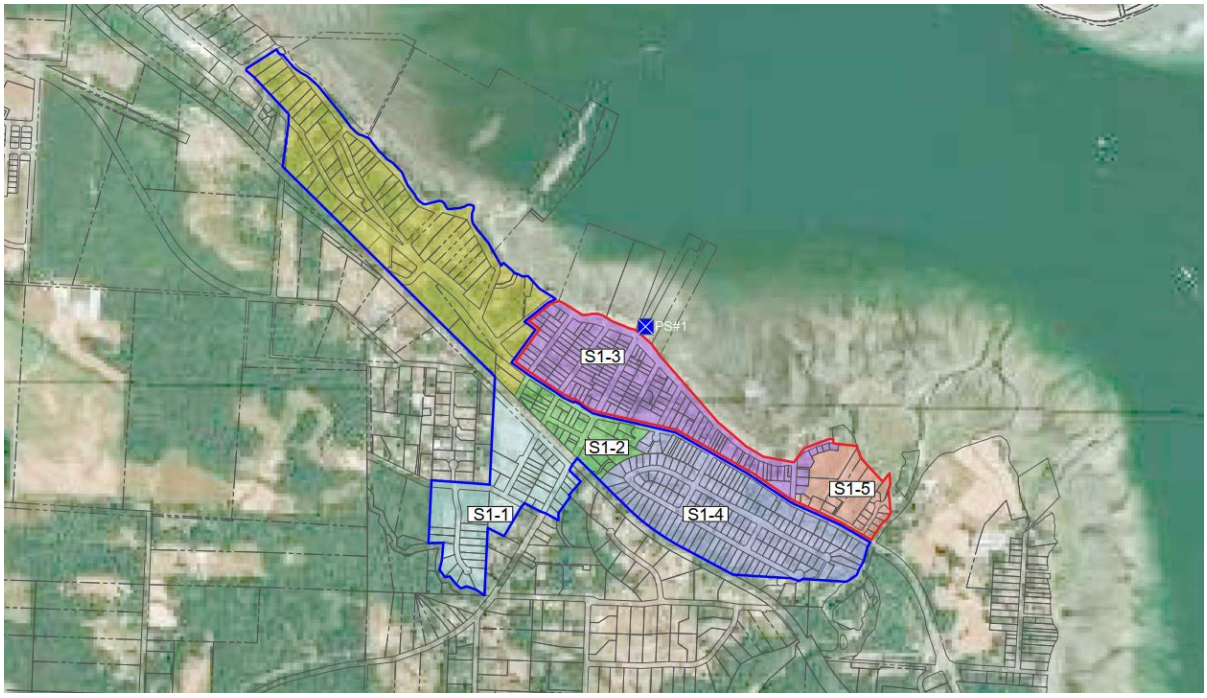

Figure 12: Royston Pump Station Sub-catchments

For the purpose of the collection system, all Royston Pump Station sub-areas require sub-area S1-3 to be completed before servicing can occur as this sub-area will include the installation of a 375 mm collection main conveying the sewage to the pump station. As such, S1-3 was identified as the first sub-area to be serviced if funding limitations preclude buildout of the entire Royston Pump Station catchment area at system onset. However, the entire Royston Pump Station catchment has been considered in the capacity of the Phase 1A pump station design, even if the sub-area collection systems are not all built as part of the first phase of construction.

The catchment for Union Bay Pump Station is shown in **Figure 13** below. The catchment area was selected based on proximity to Union Bay Pump Station and discussions with the CVRD. The selection of the contributing area for the Union Bay Estates future development was based on the phasing provided in the Kensington Union Bay Estates Sanitary Master Plan (2019). The areas located in close proximity to PS#5 and Union Bay Pump Station are part of Union Bay Estates proposed Phase 1 and as such are expected to be developed within the next 10 years. The remaining Union Bay Estates area included in the catchment is in the Master Plan Phase 2 and as such are expected to be developed in the next 20 years. K'ómoks lands south of McLeod Road are also included in the catchment due to proximity to the proposed Union Bay Pump Station.

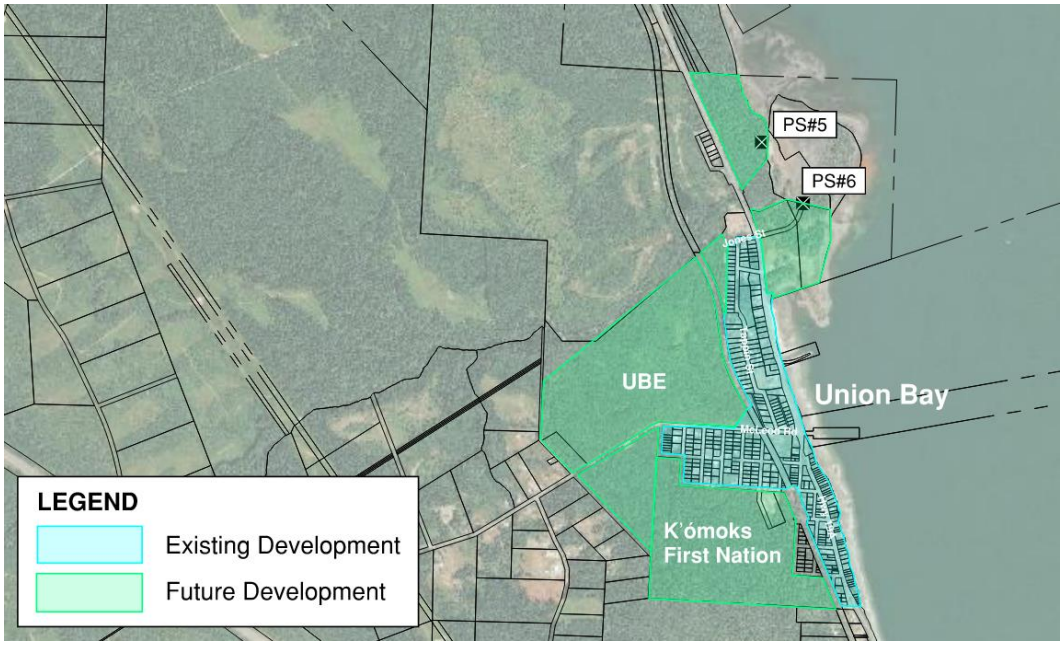

Figure 13: Union Bay Pump Station Catchment

In Phase 1B of the project, Kilmarnock Pump Station will be constructed. Kilmarnock Pump Station will service the existing neighbourhood of Kilmarnock and K'ómoks future development lands. The catchment area of Kilmarnock Pump Station, shown in **Figure 14**, was selected based on proximity to the proposed pump station and discussions with the CVRD. K'ómoks lands located to the west of Kilmarnock are expected to be developed in the medium term and therefore are included in this catchment area.

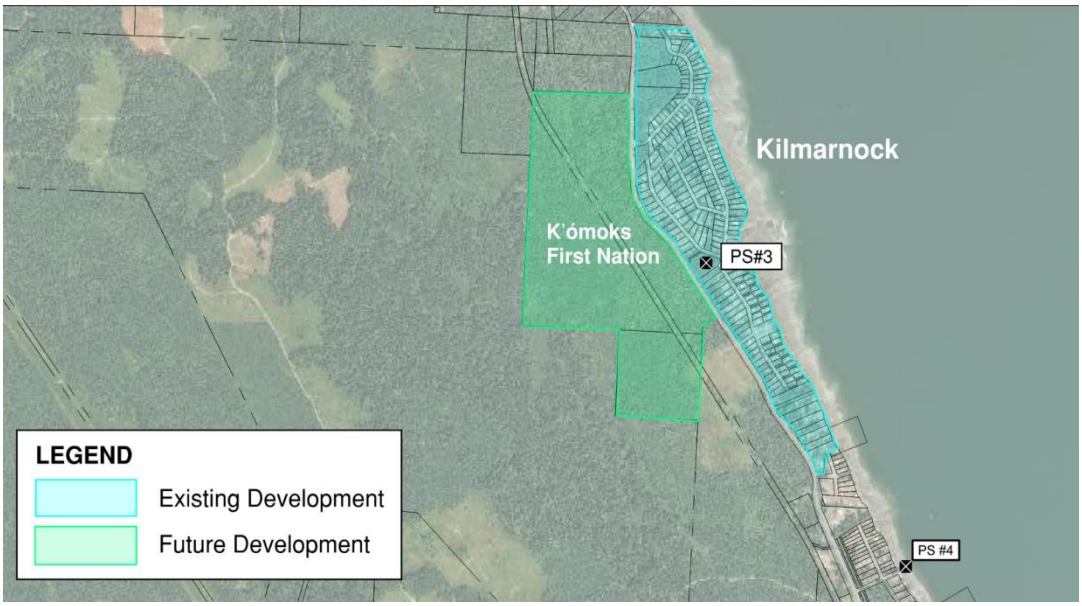

Figure 14: Kilmarnock Pump Station Catchment

5.4 LOCAL COLLECTION SYSTEMS

5.4.1 WASTEWATER COLLECTION OPTIONS

Sewer collection system options and alternatives were previously identified and evaluated in TACPAC Meeting #2 Discussion Paper #2 (Appendix B). In total, seven (7) different collection system alternatives were evaluated for a sanitary collection system to service the CVRD south region:

1. Gravity Sewers
2. Low Pressure Sewer (LPS) System
3. Vacuum Sewer (VS) System
4. Septic Tank Effluent Gravity/Pump (STEG/STEP) Hybrid System
5. Gravity/LPS Hybrid System
6. Gravity/Vacuum Hybrid System
7. LPS/Vacuum Hybrid System

A hybrid Gravity Sewer - LPS system (with grinder pumps) was identified as the preferred approach to service the area. The majority of the service connections are expected to be gravity, however, there are some properties that will utilize grinder pumps to connect to the system. TACPAC Meeting #2 Discussion Paper #2 (Appendix B) summarizes the evaluation of options and outlines the preferred approach and conceptual design of the gravity sewer – LPS system option.

The subsections below summarize the gravity sewer and LPS options.

GRAVITY SEWER (GS)

Gravity sewer systems are most commonly used to collect and transport domestic wastewater. A well-designed system is reliable and requires a minimum level of maintenance that can handle grit and solids in sanitary sewage.

Compared to other alternatives, the gravity sewer system has a longer service life and lower operating costs. The wastewater from each source is conveyed through a building sewer to a collection main. If gravity flow is not possible throughout the system, lift stations are used. Lift stations are installed at the lowest elevations of the network to pump the sewage to convey it through the collection system and ultimately to the treatment plant.

CONSIDERATION

If deep excavation is required, the gravity system can result in a high construction cost. If the development is low-density and fewer lots are to be serviced, gravity sewer construction can be cost-prohibitive.

The site topography also plays a major role in determining the viability of gravity sewer construction. Significant elevation variations in the service area can result in a complex and high-cost gravity sewer system that may require multiple lift stations.

LOW PRESSURE SEWER SYSTEM (LPS)

In a Low Pressure Sewer (LPS) system, each connection point uses a grinder pump to transport the wastewater through the system.

The primary reason for the use of pressure sewers is economical, as the system requires a minimal depth of cover and is well suited to trenchless installation. In some areas experiencing slow growth development LPS is economically attractive to avoid the significant cost associated with lift stations and manholes. Where the groundwater level is high, the decision to choose LPS is environmentally motivated.

Pressure sewers are typically small diameter sewer pipelines following the existing ground profile. The minimum depth of burial is usually dictated by the frost penetration depth and additional depths, if required, to avoid other buried utility interference.

The concept of a grinder pump system consists of replacing the septic tank with a smaller holding tank. All solids introduced into the sewage holding tank are ground and then pumped to the low-pressure sewer system. Each time the grinder pump is activated, the contents of the holding tank will be removed. With the smaller tank capacity, grinder pumps pump fresher sewage, reducing odour problems. The grinder pump system will also reduce inflow and infiltration and, since each grinder pump station is similar, it provides a uniform approach.

LPS can also be used in conjunction with the gravity system, for instance where low-lying properties do not allow gravity flow into a gravity fronting sewer line.

CONSIDERATION

Potential power outages can affect LPS system operation, and impact and mitigation measures need to be determined on a case-by-case basis. There is limited storage capacity (up to 24 hr) in each grinder pump tank, and prolonged power outages can cause system backup for each connection.

The ownership model of the sewer infrastructure, for all the options, is defined to be divided at the property line; where the CVRD would be responsible for infrastructure within the Right of Way (ROW) up to the property line, while the individual homeowners have the responsibility for infrastructure between the house and the property line.

For the LPS option, the grinder pump is located on private property and owned by each property owner, who would be responsible for the sewer infrastructure on their private property. Homeowners also are responsible for the operation and maintenance (O&M) cost of the system on their property, e.g., pumping energy and sludge removal (if necessary). Currently, the existing property owners in the study area with private septic systems are responsible for their systems' maintenance.

5.4.2 PRELIMINARY DESIGN

The preliminary design of the collection systems for Phase 1A and 1B has been completed for the LWMP Addendum and is summarised in the following sections. Collection System Design Criteria.

The preliminary design of the collection system was completed where possible to MMCD (2022) design standards including:

- Minimum cover of 1m and maximum cover depth of 4.5 m;
- Manholes are provided at every change of pipe size, change in grade and direction with the maximum spacing of 150 m;
- Sewers to have a minimum grade of 0.6 per cent and a minimum velocity of 0.6 m/s;
- The pipes are designed to be flowing at a maximum capacity of 80 per cent; and
- Minimum pipe size of 200 mm or 150 mm for upstream sections of a residential sewer where future extension is not possible.

Where minimum velocity cannot be achieved with 150 mm diameter pipes, the use of 100m m diameter pipes for upstream sections was discussed with CVRD operations team. To reduce the depth of certain pipe sections, the minimum slope was not achieved. However, for these pipes the minimum velocity was achieved.

The preliminary design for the Phase 1A and 1B collection system is detailed in Appendix I with refinements made to decrease costs using a gravity sewer-focused system.

The collection systems may have potential impacts on existing properties in some areas. A detailed study will be required to determine the actual ROW boundaries based on considerations for construction and operations. This is assumed to be completed during the detailed design phase as part of the Stage 3 LWMP.

ROYSTON PUMP STATION COLLECTION SYSTEM (PHASE 1A & 1B)

LOCATION

The proposed catchment boundary for Royston Pump Station is show in **Figure 15**.

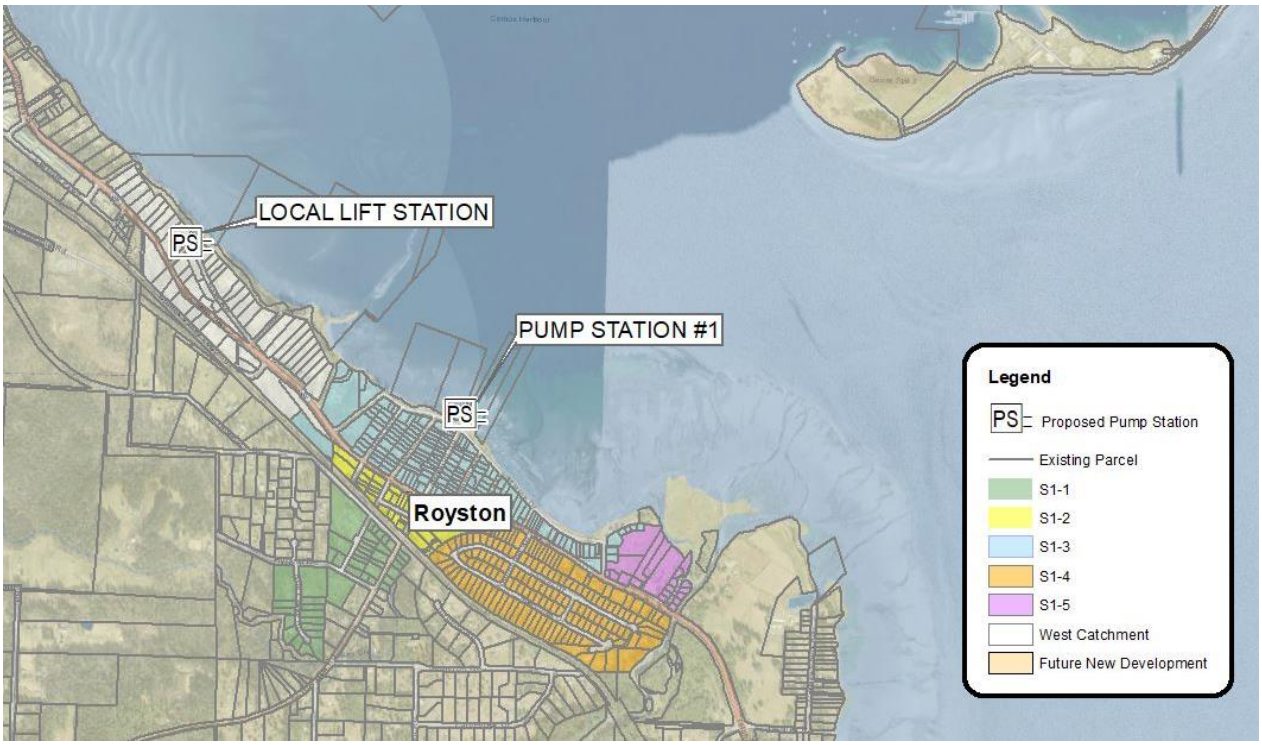

Figure 15: Royston Pump Station Catchment Area

COLLECTION SYSTEM ALIGNMENT

The proposed collection system alignment is shown in **Figure 16**. Pipe sizes for the proposed Royston conveyance system range between 100 mm at upstream locations and 250 mm at the most downstream pipe. The design would require five utility easements along the new sewer alignments and forcemain connections. Areas where these easements are expected are presented in **Figure 16**.

A low pressure sewer system will be required in areas unable to be serviced by gravity. Two low pressure forcemains are proposed in the eastern sanitary catchment along the eastern section of Marine Drive and along Carey Place and Hwy 19A. In the western catchment, two separate low pressure forcemains are proposed along Beach Terrace and another along Island Hwy S (19A) west of Thomson Road.

Parcels that are low lying resulting in a service connection that is less than 1m below grade at the property line will require a LPS connection with grinder pump.

The proposed alignment does not cross any open bodies of water. Highway crossings are required at six locations where the proposed sanitary sewers cross the Island Hwy S.

Figure 16: Proposed Royston Pump Station Collection System

UNION BAY PUMP STATION COLLECTION SYSTEM (PHASE 1A)

LOCATION

The Union Bay Pump Station catchment includes existing development in Union Bay from Jones Street to Lansdowne Street as shown in **Figure 17**. The catchment also conveys future sewage flows from the planned K'ómoks development lands located south of Nelson Street as well as a portion of future sewage flows from the comprehensive development area of Union Bay Estates.

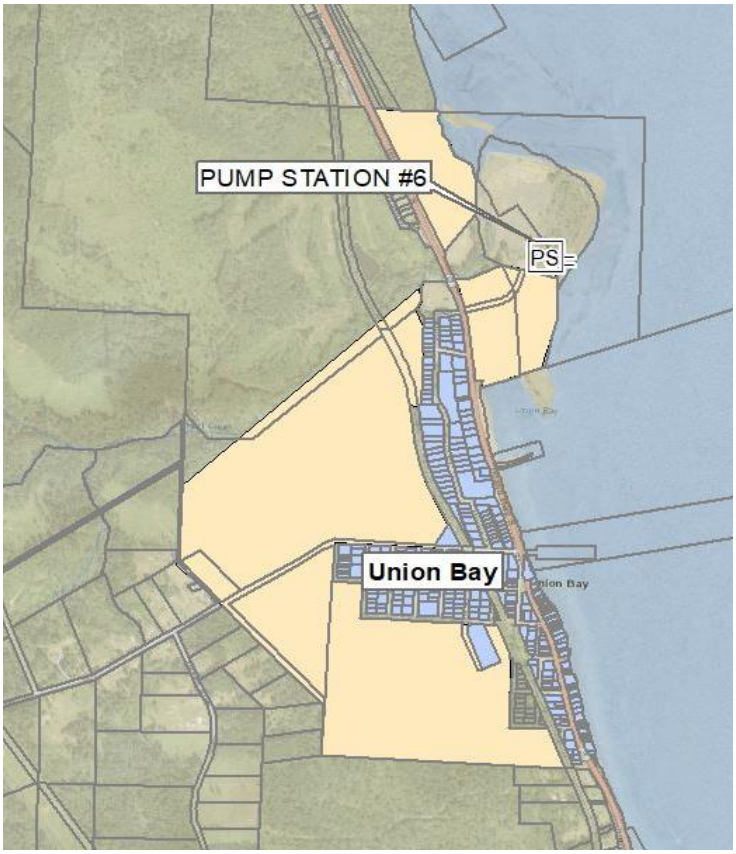

Figure 17: Union Bay Pump Station Catchment Area

COLLECTION SYSTEM ALIGNMENT

The collection system sewers range in diameter between 100 mm at the upstream sections to 375 mm at the downstream alignments close to the pump station. Utility easements are required in areas where access over private property may be needed for operations and maintenance work. The easement locations are indicated in **Figure 18** below.

The Union Bay sanitary system does not require any low pressure forcemains, however some parcels still require a LPS connection to convey the wastewater into the gravity sewers. The hybrid gravity LPS system uses individual grinder pumps that serve each home. These parcels exist in low lying areas causing the service connection to be less

than 1m below grade which can't make use of conventional gravity sewers and where connection to sewers at the rear of the property is not preferred.

The proposed Union Bay alignment does not go cross any open bodies of water or streams. However, two highway crossings are required as well as two railway crossings.

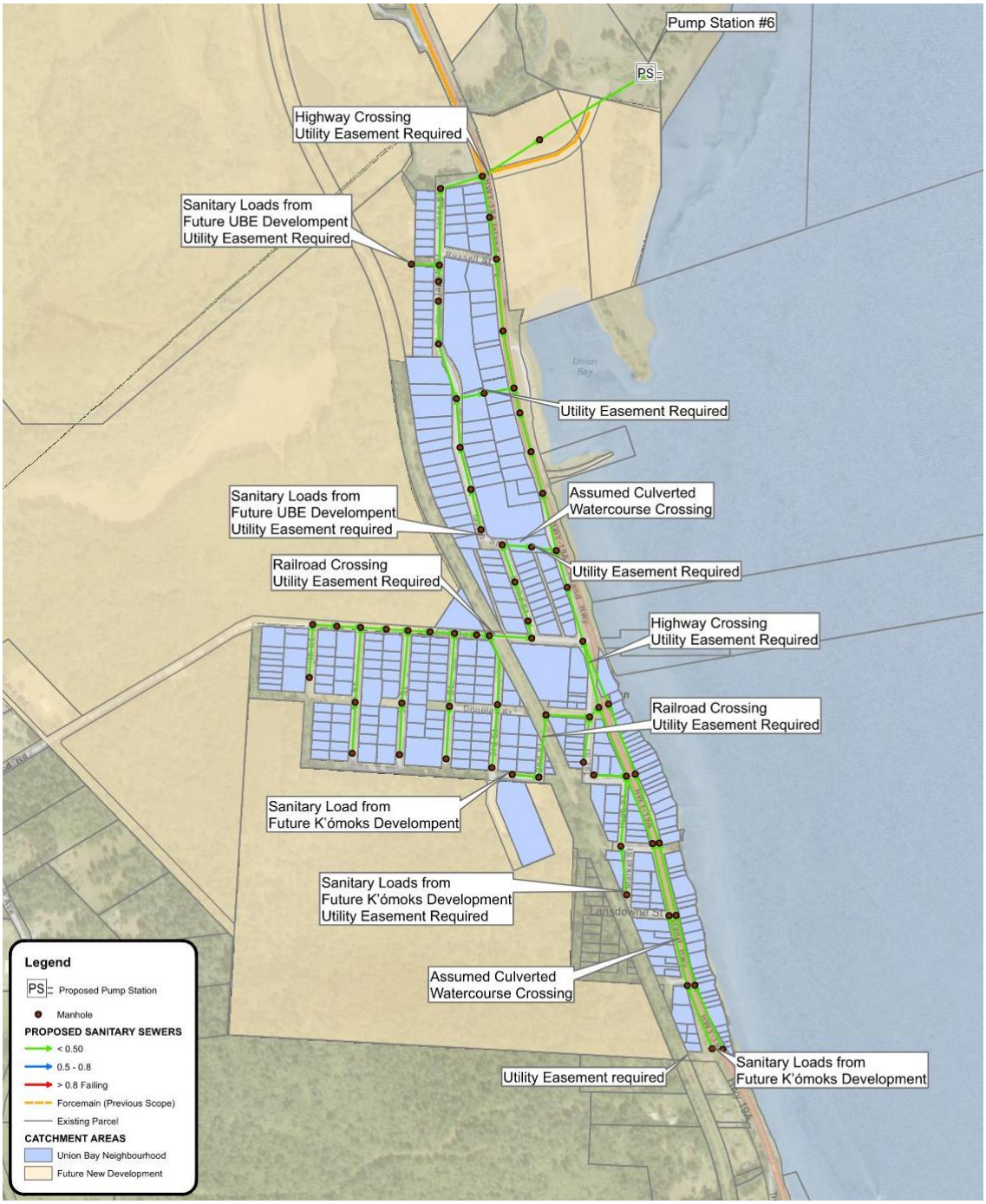

Figure 18: Proposed Union Bay Pump Station Collection System

KILMARNOCK PUMP STATION COLLECTION SYSTEM (PHASE 1B)

LOCATION

The Kilmarnock Pump Station catchment is comprised of the Kilmarnock neighbourhood and K'ómoks future development lands as shown in **Figure 19**.

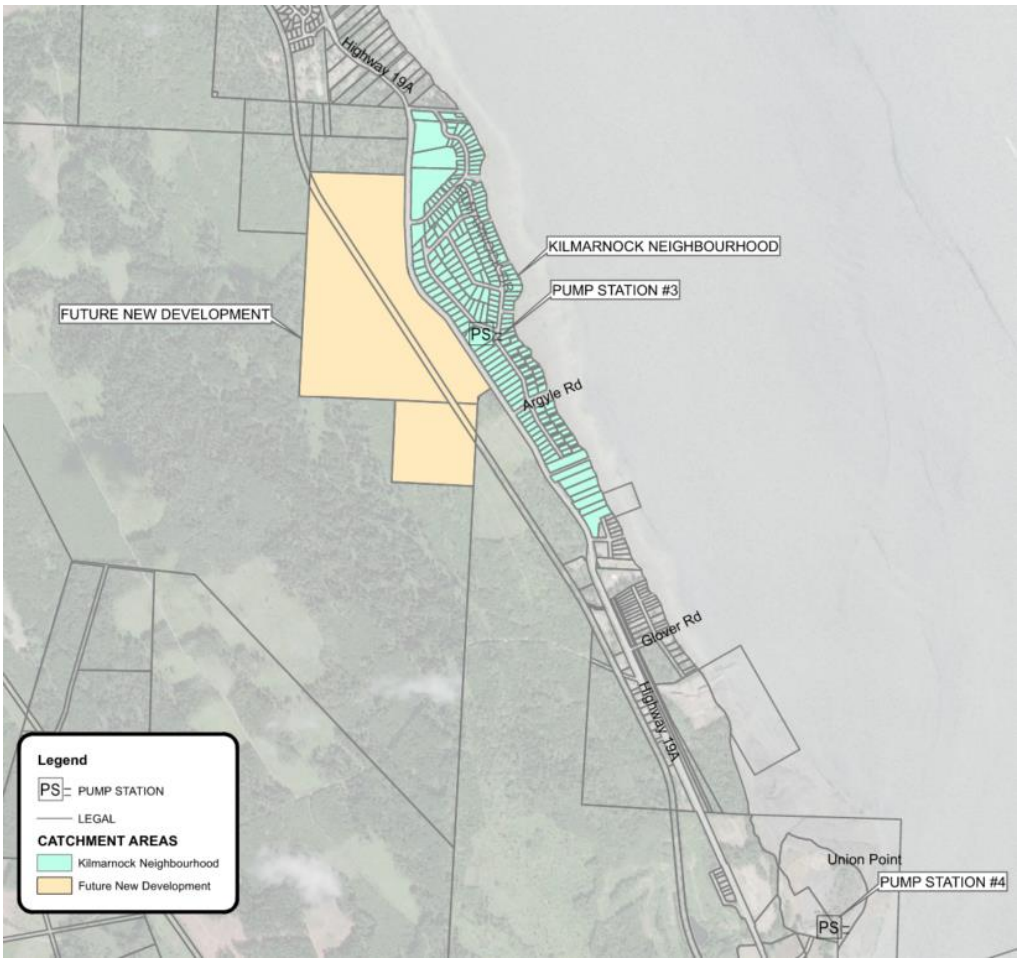

Figure 19: Kilmarnock Pump Station Catchment Area

COLLECTION SYSTEM ALIGNMENT

The alignment of the collection system is outlined in **Figure 20**. The pipe sizes range from 100 mm in the upstream sections to 375 mm close to the pump station. To achieve the minimum velocity requirement of 0.6 m/s (MMCD), three connections to the proposed 250 mm South Royston Forcemain were included. Flushing the system is required periodically to prevent the deposition or settlement of solids within the pipeline. The forcemain connection includes a 100 mm tie-in connection to the forcemain with a chamber with actuated valve and flowmeter. The additional flow from the forcemain connections is 6 L/s. In addition to the forcemain connections, the future new development sanitary loads were distributed over three upstream manholes. The location of the forcemain connections and future new development loads are shown in **Figure 20**.

Low lying parcels that cause the service connection to be less than 1m are unable to make use of a conventional gravity sewer connection and will therefore require a LPS service connection. Refer to TACPAC Meeting #3.5 Discussion Paper #1 (Appendix D) for further details.

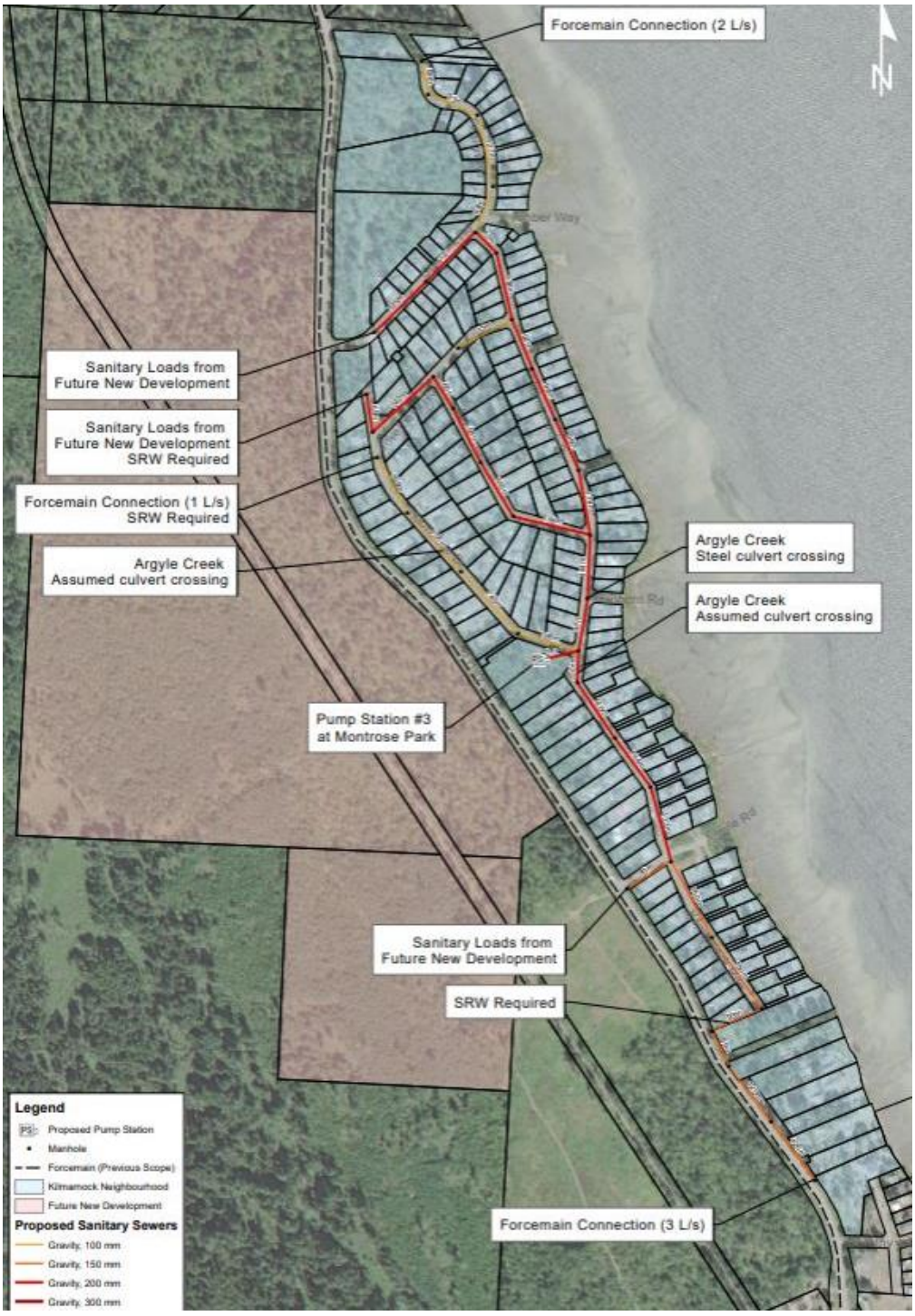

Figure 20: Proposed Kilmarnock Pump Station Collection System

5.5 PUMP STATIONS – KILMARNOCK PUMP STATION & UNION BAY PUMP STATION

5.5.1 SITING CONSIDERATIONS

UNION BAY PUMP STATION

The proposed Union Bay Pump Station (PS#6) site is located on Union Bay Estates land west of Jones Street as shown in **Figure 21**.

Figure 21: Union Bay Pump Station Site Location

KILMARNOCK PUMP STATION (PHASE 1B)

Kilmarnock Pump Station is located in Kilmarnock to collect the flow from the Kilmarnock catchment area as well as the flow from the South Royston Forcemain as shown in **Figure 22**. A previous study by Koers & Associates Engineering in 2016 reviewed locations for a pump station in the Kilmarnock neighbourhood. Three site options where considered, one site at Sanborn Road and two at Montrose Park.

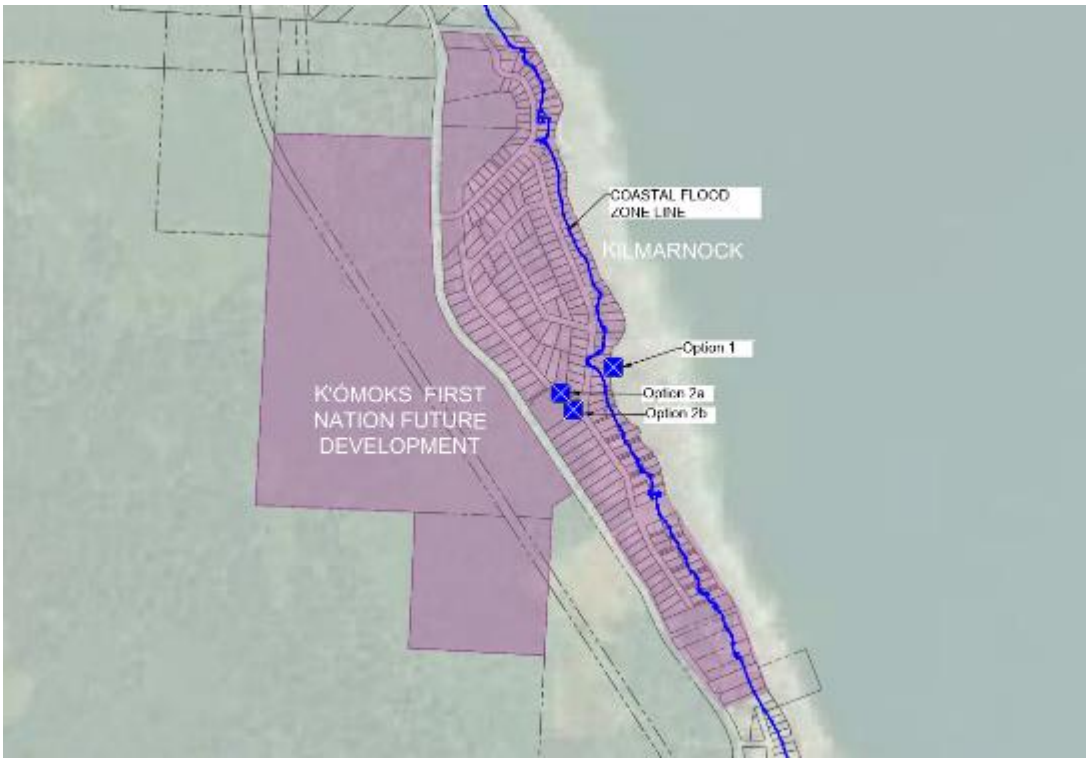

Figure 22: Kilmarnock Pump Station Siting Options, 2016

Option 1 is within the coastal flood zone as shown in **Figure 22**. Montrose Park is outside of the coastal flood zone, therefore Option 2a and 2b are not at risk of future flooding and don't require flood protection measures. Hence, the preferred location of the pump station is at Montrose Park. The proposed location is further west into the park than shown above, outside of environmentally sensitive/wetland areas (refer to Section 6 for more information from the Environmental Impact Study).

5.5.2 PRELIMINARY DESIGN

PROPOSED PUMP STATION LAYOUT

In the design development of the pump station configurations, two options have been considered. Option A, pump station with a building, and Option B, pump station with kiosks, both options are outlined below. The preliminary design of Union Bay Pump Station is outlined in TACPAC Meeting #2 Discussion Paper #3 (Appendix B) and preliminary design of Kilmarnock Pump station is outlined in TACPAC Meeting #3.5 Discussion Paper #1 (Appendix D).

OPTION A (BUILDING)

Option A consists of a control building for the MCC, genset and odour control. The control building will contain backup generator, onboard fuel tank, an electrical room to accommodate the electrical equipment and SCADA system, odour control room and public washrooms.

The pump station will consist of a Fibre Reinforced Plastic (FRP) feeding manhole as shown in **Figure 23** for the collection of flow from the catchment areas. This configuration also provides the possibility of constructing an additional manhole pump station in the future if this should be required, without the need to isolate the pump station. The pump station will have a FRP wet well and two submersible pumps. To limit the standing/retention time of the sewage in the wet well, the operating levels can be reduced to ensure shorter standing time by pumping a smaller volume per cycle. The pumps will be removed by a crane truck (or other suitable mobile rig) in lieu of an overhead gantry to limit the visual impact of the pump station on local residents.

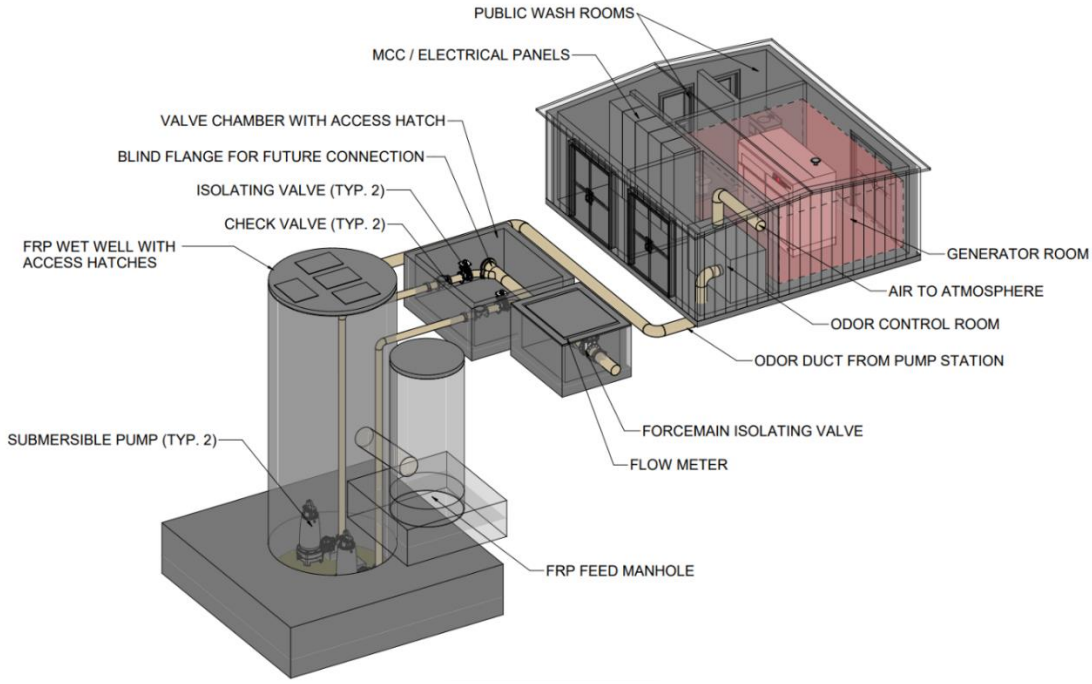

Figure 23: Option A Configuration

OPTION B (KIOSKS)

The alternative option (Option B) configuration consists of individual units instead of a control building as shown in **Figure 24**. The generator, MCC and electrical kiosk and odour control unit would all be individual units. The electrical equipment and SCADA system would be housed in the electrical kiosk. The pump station and valve chambers would be below ground level and have a similar configuration to Option A with a feed manhole, isolation valve chamber and flow meter chamber.

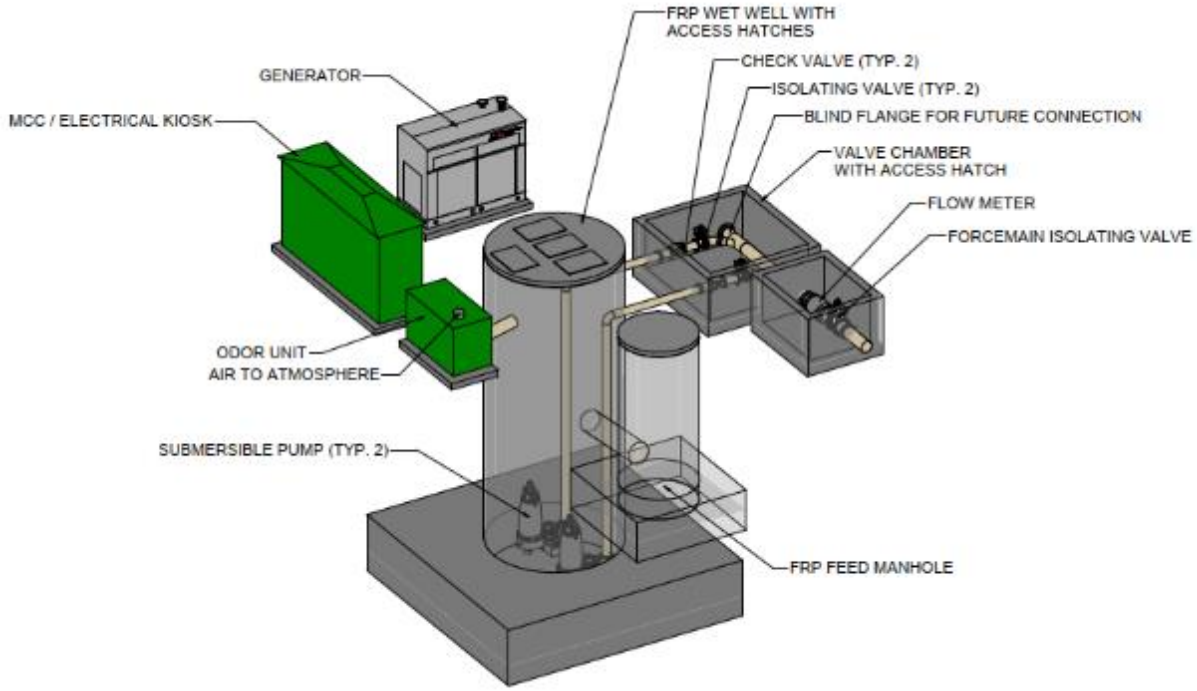

Figure 24: Option B Configuration

This configuration requires less space than Option A, however there will be increased noise during power failures when the generator is operational. The equipment may also be more susceptible to vandalism as they would not be enclosed within a building.

ODOUR CONTROL

At the start-up stage of the project, the incoming flow could be very low compared to the design flows, if certain sub-catchments are not included in the initial collection scheme. The long standing/retention time in the wet well and forcemain may create odours that will need to be treated. Active carbon adsorption columns are proposed for odour control as default option.

PUMP STATION LAYOUT COMPARISON

The advantages and disadvantages of the two options outlined above, pump station with control building (Option A) and pump station with kiosks (Option B), are summarized in the table below.

Table 8: Pump Station Layout Comparison

	OPTION A (BUILDING)	OPTION B (KIOSKS)
Advantages	– Opportunity for public facilities provided (washrooms) – More security available	– Reduces visual impact of the pump station – Lower cost associated with kiosks
Disadvantages	– Visual impact of the pump station building – Higher costs for construction of building	– Does not provide opportunity for any public facilities – Risk of vandalism – Increased noise at times when the genset is operating

5.6 PUMP STATION – ROYSTON PUMP STATION

5.6.1 SITING CONSIDERATIONS

Royston Pump Station is located in Royston to collect the flow from the Royston catchment area as well as the South Royston Forcemain. A previous study by Koers & Associates Engineering in 2016 reviewed locations for the pump station, two sites at the intersection of Marine Drive and Royston Road and one site at Marine Drive and Hayward Avenue. The options, Marine Drive at Royston Road (north) and Marine Drive at Royston Road (south) as shown in **Figure 25**, were recommended in the review as they had lower estimated costs.

Figure 25: Royston Pump Station proposed locations

Through a value planning process, completed in February 2023, concerns were raised about both locations being within the coastal flood zone, therefore a flood mitigation assessment (Appendix J) was completed to assess alternative options for Royston Pump Station. The report indicated three viable options, Option 1, 2 and 3.

Option 1 reviewed various methods undertaken to improve the flood resilience of the pump station at the proposed location within the coastal flood zone. The option applied the principles outline in the Guide for Design of Flood-resistant Buildings published by the NRC.

Option 2 involves installation of a smaller manhole-type pump station (Local Royston Pump Station) at the original proposed location (Royston Rd and Marine Dr) to pump the low-lying areas to a new regional pump station. The position of the regional pump station was not finalized in the assessment; however, it is expected to be close to Highway 19A as shown in **Figure 26**.

Option 3 involves keeping the pump station at the original proposed location at Royston Road and Marine Drive and moving the electrical supply equipment located at a different location on Royston Road above the flood line.

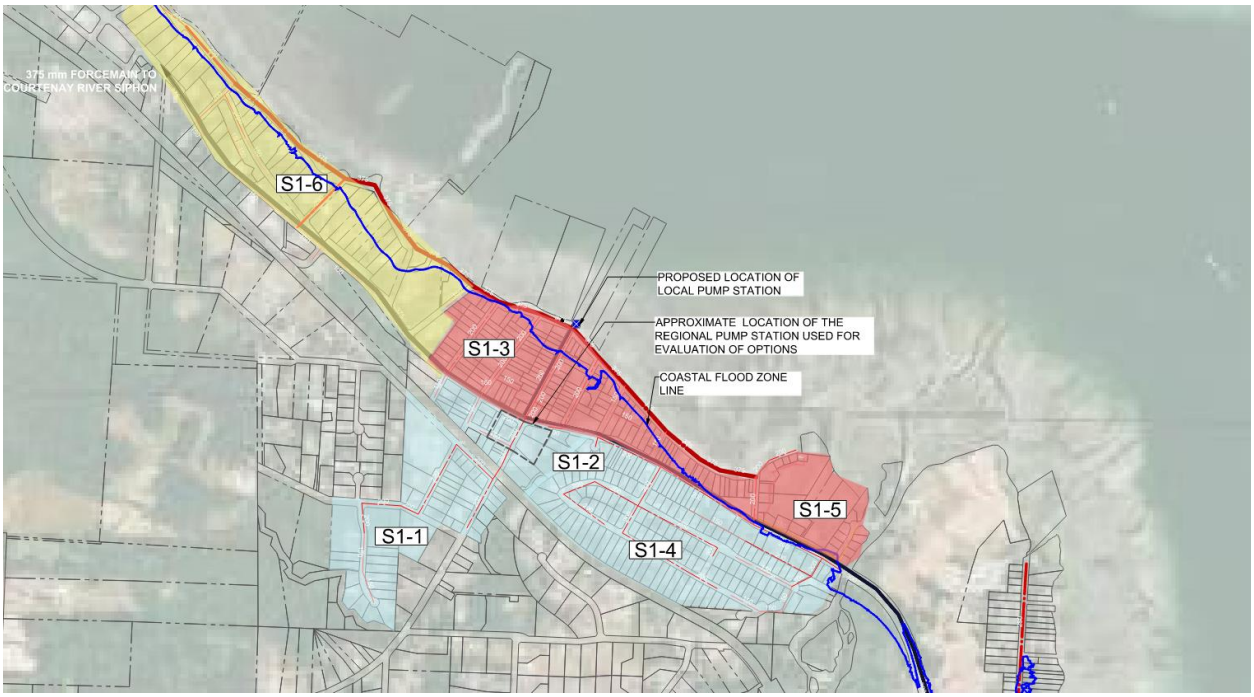

Figure 26: Royston Pump Station Flood Mitigation Option 2

5.6.2 PRELIMINARY DESIGN

OPTION 1

This option involves keeping the proposed pump station at the original proposed location. The pump station will be a manhole type pump station with the wet well, valve chamber and the inlet manhole having a bolted down lid. This will not allow any flood water into the chambers/wells. The new proposed building would include public washrooms. The building will also contain the odour control unit in a secure sump area, as shown in **Figure 27**. The Motor Control Centre (MCC) will be relocated to the second floor to ensure that it will be above the flood level and would be able to operate continuously, even if the surrounding area is flooded.

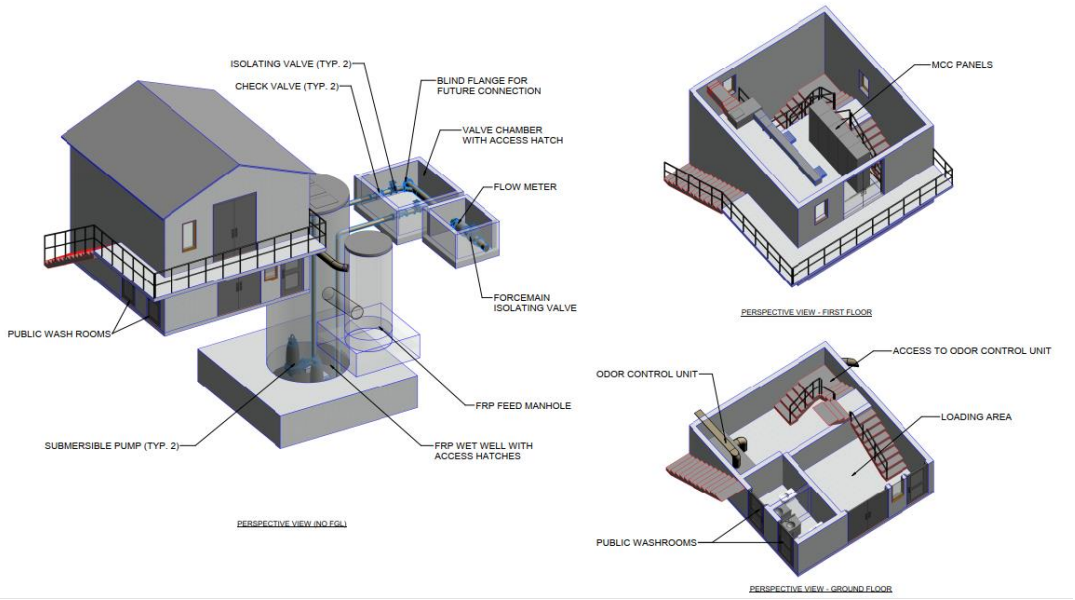

Figure 27: Option 1 Royston Pump Station Layout

OPTION 2

This option will have a small manhole-type pump station (Local Royston Pump Station) at the original proposed location (Royston Rd and Marine Dr) to pump the low-lying sub catchment areas to the new regional pump station.

The pump station layout for Local Royston Pump Station is shown in **Figure 28** below. The pump station will have an FRP wet well and submersible pumps. The MCC for the local pump station can be positioned at the Regional Pump Station, however this will require the cable to increase in size from an estimated 6 mm core cable up to 50 mm, which will increase the cost significantly. This is due to the voltage drop over a cable length of more than 500 m. However, it will prevent any electrical equipment from exposure to possible flooding conditions.

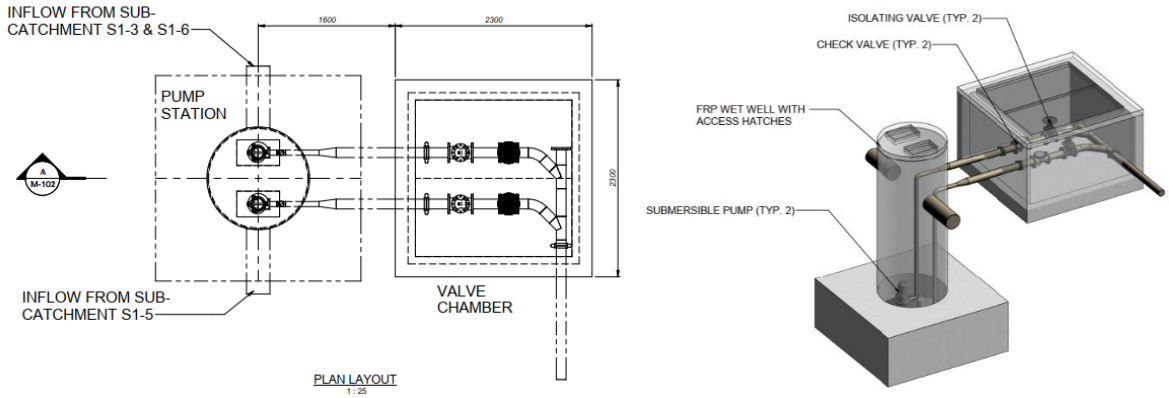

Figure 28: Option 2 Local Royston Pump Station Layout

Odour control will not be required at the Local Royston Pump Station as it is only a localized pump station and is not expected to have sewage accumulated for long periods of time.

OPTION 3

This option involves keeping the proposed pump station at the original proposed location. To mitigate the flood risk, the electrical supply equipment will be located at a different location above the flood line.

The pump station will consist of a Fibre Reinforced Plastic (FRP) feeding manhole, as shown in **Figure 29**, for the collection of flow from the catchment areas as well as the forcemain from Union Bay Pump Station. This configuration also provides the possibility of constructing an additional manhole pump station in the future should it be required, without the need to isolate Royston Pump Station. The pump station will have an FRP wet well and submersible pumps.

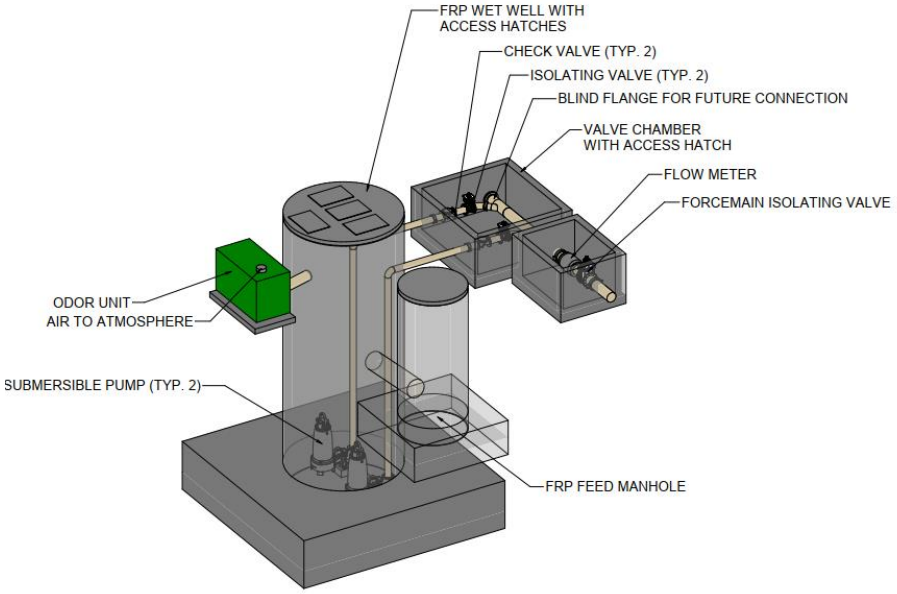

Figure 29: Option 3 Royston Pump Station Layout

The pump station will have all the functionality of Kilmarnock Pump Station and Union Bay Pump Station as outlined in Section 5.5.2. The wet well, valve chamber and the inlet manhole will have a bolted down lid. This will not allow any flood water into the chambers/wells.

The power supply from BC Hydro will be above the flood line. Having the transformer and generator above the flood line will reduce the likelihood of uninterrupted power supply to the pump station. The generator will include an automatic transfer switch. This will provide the functionality to start the generator automatically in case of a power failure. In this option, the MCC will also be located above the flood line.

5.7 FORCEMAIN

The Highway 19A forcemain consists of two proposed sections in Phase 1A, the North Royston Forcemain and the South Royston Forcemain. The proposed route is along Highway 19A to connect proposed Union Bay Pump Station

(PS#6) at Union Bay to the existing Courtenay River Siphon in Courtenay via proposed Royston Pump Station (PS#1) at Royston. The siphon discharges into the existing Courtenay Pump Station for pumping to the Comox Valley Water Pollution Control Centre. It is assumed that the proposed forcemains will be constructed within the BC Ministry of Transportation and Infrastructure (MOTI) road right of way and therefore no private property acquisition is required. As the alignment is along a provincial secondary highway, MOTI approvals will be required.

In Phase 1B, the Kilmarnock Pump Station (PS #3) will be connected at the approximate mid-point of the South Royston Forcemain and will receive flow from Union Bay Pump Station. The pump station will then convey this flow to Royston Pump Station.

5.7.1 PHASE 1A NORTH ROYSTON FORCEMAIN

The North Royston forcemain conveys flow from Royston Pump Station to the existing Courtenay River Siphon at 20th Street as shown in **Figure 30**. The proposed forcemain has two different diameters along the route. The initial 275 m of the forcemain from Royston Pump Station on Royston Road to Highway 19A will be a 250 mm HDPE pipe. For the remaining 5.1 km to the siphon, the pipe increases to a 300 mm HPDE forcemain in anticipation of future flows in future phases of the project. The forcemain ties into an existing sanitary manhole upstream of the Siphon on 20th Street. The installation method of the pipe is proposed to be open cut.

The alignment along the highway begins at Royston Road which is a rural highway. From Anfield Road to the siphon at 20th Street, the alignment will be in the urban roadway. The alignment has been selected to maintain minimum clearances to existing utilities and minimize conflicts as well as minimising traffic impacts. The utilities identified along the alignment include buried watermains and gas mains as well as overhead communication and hydro lines and poles.

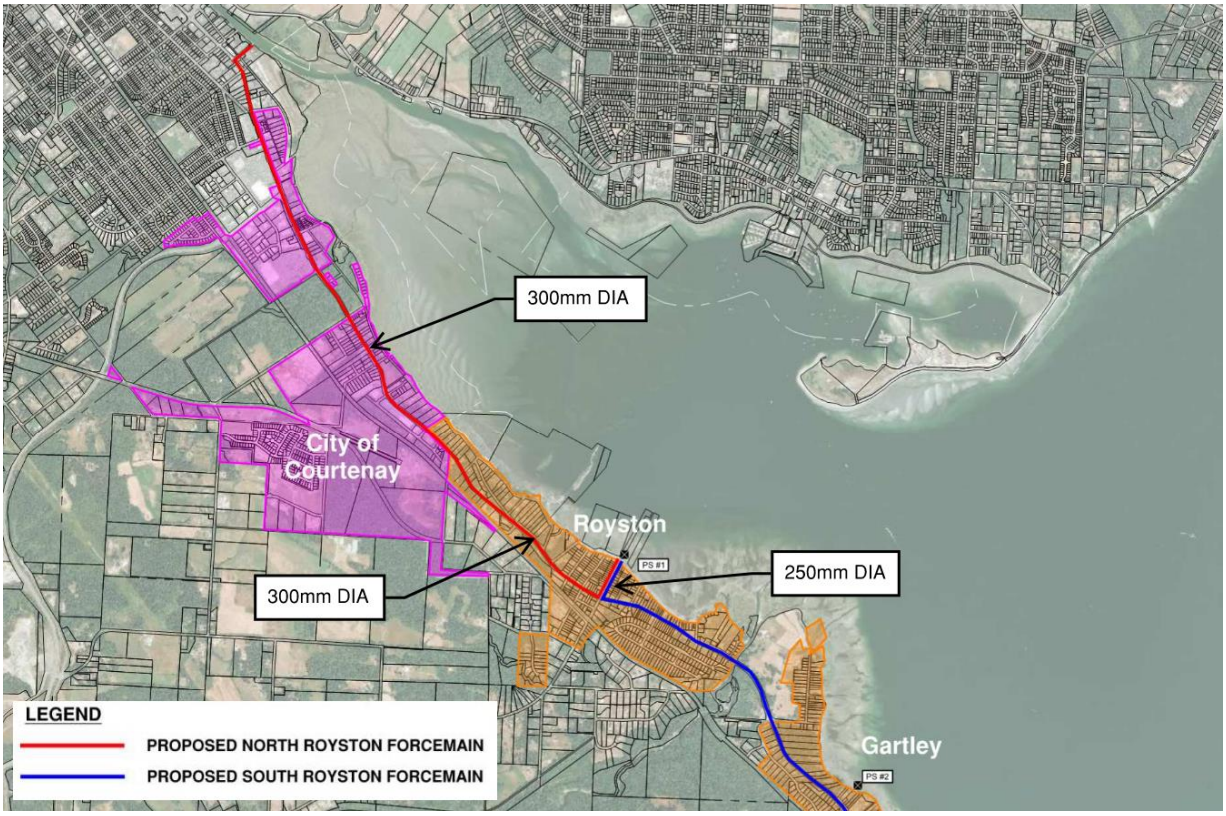

Figure 30: North Royston Forcemain Alignment

5.7.2 PHASE 1A SOUTH ROYSTON FORCEMAIN

The proposed South Royston forcemain from Union Bay Pump Station to Royston Pump Station is a 250 mm HDPE pipe. The forcemain begins at Union Bay Pump Station at Jones St, Union Bay and conveys flow along Highway 19A to Royston Pump Station on Royston Road as shown in **Figure 31**. The proposed length of the forcemain is 8.6 km.

The proposed alignment is located on the boulevard from Union Bay Pump Station to Royston Pump Station. The forcemain is proposed to be on the shoulder of the west bound lane. The alignment has been selected to maintain minimum clearances to existing utilities and minimize conflicts. The utilities identified along the alignment include, watermains, gas mains and hydro poles.

There are two river crossings on this section: the Trent River south of Royston, and Hart Creek, north of Union Bay. These crossing, 40 m and 20 m in length respectively, are proposed to be completed using horizontal directional drilling (HDD), with a pipe bridge under consideration for the Trent River crossing. The remaining forcemain will be installed using open cut methods.

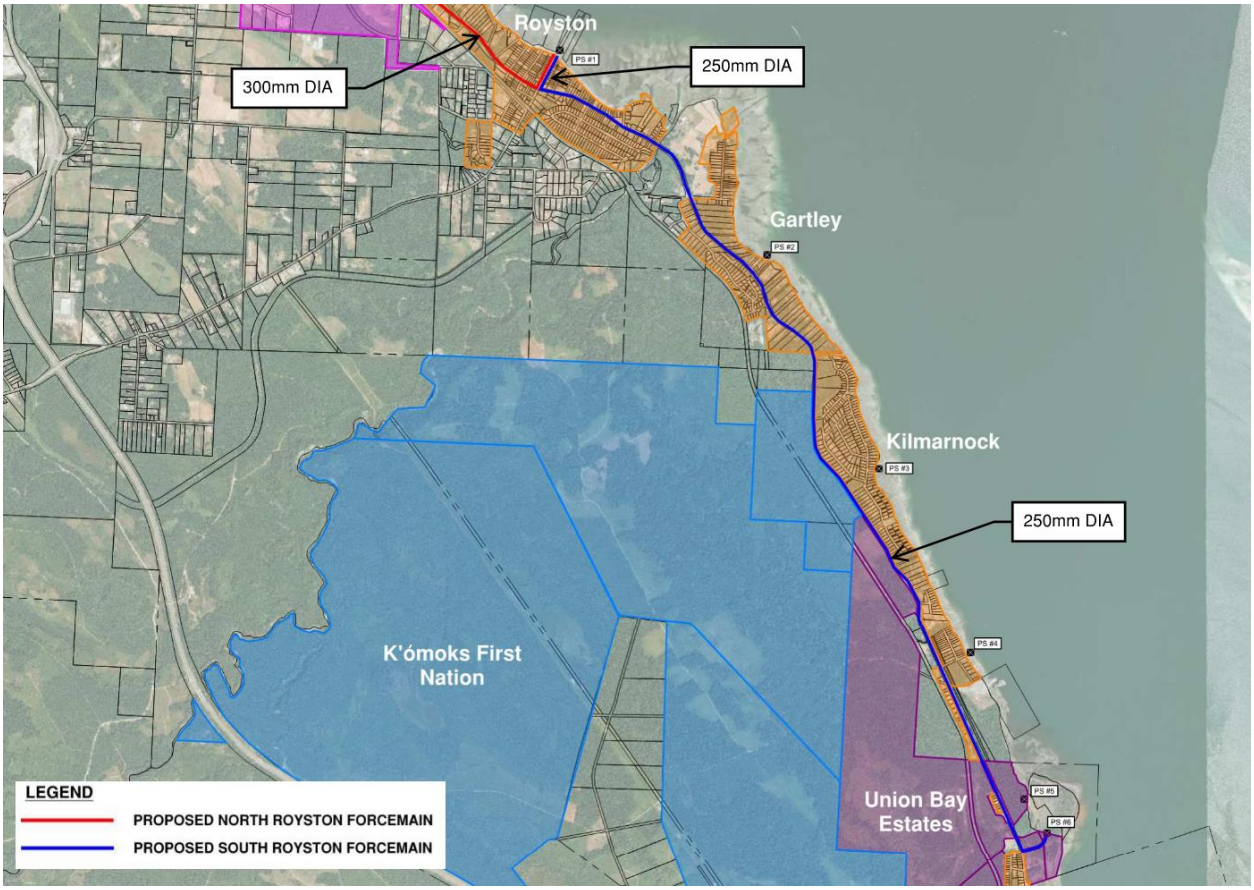

Figure 31: South Royston Forcemain

5.7.3 ALTERNATIVE ALIGNMENT

During the value engineering planning process, an alternative to the proposed forcemain alignment was identified. The alternative alignment involved moving the forcemain away from Highway 19A to the E&N Railway Corridor for the majority of the alignment. This option was assessed to determine if it added value to the project, including:

- Fill, excavation, restoration, and traffic management
- Impact of the alignment on the pump stations and their operations
- Soil condition
- E&N corridor impacts
- Access to the forcemain
- Cost

The cost comparison of the two options determined that there was only a 1 per cent difference in capital cost between the alignment. The uncertainties of the E&N corridor alignment include:

- unknown ground conditions;
- jurisdictional requirements;

– access issues during construction and under regular operations; and
– scheduling/environmental impacts associated with extensive tree clearing.

The recommendation from the assessment was not to pursue the E&N corridor alignment as outlined in the value engineering report at this time. There is however still the opportunity to use portions of the proposed E&N corridor alignment for cost-savings and reduced traffic impacts, which should be further evaluated during detailed design.

5.7.4 PHASE 1B FORCEMAIN ALIGNMENT

Phase 1B includes the addition of Kilmarnock Pump Station located in the Kilmarnock neighbourhood, between Union Bay Pump Station and Royston Pump Station. The pump station will connect to the South Royston forcemain, creating two shorter forcemains. Union Bay Pump Station will pump to Kilmarnock Pump Station via a 3.9 km forcemain, and Kilmarnock Pump Station will pump to Royston Pump Station via a 6.0 km forcemain as shown in **Figure 32**. The North Royston forcemain will remain unchanged in Phase 1B.

Figure 32: Phase 1B Forcemain Alignment

5.7.5 FUTURE PROVISION

The system configuration described in Section 5.3 outlines a number of phases of development. This will involve the twinning of the forcemain along Highway 19A, from Union Bay Pump Station to the siphon, in the ultimate build out phase. To avoid causing repeated traffic impacts, it is proposed that during the construction of the Phase 1A forcemains, concrete sleeves will be constructed at busy highway intersections. This will allow the future forcemain to be installed without closing the intersections. The sleeves will be 1800 mm diameter concrete culverts.

At the watercourse crossings, it is proposed that the future twin forcemain will be installed at the same time by HDD. The twin pipe will be a larger diameter to accommodate the future flow. This will avoid having to use HDD to install the future forcemain, which is expensive and time intense. This will reduce the future impact to traffic.

6 ENVIRONMENTAL IMPACT STUDY

A draft Stage 1 Environmental Impact Study (EIS) for Phase 1A and Phase 1B of the project was completed by Current Environmental Ltd. (Current) in November 2022 with a revision provided in January 2024. Refer to Appendix K for the draft EIS. The EIS pertains only to Phase 1A (short term) and 1B (medium term), the former including the construction of Pump Stations 1 and 6 (Royston Pump Station and Union Bay Pump Station), and two forcemains, conveying wastewater from Union Bay to the Courtenay River Siphon, and the latter Pump Station 3 (Kilmarnock Pump Station) in the Kilmarnock neighbourhood.

Two primary objectives of the EIS were to describe Environmentally Sensitive Areas (ESAs) in the project vicinity and to complete a screening level review of existing contaminated sites information to identify Areas of Potential Environmental Concern (APECs). The EIS also investigated potential adverse impacts to environmental, social, and cultural components resulting from construction and operation of the project, and recommended mitigation strategies to avoid or minimize potential impacts.

An Archaeological Overview Assessment (AOA) and Preliminary Field Reconnaissance (PFR) was conducted in 2015 by Baseline Archaeological Services Ltd. (Baseline). The AOA identified seven archaeological sites in conflict with the proposed project alignment. The PFR included revisits to the majority of the sites, including DjSf-11, DjSf-21, DjSf-23/39, DjSf-26 and DjSf-27. In correspondence with WSP in October 2022, Baseline confirmed that the only relevant update from the 2015 report is that site DjSf-36 (Union Bay) was moved inland and assigned legacy status and therefore no longer requires permitting.

6.1 ENVIRONMENTALLY SENSITIVE AREAS

Background information on ESAs was identified via desktop review of online mapping inventories and databases. ESAs located within 30 m of the proposed forcemain alignment and within 100 m of the proposed pump station locations, designated as the “impacted area,” were considered to possibly intersect or be at risk of direct disturbance from construction and operation of the Sewer Extension South Project. Following desktop analysis, site visits were conducted in October 2022 and September 2023, during which the entire alignment was reviewed. Watercourses, sensitive habitats, and ecosystems, as well as occurrences of species at risk within the impacted area, as identified by the background review, were the focus of field surveys.

A total of 12 at-risk ecological communities were identified as potentially occurring within the biogeoclimatic subzone and variant where the Project is located. There are also three habitats identified by the Sensitive Ecosystem Inventory within or intersecting the impacted area. A red-listed seashore saltgrass community is located directly adjacent to the proposed location of Royston Pump Station, within the foreshore of Comox Harbour, which will require application of measures during construction to prevent encroachment into or impacts from construction on the intertidal habitats. Two wetlands and several wildlife trees with high bird nesting potential are present within Montrose Park, the proposed site of Kilmarnock Pump Station, and roadside channels along Kilmarnock and Montrose Drives will have associated protected riparian area setbacks.

Numerous species at risk have either been observed or have the potential to occur within the Project footprint and surrounding area including bird, mammal, amphibian, reptile, insect, and plant species. Seven Bald Eagle nests are present within the Project area that will require heightened mitigation measures to minimize disturbance should the nests be in use during the breeding season coinciding with Project construction.

Although Great Blue Heron colonies within the Project area are listed as "inactive" according to online databases, foraging habitat in the vicinity is plentiful, and it is possible that herons will return to use these historical nesting sites. In this case, heightened mitigation measures similar to those in place for Bald Eagle nests may be required. Sixteen watercourses either cross or flow directly adjacent to the proposed Sewer Extension South forcemain alignment, with ten having confirmed fish presence. Care must be taken to install forcemain lines either above or below the road-crossing culverts or suspended along bridge crossings to avoid any interaction with watercourses. Appropriate erosion and sediment control measures will also be important to avoid release of deleterious substances into streams and ditches during construction, and possible post-construction rehabilitation should any impacts occur.

6.1.1 CONTAMINATED SITES ASSESSMENT

The screening level review of known or potential sources of contamination along the project alignment was completed using a combination of site-level investigation and desktop review of existing databases including custom Environmental Risk Information Services (ERIS) reporting. This review identified potential issues that may arise with exposure/handling of soils or groundwater during construction. Unforeseen costs and delays associated with characterization (sampling, analysis, and reporting) and handling (removal, trucking, disposal) can result from encounters with uncharacterized suspect materials.

Of the 62 results within 100 m of the indicative project alignment, 9 APECs warranted a "High" risk rating, where a well prepared, measured, and safety-oriented approach must be taken during any activities that will disturb soils/groundwater in these areas. For linear components, mostly located in road rights-of-way (predominantly Cliffe Ave/Highway 19A), the risk of ERIS results affecting these construction elements are generally low. However, four of the "High" risk ERIS results, two adjacent to pump station locations (i.e., large sites with complex contamination) and two adjacent to the linear portion, may intersect with the Project. A High-risk rating is associated with past records of spills/remediation of hazardous materials, Provincial site registry "high-risk" classification, and/or records of potential off-site migration of contaminants onto neighbouring properties. To mitigate risks at these locations: soil, water, and/or vapour testing can be completed to ensure that no contamination will be encountered, and if contamination is present in these areas, that the owner may make informed decisions to adjust plans and avoid these areas or prepare to define, treat and/or dispose of them appropriately. It is recommended that the results of this screening-level review of potential sources of contamination be considered in the context of final/confirmed project elements and decisions be made as to whether a Phase II ESA type sampling program be initiated for the characterization of materials likely to be disturbed during the project.

6.1.2 CONCLUSIONS

With over 98 per cent of the permanent Project footprint located within existing road prisms, construction and operation of the Sewer Extension South Project is expected to have less than significant residual effects to environmental, social, and cultural valued components. Adverse cumulative effects, resulting from interactions between the Sewer Extension South Project and other projects and activities in the vicinity, to valued components are also expected to be less than significant. Permanent alteration to the landscape will occur at three pump station locations; there are previously cleared areas within the proposed parcels that could accommodate the footprints of Pump Stations 1 and 6 without significant impacts to existing biota, while the proposed location of Pump Station 3 will require further investigation and delineation, and careful planning and design to avoid contravention of legislation protecting ESAs. Assuming negative impacts to ESAs can be avoided and these parcels can be cleared of potential interactions with contaminated materials, little to no environmental impacts are anticipated.

7 COST IMPACTS

7.1 SUMMARY OF CAPITAL PROJECT COSTS, PHASE 1A & PHASE 1B

At the preliminary design stage of projects, a Class C cost estimate is prepared. Preliminary design is when the project has, for the most part, been developed but additional changes or additions to the program are still being made. The Class C cost estimate has a 30 per cent contingency to account for any unforeseen changes in detailed design.

Class C cost estimates have been completed for the different aspects of the Sewer Extension South design for Phase 1A and 1B, including forcemains, collection systems, and pump stations; these estimates were prepared in October 2023. The detailed cost estimated is provided in Appendix B.

Table 9: Phase 1A cost estimate (Oct 2023)

FORCEMAIN

North & South Royston FM	$ 27,128,000					
Collector Systems						
Royston (S1 – 3 only)	$ 7,177,000					
Union Bay	$ 14,088,000					
Pump Stations						
	Option 1: Flood resilient building		Option 2: Regional PS with small local PS		Option 3A: Building PS with mechanical / electrical outside flood zone	Option 3B: Kiosk PS with mechanical / electrical outside flood zone
Royston	$3,996,000		$2,765,000		$3,171,000	$2,555,000
	Building	Kiosk	Building	Kiosk	Building	Kiosk
Union Bay	$2,377,000	$1,859,000	$2,377,000	$1,859,000	$2,377,000	$1,859,000
Total	**$54,766,000**	**$54,248,000**	**$53,535,000**	**$53,017,000**	**$53,941,000**	**$52,807,000**

Table 10: Phase 1B cost estimate (Oct 2023)

	PS#3 OPTION A	PS#3 OPTION B
Collector Systems		
Kilmarnock	$7,553,000	
Royston - remainder	$10,569,000	
Pump Stations		
	Building	Kiosk
Kilmarnock	$2,534,000	$2,098,000
Total	**$20,656,000**	**$20,220,000**

Table 11: Cost escalation to estimated mid-point of construction and CVRD internal costs

	PHASE 1A	PHASE 1B
Cost escalation (4%/yr to 2027, 3% beyond)	$6,265,000	$2,645,000
CVRD internal costs (legal, land, admin, etc)	$5,785,000	$2,240,000
Total project cost range:	**$64,848,000 - $66,816,000**	**$25,105,000 - $25,541,000**

7.2 OPERATING COSTS

Operations costs for the Sewer Extension South will be comprised of energy costs to operate the pump stations, chemical costs for odour control at pump stations, and maintenance costs for the collection systems. Pump stations will be operated and maintained as part of the Comox Valley Sewer Service, while individual collection systems will be operated and maintained through a sewer collection local service area.

Pump station operating costs for Phase 1A are estimated at $245,000 per year. Collection system operating costs will be estimated during Stage 3 of the LWMP.

7.3 COST IMPACTS TO RESIDENTS

Property owners are expected to pay the cost of connecting residences on each property to service connections at the property line, as well as a share of costs for constructing, operating, and maintaining the sewer system. There are two categories of costs associated with the service connections:

1. One-time costs which will vary from home to home; and
2. Ongoing annual costs.

Grant funding in the amount of $30 million received from the Province of BC's Critical Community Infrastructure program, a May 2023 allocation of $1.25 million in Community Works Funds, a December 2023 allocation of $808,500 in Growing Communities Funds, as well as partner contributions towards the cost of shared conveyance

infrastructure will reduce the overall cost impact to property owners in the plan area. When considering these external funding sources alongside additional contingencies for project risks, construction cost escalation, Comox Valley Sewer Service capital improvement cost charges and other ancillary costs, the resulting approximate one-time and annual costs for Phase 1A are outlined in **Table 12.**

Table 12: Phase 1A property owner costs

	COST PER HOUSEHOLD
One Time Costs	
Connection from home to new pipe at property line	$3,500 – $6,000
Decommissioning of septic system:	$1,000 – $2,000
Installation of LPS Equipment	$4,500
Total	**$3,500 – $12,500**
Annual Costs	
Borrowing (25 years)	$1,200 – $1,500
Operations + Maintenance (ongoing)	$550 – $650
Total	**$1,730 – $2,150**

Phase 1B property owner cost impacts will be calculated at a further stage of project planning as external funding sources and timelines for implementation of this next phase are established. In order to maintain fairness between Phase 1A and future project phases, the CVRD is committed to create as much equity between system participants and neighbours as possible. The Comox Valley Regional District will make all reasonable efforts to identify and secure additional grants, partnerships, and funding opportunities to help create equitable costs per household between all phases of the Sewer Extension South Project.

8 REFERENCES

Associated Engineering (2015) “Comox Valley Regional District South Region LWMP - Feasibility of Continuing to Use Private Septic Systems as Primary Wastewater Strategy”, Technical Memo, April 2015.

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WSP (2022) “Comox Valley Regional District - Liquid Waste Management Plan Stage 1 and 2”.