Capital Regional District

625 Fisgard St.,
Victoria, BC V8W 1R7

Notice of Meeting and Meeting Agenda
Regional Water Supply Commission

Wednesday, September 16, 2026 | **1:30 PM** | **6th Floor Boardroom, 625 Fisgard St., Victoria, BC V8W 1R7**

Budget

G. Baird (Chair), M. Wagner (Vice Chair), J. Caradonna, N. Chambers, C. Coleman, Z. de Vries, S. Duncan, C. Graham, S. Gray, C. Green, K. Guiry, S. Hammond, K. Harper, K. Jordison, S. Kim, T. Morrison, K. Pearson, T. Phelps Bondaroff, J. Rogers, C. Stock, M. Westhaver, A. Wickheim

The Capital Regional District strives to be a place where inclusion is paramount and all people are treated with dignity. We pledge to make our meetings a place where all feel welcome and respected.

1. TERRITORIAL ACKNOWLEDGEMENT

2. APPROVAL OF THE AGENDA

3. ADOPTION OF MINUTES

3.1. 26-1008 Minutes of the Regional Water Supply Commission Meeting of July 15, 2026

Recommendation: That the minutes of the Regional Water Supply Commission meeting of July 15, 2026 be adopted as circulated.

Attachments: Minutes: July 15, 2026

4. CHAIR'S REMARKS

5. PRESENTATIONS/DELEGATIONS

The public are welcome to attend CRD meetings in-person.

Delegations will have the option to participate electronically. Please complete the online application at www.crd.ca/address no later than 4:30 pm two days before the meeting and staff will respond with details.

Alternatively, you may email your comments on an agenda item to the Commission at legserv@crd.bc.ca.

6. CONSENT AGENDA

6.1. 26-0991 Summary of Recommendations from Other Water Commissions

Recommendation: There is no recommendation. This report is for information only.

Attachments: Summary: SPWC - September 3, 2026

6.2. 26-0992 Water Watch Report - September 2026

Recommendation: There is no recommendation. This report is for information only.

Attachments: Water Watch Report - September 8, 2026

6.3. 26-1012 Monthly Water Quality Dashboard - July & August 2026

Recommendation: There is no recommendation. This report is for information only.

Attachments: Monthly Water Quality Dashboard - July 2026

Monthly Water Quality Dashboard - August 2026

7. ADMINISTRATION REPORTS

7.1. 26-0873 General Manager's Verbal Update - September 2026

Recommendation: There is no recommendation. This verbal update is for information only.

7.2. 26-0878 Regional Water Supply Service 2027 Capital and Operating Budget

Recommendation: The Regional Water Supply Commission recommends that the Committee of the Whole recommend that the Capital Regional District Board:
1. Approve the 2027 Operating and Capital Budget and the Five-Year Capital Plan;
2. Approve the 2027 wholesale water rate of $0.9954 per cubic metre;
3. Approve the 2027 agricultural water rate of $0.2105 per cubic metre;
4. Direct staff to balance the 2026 actual revenue and expense on the transfer to the water capital fund;
5. Direct staff to update carry forward balances in the 2027 Capital Budget for changes after year end; and
6. Direct staff to amend the Water Rates Bylaw accordingly.
(WP – All)

Attachments: Staff Report: RWSS 2027 Capital and Operating Budget

Appendix A: Draft RWS Service Budget

Appendix B: 2026-2031 Budget Dashboard

Appendix C: Agricultural Water Rate Funding Comparisons 2011-2025

Appendix D: Report-2027 Service Delivery - Staffing Req (May 20, 2026)

Presentation: RWSS 2027 Budget Review

7.3. 26-0929 Renewable Energy Generation Proposal at Humpback PCS

Recommendation: The Regional Water Supply Commission recommends that staff:
1. Proceed to incorporate a microturbine at Humpback PCS to capture energy from the pressure reduction on Supply Main No. 3, by incorporating this work with existing capital works planned at this location;
2. Reassess the Net Present Value assumptions as estimates and quotes are updated, to verify a positive payback period remains anticipated, prior to entering a supply contract; and
3. Report back if new information becomes available to impede the viability of this initiative.
(WP – All)

Attachments:
- Staff Report: Renewable Energy Generation Proposal at Humpback PCS
- Appendix A: Microturbine Feasibility Study
- Appendix B: Location Plan and Schematics

7.4. 26-0930 Transmission Main Upgrade Program Update and Award Recommendation

Recommendation: That the Regional Water Supply Commission:
1. Authorize the award of Change Order #18 and Change Order #19 to Jacobs Consultancy Canada Inc. and authorize staff to award subsequent changes to a total of $6,131,238.50 up to a maximum contract value of $6,500,000; and
2. Direct Staff to amend the maximum payable under the contract to the new maximum amount of $6,500,000.
(WA)

Attachments:
- Staff Report: Transmission Main Update and Award Recommendation
- Appendix A: Project Location Plans
- Appendix B: Project Specific Status Updates
- Appendix C: Program Schedule Update
- Appendix D: Summary of Changes to Date and Draft CO#18 and CO#19
- Appendix E: Main No. 4 (Leigh Rd to VMP) - Preliminary Design Report

8. NOTICE(S) OF MOTION

9. NEW BUSINESS

10. MOTION TO CLOSE THE MEETING

10.1. 26-1010 Motion to Close the Meeting

Recommendation: That the meeting be closed for intergovernmental negotiations in accordance with Section 90(2)(b)(iii) of the Community Charter. [1 item]

11. RISE AND REPORT

12. ADJOURNMENT

Votinq Key:
NWA - Non-weighted vote of all Directors
NWP - Non-weighted vote of participants (as listed)
WA - Weighted vote of all Directors
WP - Weighted vote of participants (as listed)

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Capital Regional District

625 Fisgard St.,
Victoria, BC V8W 1R7

Meeting Minutes

Regional Water Supply Commission

Wednesday, July 15, 2026 | **1:30 PM** | **Electronic**

Electronic Meeting

PRESENT ELECTRONICALLY
G. Baird (Chair), M. Wagner (Vice Chair), J. Caradonna, N. Chambers, C. Coleman, Z. de Vries, S. Duncan, C. Graham, S. Gray, C. Green, K. Guiry, K. Harper, K. Jordison, S. Kim, K. Loughton (for S. Hammond), T. Morrison, K. Pearson, J. Rogers, M. Westhaver

STAFF: T. Robbins, Chief Administrative Officer; A. Constabel, Acting General Manager, Infrastructure and Water Services; G. Harris, Senior Manager, Environmental Protection; S. Irg, Senior Manager, Water Infrastructure Operations; J. Marr, Senior Manager, Infrastructure Planning and Engineering; C. Vernon, Senior Manager, First Nations Relations; M. Miklea, Deputy Corporate Officer/Manager, Legislative Services; J. Ives, Committee Clerk (recorder)

Regrets: Commissioners S. Hammond, T. Phelps Bondaroff, C. Stock, A. Wickheim

The meeting was called to order at 1:30 pm.

ELECTRONIC MEETING

1. TERRITORIAL ACKNOWLEDGEMENT

Chair Baird provided a Territorial Acknowledgement.

2. APPROVAL OF THE AGENDA

MOVED by Commissioner Coleman, SECONDED by Commissioner Chambers,
That the agenda for the Regional Water Supply Commission meeting of July 15, 2026 be approved.
CARRIED

3. ADOPTION OF MINUTES

3.1. 26-0829 Minutes of the Regional Water Supply Commission Meeting of June 17, 2026

J. Rogers joined the meeting electronically at 1:33 pm.

MOVED by Commissioner Chambers, SECONDED by Vice Chair Wagner,
That the minutes of the Regional Water Supply Commission meeting of June 17, 2026 be adopted as circulated.
CARRIED

4. CHAIR'S REMARKS

There were no Chair's remarks.

5. PRESENTATIONS/DELEGATIONS

There were no presentations or delegations.

6. CONSENT AGENDA

MOVED by Commissioner Green, SECONDED by Commissioner Guiry,
That consent agenda Items 6.1. to 6.2. be approved.
CARRIED

6.1. 26-0824 Water Watch Report - July 2026

There is no recommendation. This report is for information only.

6.2. 26-0706 Monthly Drinking Water Quality Dashboard - June 2026

There is no recommendation. This report is for information only.

7. ADMINISTRATION REPORTS

7.1. 26-0828 General Manager's Verbal Update - July 2026

A. Constabel presented Item 7.1. and provided the following information:

- Sooke reservoir is at 82 per cent capacity, well within the criteria for maintaining Stage 1 water restrictions
- weather stations are expected to advance to extreme fire danger rating across the water supply area

Discussion ensued regarding:
- warmer June weather drove a rise in water demand
- wildfire fighting in forested areas and its potential impacts on the regional water supply

7.2. 26-0793 Designation of Watershed Security Officers

A. Constabel spoke to Item 7.2.

Discussion ensued regarding the potential to delegate the appointment of Watershed Security Officers to the General Manager in future.

MOVED by Commissioner Green, SECONDED by Commissioner Rogers,
The Regional Water Supply Commission recommends that the Capital Regional District Board:
Appoint Hugh Slater as Watershed Security Officer, and remove Derek Hall from appointment, for the purpose of Section 233 of the Local Government Act and Section 28(3) of the Offence Act, and in accordance with Capital Regional District Bylaw No. 2681.
CARRIED

7.3. 26-0794 Environmental Monitoring Access Agreement - WSANEC Leadership Council Society

A. Constable spoke to Item 7.3.

Discussion ensued regarding:
- three-year term does not preclude initiation of other access agreements related to traditional, cultural or other uses
- agreement allows for the temporary denial of access when fire danger rating is extreme
- orientation materials include a map showing roads and facilities in the water supply area
- potential indications of successful execution include regular contact, responsiveness and reciprocity
- agreement has been forwarded to the WSANEC Leadership Council Society for approval

MOVED by Commissioner Chambers, SECONDED by Commissioner Jordison,
1. That access to the Greater Victoria Water Supply Area for the WSANEC Leadership Council Society be approved; and
2. That the General Manager Infrastructure & Water Services be authorized to finalize, and the Regional Water Supply Commission Chair be authorized to execute, the Environmental Monitoring Access Agreement with the WSANEC Leadership Council Society, attached as Appendix A.
CARRIED

8. NOTICE(S) OF MOTION

There were no notices of motion.

9. NEW BUSINESS

There was no new business.

10. ADJOURNMENT

MOVED by Commissioner Chambers, SECONDED by Commissioner Coleman,
That the Regional Water Supply Commission meeting of July 15, 2026 be adjourned at 2:05 pm.
CARRIED

_____
Chair

_____
Recorder

HOTSHEET AND ACTION LIST

Saanich Peninsula Water Commission

Thursday, September 3, 2026 **9:35 AM** **Meeting Rm. 2, Sidney Community Safety Bldg. 2245 Oakville Ave., Sidney, BC**

The following is a quick snapshot of the FINAL decisions made at the meeting. The minutes will represent the official record of the meeting. A name has been identified beside each item for further action and follow-up.

6. Consent Agenda

6.1. **26-0936** Summary of Recommendations from Other Water Commissions — A. Fraser

Recommendation: There is no recommendation. This report is for information only.

6.2. ***26-0937*** Water Watch Report - August 2026 — A. Fraser

Recommendation: There is no recommendation. This report is for information only.

6.3. ***26-0921*** Monthly Drinking Water Quality Dashboard - July 2026 — A. Fraser

Recommendation: There is no recommendation. This report is for information only.

7. Commission Business

7.1. ***26-0873*** General Manager's Verbal Update - September 2026 — A. Fraser

Recommendation: There is no recommendation. This verbal update is for information only.

7.2. **26-0874** Saanich Peninsula Water Service 2027 Capital and Operating Budget — A. Fraser/ N. Chan

Recommendation: The Saanich Peninsula Water Commission recommends that the Committee of the Whole recommend that the Capital Regional District Board:
1. Approve the 2027 Operating and Capital Budget and the Five-Year Capital Plan;
2. Approve the 2027 Saanich Peninsula Water Service wholesale water rate of $1.4551/m3, and the Agricultural Research Station water rate of $1.4903/m3, adjusted, if necessary, by any changes in the Regional Water Supply wholesale water rate;
3. Direct staff to balance the 2026 actual revenue and expense on the transfer to capital reserve fund;
4. Direct staff to update carry forward balances in the 2027 capital budget for changes after year end; and
5. Direct staff to amend the Wholesale Water Rates Bylaw accordingly.

7.3. ***26-0934*** *Remuneration for Saanich Peninsula Water Commissioners*

A. Fraser / K. Morley

Recommendation: The Saanich Peninsula Water Commission recommends to the Capital Regional District Board:

1. That effective January 1, 2027, all Commissioners of the Saanich Peninsula Water Commission be eligible to receive per meeting payments pursuant to the CRD Board Remuneration and Travel Expense Reimbursement Policy.
2. That the 2027-2031 Financial Plan be updated to include an annual cost of $13,992 for per meeting payments to Commissioners.

File No. 902-03

CAPITAL REGIONAL DISTRICT - INFRASTRUCTURE & WATER SERVICES

Water Watch

Issued September 08, 2026

Water Supply System Summary:

1. Useable Volume in Storage:

Reservoir System	September 30 5 Year Ave	September 30/25	September 6/26	% Existing Full Storage
	ML[1]	ML[1]	ML[1]	
Sooke	62,398	59,408	62,780	67.7%
Goldstream*	7,579	7,268	7,444	75.1%
Total	69,977	66,676	70,224	68.4%

* Goldstream System is the emergency backup water supply for the Greater Victoria Region

[1]ML = Million Litres

2. Average Daily Demand:

For the month of September	182.4	MLD[2]
For week ending September 06, 2026	183.6	MLD[2]
Max. day September 2026, to date:	193.0	MLD[2]

3. Average 5 Year Daily Demand for August

Average (2021 - 2025)	166.3	MLD[2]

[2]MLD = Million Litres Per Day

4. Rainfall August:

Average (1914 - 2025):	65.3	mm
Actual Rainfall to Date	5.7	mm (9% of monthly average)

5. Rainfall: Sep 1- Sep 6

Average (1914 - 2025):	9.2	mm
2025/2026	5.7	mm (62% of average)

6. Water Conservation Required Action:

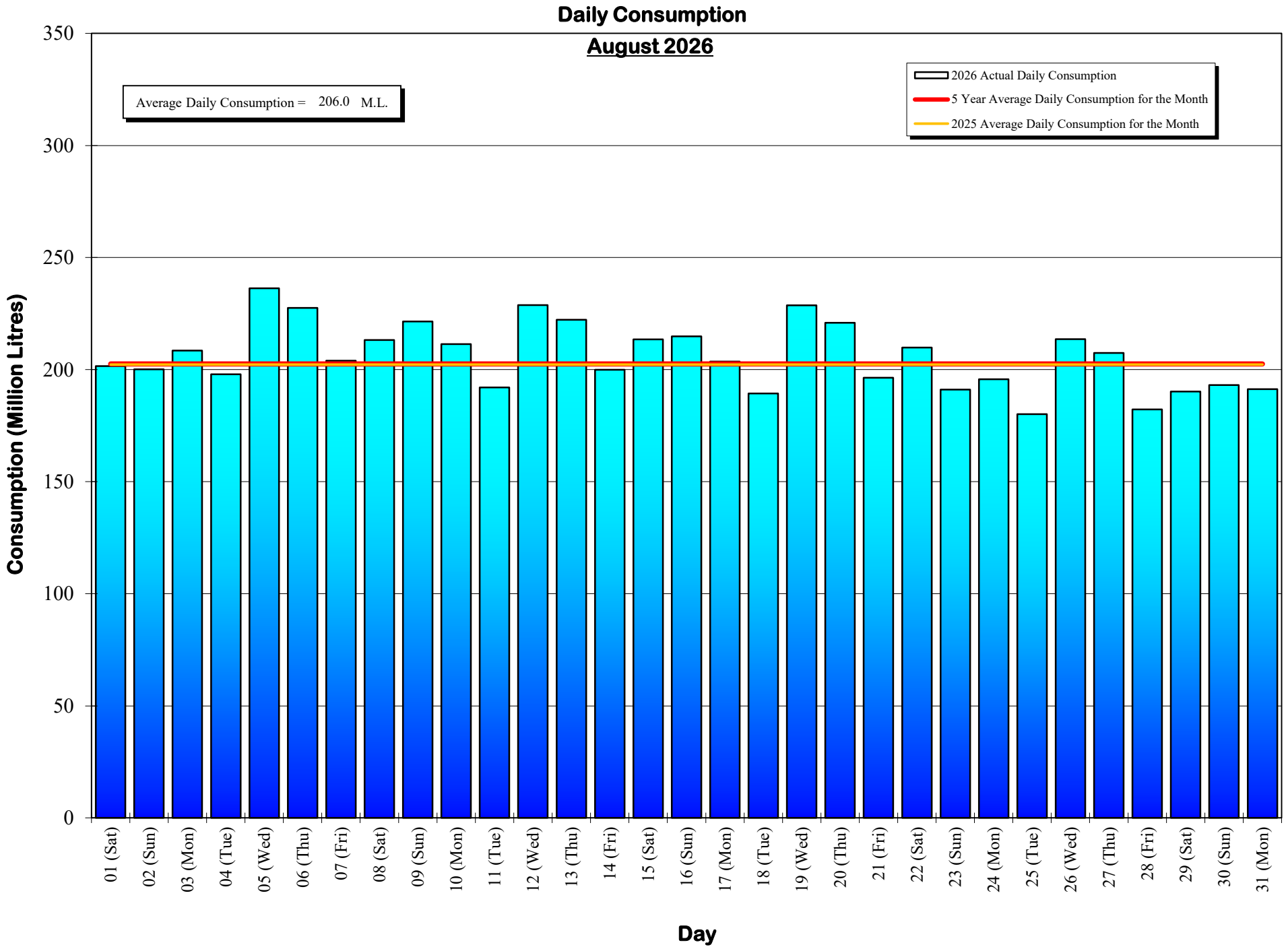
Did you know that the 2024 change to the Water Conservation Bylaw recommends that landowners and residents switch timing of residential irrigation systems from 4:00 am to an expanded window anytime between 12:01 am to 10:00 am on established watering days? Please go to Water Conservation Bylaw Changes | Capital Regional District to get informed and do your part to help protect our regional water supply system.
https://www.crd.ca/news/water-conservation-bylaw-changes

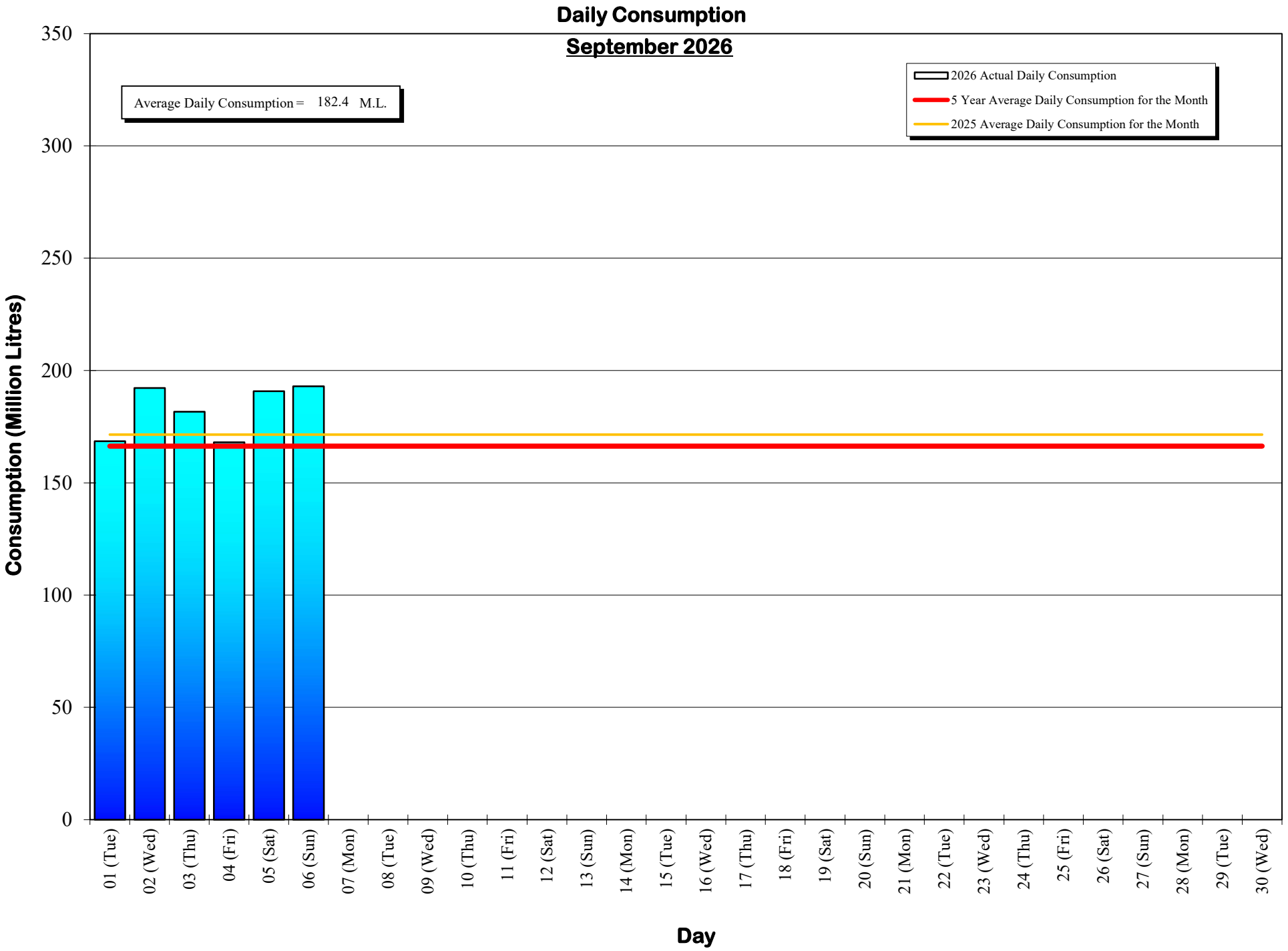
For general information regarding water conservation, visit the CRD webpage linked below:
https://www.crd.ca/environment/water-conservation

Please note: CRD is planning improvements to modernize the Water Watch Reports.
If you have any questions, comments or concerns, please contact:

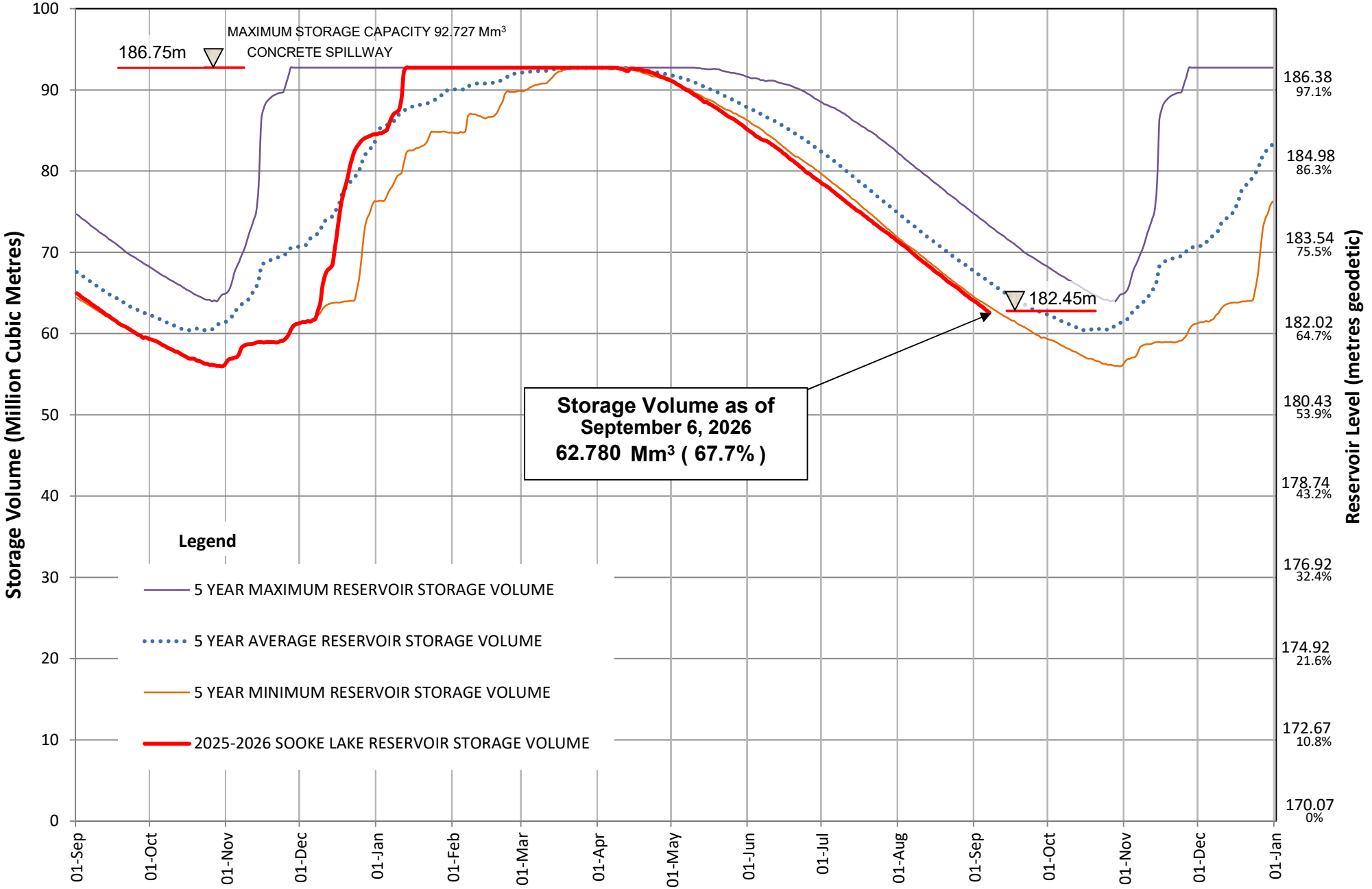
Alicia Fraser, P. Eng.
General Manager, CRD - Infrastructure and Water Services
or
Glenn Harris, Ph D., RPBio
Senior Manager - Environmental Protection

CRD Infrastructure & Water Services
479 Island Highway
Victoria, BC V9B 1H7
(250) 474-9600


Daily Consumption
August 2026
Average Daily Consumption = 206.0 M.L.
2026 Actual Daily Consumption
5 Year Average Daily Consumption for the Month
2025 Average Daily Consumption for the Month
Consumption (Million Litres)
350
300
250
200
150
100
50
0
01 (Sat)
02 (Sun)
03 (Mon)
04 (Tue)
05 (Wed)
06 (Thu)
07 (Fri)
08 (Sat)
09 (Sun)
10 (Mon)
11 (Tue)
12 (Wed)
13 (Thu)
14 (Fri)
15 (Sat)
16 (Sun)
17 (Mon)
18 (Tue)
19 (Wed)
20 (Thu)
21 (Fri)
22 (Sat)
23 (Sun)
24 (Mon)
25 (Tue)
26 (Wed)
27 (Thu)
28 (Fri)
29 (Sat)
30 (Sun)
31 (Mon)
Day

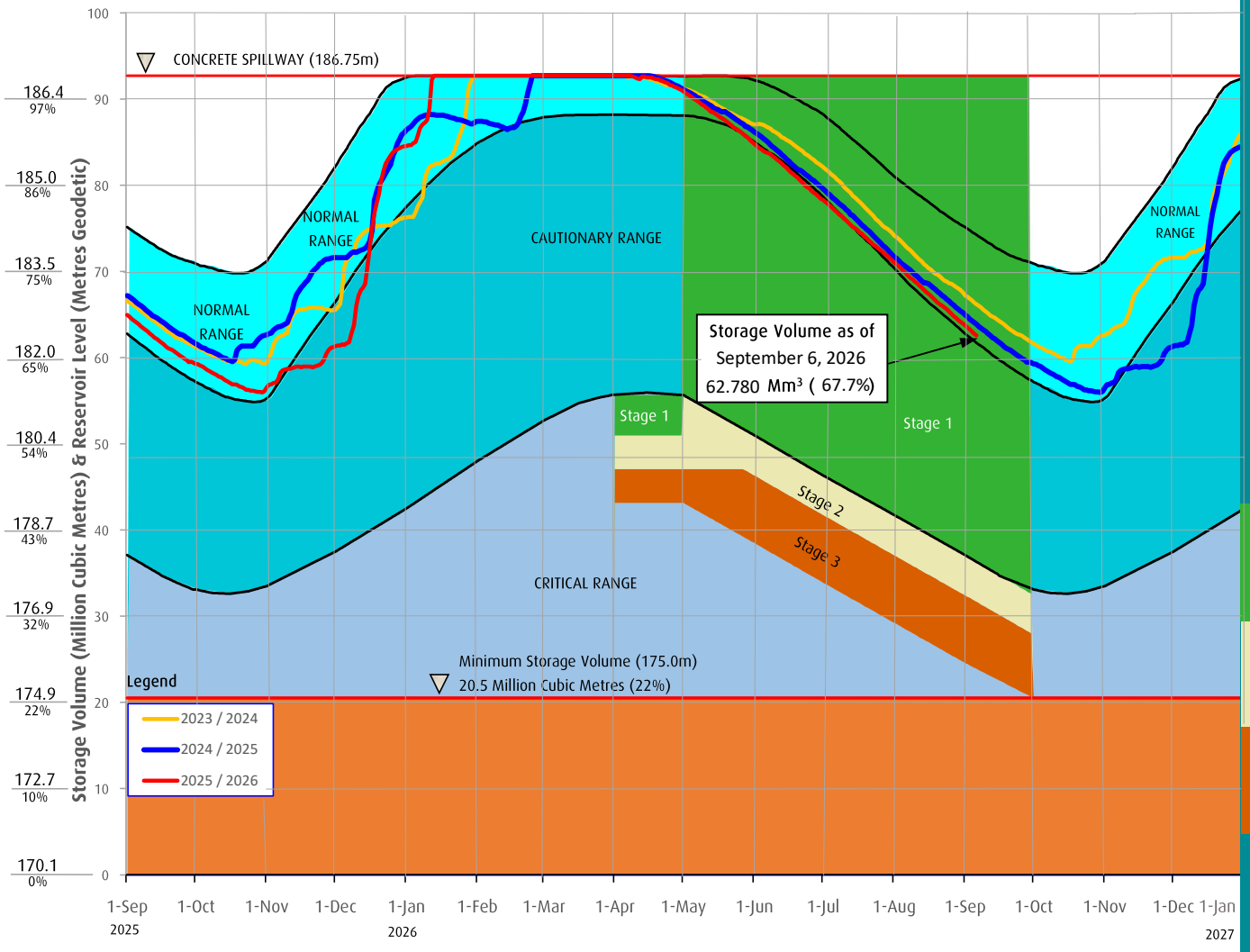

Daily Consumption
September 2026
Average Daily Consumption = 182.4 M.L.
2026 Actual Daily Consumption
5 Year Average Daily Consumption for the Month
2025 Average Daily Consumption for the Month
Consumption (Million Litres)
350
300
250
200
150
100
50
0
01 (Tue)
02 (Wed)
03 (Thu)
04 (Fri)
05 (Sat)
06 (Sun)
07 (Mon)
08 (Tue)
09 (Wed)
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22 (Tue)
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26 (Sat)
27 (Sun)
28 (Mon)
29 (Tue)
30 (Wed)
Day

SOOKE LAKE RESERVOIR STORAGE SUMMARY
2025 / 2026



Sooke Lake Reservoir Storage Level

Water Supply Management Plan



FAQs

How are water restriction stages determined?

Several factors are considered when determining water use restriction stages, including,

1. Time of year and typical seasonal water demand trends;
2. Precipitation and temperature conditions and forecasts;
3. Storage levels and storage volumes of water reservoirs (Sooke Lake Reservoir and the Goldstream Reservoirs) and draw down rates;
4. Stream flows and inflows into Sooke Lake Reservoir;
5. Water usage, recent consumption and trends; and customer compliance with restriction;
6. Water supply system performance.

The Regional Water Supply Commission will consider the above factors in making a determination to implement stage 2 or 3 restrictions, under the Water Conservation Bylaw.

At any time of the year and regardless of the water use restriction storage, customers are encouraged to limit discretionary water use in order to maximize the amount of water in the Regional Water Supply System Reservoirs available for nondiscretionary potable water use.

Stage 1 is normally initiated every year from May 1 to September 30 to manage outdoor use during the summer months. During this time, lawn watering is permitted twice a week at different times for even and odd numbered addresses.

Stage 2 Is initiated when it is determined that there is an acute water supply shortage. During this time, lawn water is permitted once a week at different times for even and odd numbered addresses.

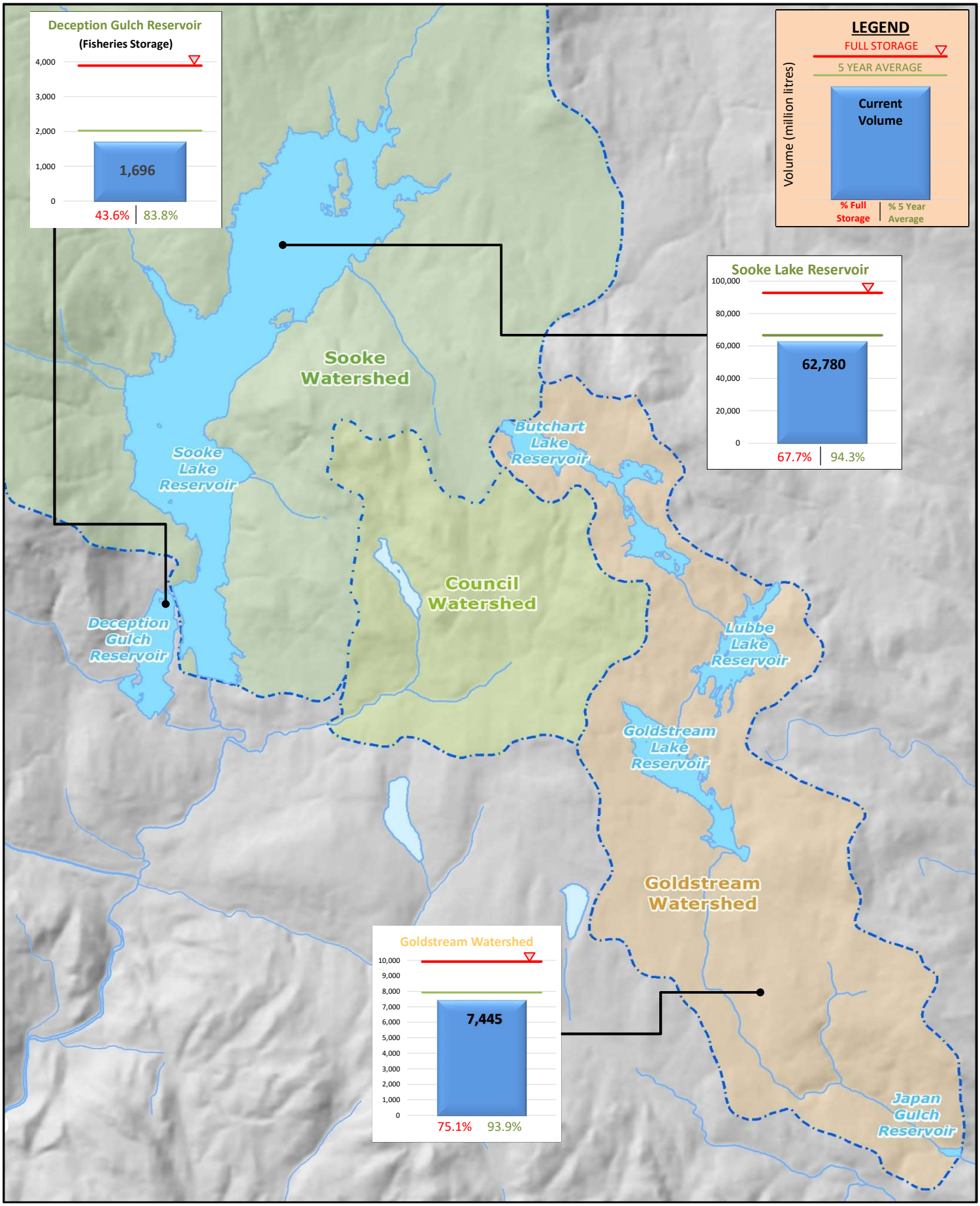
Stage 3 Is initiated when it is determined that there is a severe water supply shortage. During this time, lawn watering is not permitted. Other outdoor water use activities are restricted as well.

For more information, visit www.crd.bc.ca/drinkingwater

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Useable Reservoir Volumes in Storage for September 06, 2026



Monthly Drinking Water Quality Dashboard

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Water Quality Operations

Capital Regional District | July 2026

1. **Treated Water** | Monthly Compliance

The following table summarizes the main regulatory parameters across the various transmission and distribution systems in the Greater Victoria Drinking Water System (GVDWS). Drinking water systems in British Columbia are required to comply with the BC Drinking Water Protection Regulation and are expected to operate in accordance with recognized industry standards.

Monthly Water Quality Compliance Results by Municipality								
Municipality	**Required Samples**	**Actual Samples Collected**	**Percent Total Coliform Samples >1 CFU/100 ml**	**Total Coliform Samples >10 CFU/100 ml**	**E.coli Samples >1 CFU/ 100 mL**	**Turbidity Samples >1 NTU**	**Chlorine Residual Median mg/L**	**Water Temp. Median ºC**
Central Saanich	17	27	0	0	0	0	1.62	15.0
Saanich	94	103	1.0	0	0	0	1.52	15.6
North Saanich	13	21	0	0	0	0	1.46	15.3
Victoria / Esquimalt	93	100	1.0	0	0	0	1.52	16.4
Oak Bay	20	25	0	0	0	0	1.58	15.9
Sidney	14	17	0	0	0	0	1.59	15.2
Sooke / East Sooke	17	33	0	0	0	0	1.35	15.6
Westshore	82	94	0	0	0	0	1.38	15.4
Transmission Mains	n/a	78	1.3	0	0	0	1.92	13.6
Transmission Reservoirs	n/a	24	0	0	0	0	1.52	14.2
Total	**350**	522	3.3	0	0	0	1.55	15.2

GREEN – Compliance with industry and/or health standards

YELLOW – Exceedance of operational and/or asthetic objectives

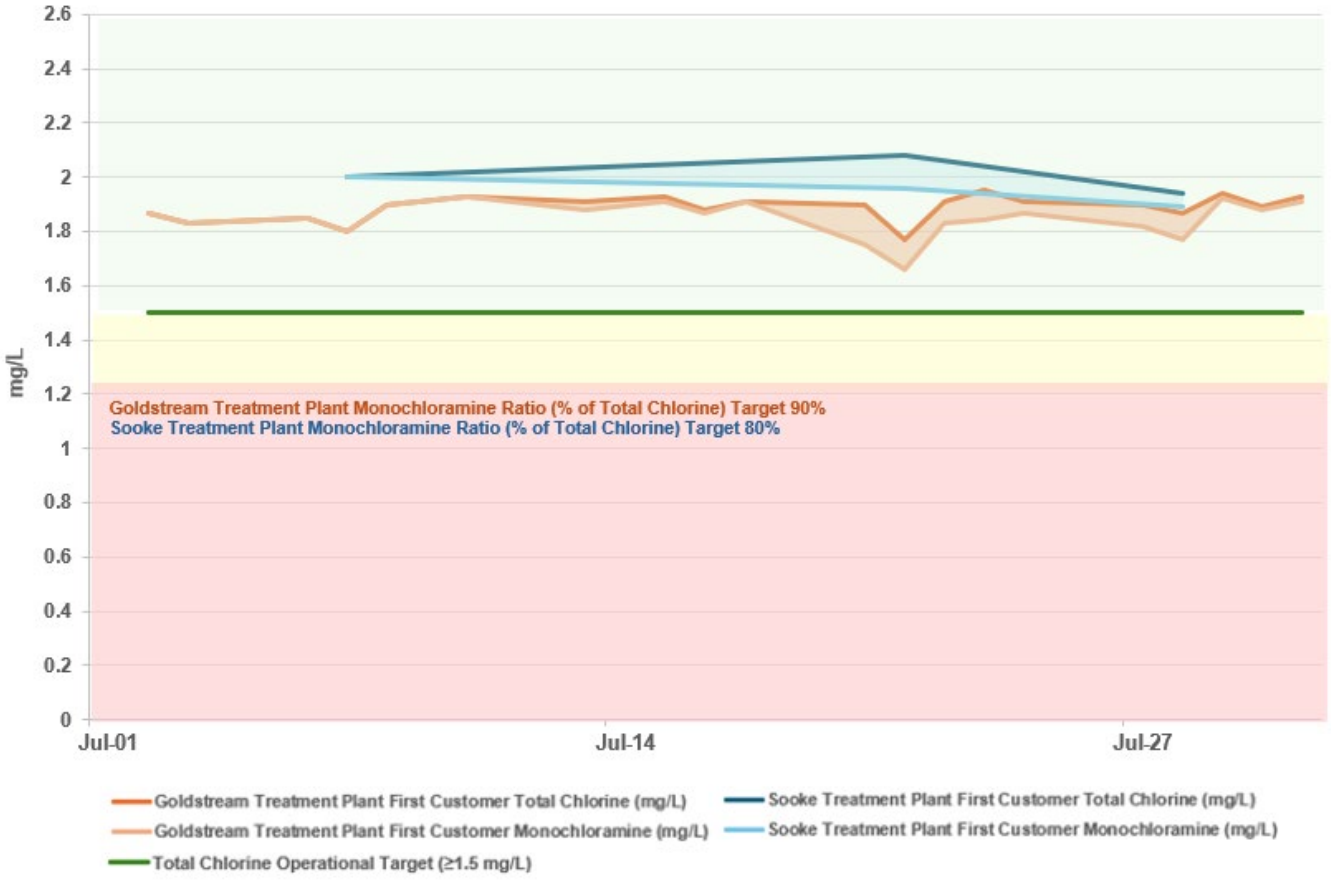
RED – Exceedance of industry and/or health standards

In July 2026, all GVDWS systems met provincial requirements and industry standards for drinking water quality.

Treated water temperature exceeded the aesthetic objective in the *Guidelines for Canadian Drinking Water Quality* in all systems except the transmission system. Temperature can influence a number of physical aspects of drinking water, including taste and odour, and also regrowth of bacteria in the infrastructure. However, it is only one of many parameters that influences water quality. Monitoring for bacteria and ensuring consistent, adequate chlorine residuals throughout the month are two important lines of evidence that confirm there is adequate protection from bacterial growth.

2. **Treated Water** | Goldstream Treatment Plant First Customer and Sooke Treatment Plant First Customer, Total Chlorine and Monochloramine

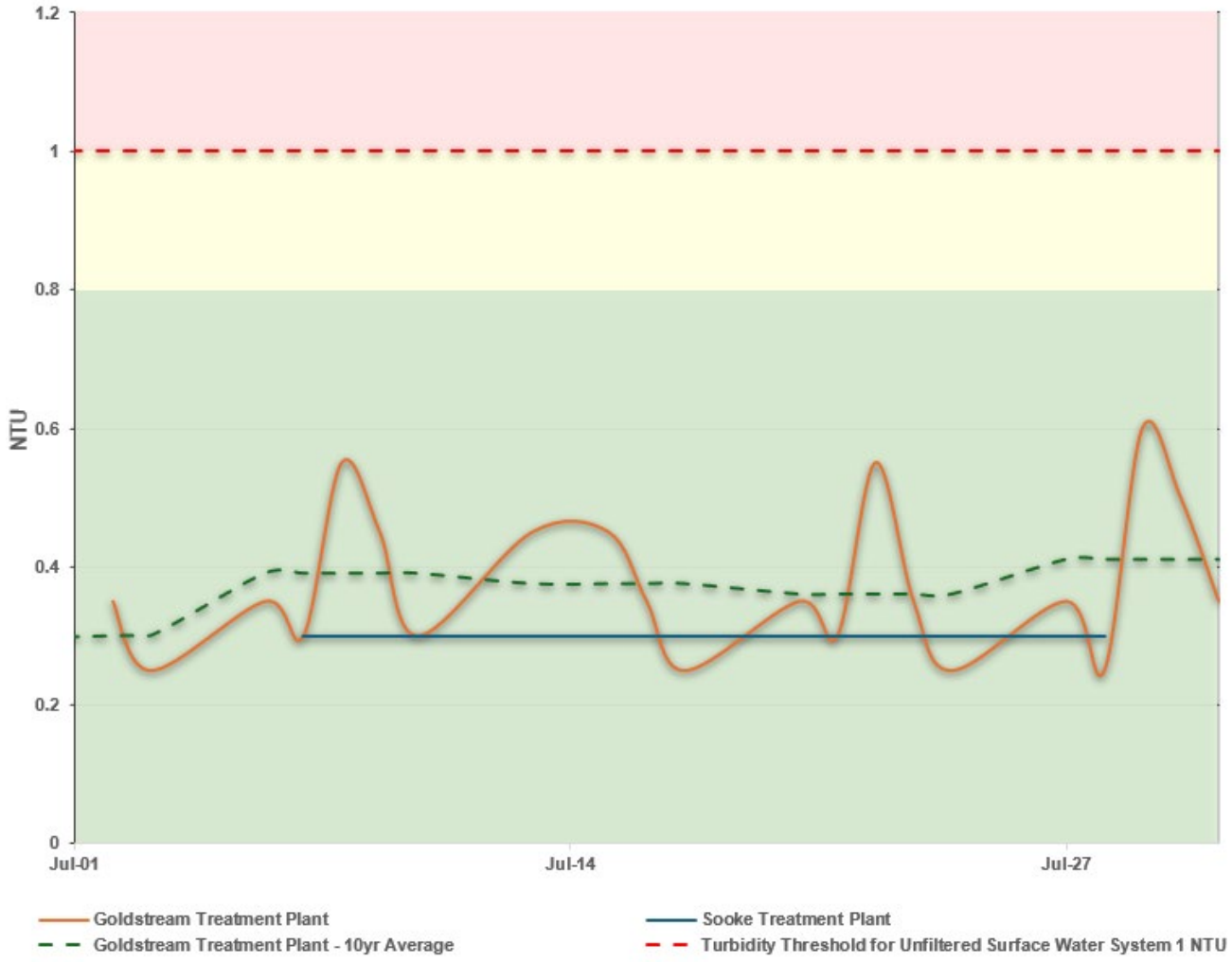
The following graph shows the daily measured total chlorine and monochloramine concentrations at the first treated water sampling stations downstream of the two CRD water treatment plants.



In July 2026, both plants consistently met the target total chlorine concentration of 1.5 mg/L and their respective monochloramine targets providing good secondary disinfection in the distribution systems.

3. Raw Water Turbidity | Goldstream Treatment Plant and Sooke Treatment Plant

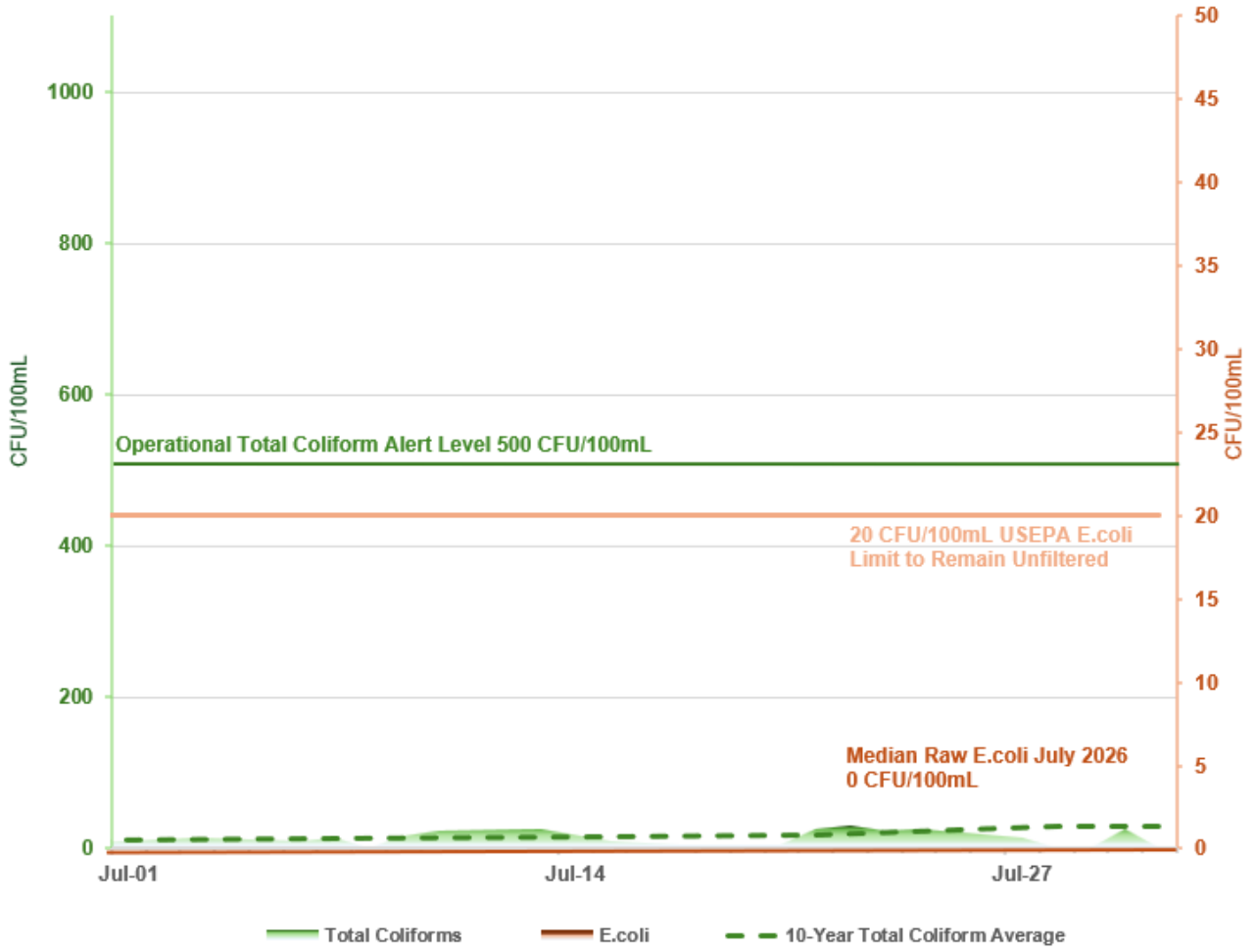
The following graph shows the raw water turbidity measured at both water treatment plants.



The GVDWS, an unfiltered surface water system, must consistently achieve turbidity levels under 1 NTU to meet regulatory standards. Turbidity levels at both treatment plants were consistently within compliance. Short-term minor turbidity spikes were recorded every Wednesday morning at the Goldstream Treatment Plant due to peak flows and watering demands.

4. Raw Water Biological Parameters | Total Coliforms and E. coli at Goldstream Treatment Plant

The following depicts the concentrations of key bacteria in the raw water.



The concentrations of total coliform and E.coli bacteria in the raw water remained below the B.C. Ministry of Health and USEPA limit for unfiltered surface water systems. The highest recorded raw water total coliform concentration during the month of July was 32 CFU/100mL.

Monthly Drinking Water Quality Dashboard

Making a difference...together

Water Quality Operations

Capital Regional District | August 2026

1. **Treated Water** | Monthly Compliance

The following table summarizes the main regulatory parameters across the various transmission and distribution systems in the Greater Victoria Drinking Water System (GVDWS). Drinking water systems in British Columbia are required to comply with the BC Drinking Water Protection Regulation and are expected to operate in accordance with recognized industry standards.

Monthly Water Quality Compliance Results by Municipality								
Municipality	**Required Samples**	**Actual Samples Collected**	**Percent Total Coliform Samples >1 CFU/100 ml**	**Total Coliform Samples >10 CFU/100 ml**	**E.coli Samples >1 CFU/ 100 mL**	**Turbidity Samples >1 NTU**	**Chlorine Residual Median mg/L**	**Water Temp. Median ºC**
Central Saanich	17	21	0	0	0	0	1.47	18.7
Saanich	94	98	2.0	0	0	0	1.49	19.8
North Saanich	13	17	0	0	0	0	1.37	18.6
Victoria / Esquimalt	93	105	0	0	0	0	1.44	20.2
Oak Bay	20	22	0	0	0	0	1.44	20.0
Sidney	14	16	0	0	0	0	1.42	19.1
Sooke / East Sooke	17	38	0	0	0	0	1.27	18.6
Westshore	82	85	1.2	0	0	0	1.13	19.5
Transmission Mains	n/a	72	0	0	0	0	1.85	18.6
Transmission Reservoirs	n/a	20	0	0	0	0	1.38	19.2
Total	**350**	494	3.2	0	0	0	1.43	19.3

GREEN – Compliance with industry and/or health standards

YELLOW – Exceedance of operational and/or aesthetic objectives

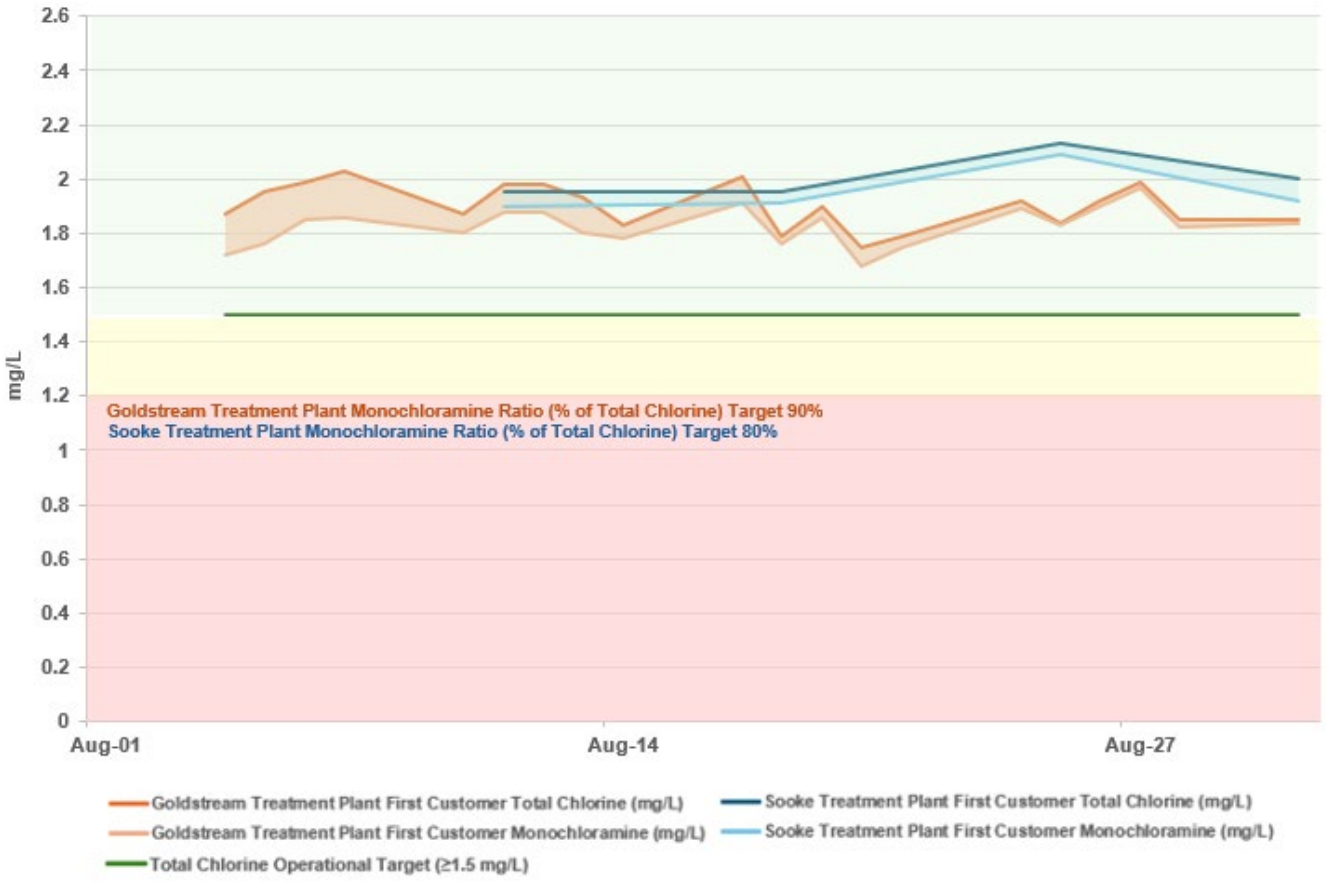
RED – Exceedance of industry and/or health standards

In August 2026, all GVDWS systems met provincial requirements and industry standards for drinking water quality.

Treated water temperature exceeded the aesthetic objective in the *Guidelines for Canadian Drinking Water Quality* in all transmission and distribution systems. Temperature can influence a number of physical aspects of drinking water, including taste and odour, and also regrowth of bacteria in the infrastructure. However, it is only one of many parameters that influences water quality. Monitoring for bacteria and ensuring consistent, adequate chlorine residuals throughout the month are two important lines of evidence that confirm there is adequate protection from bacterial growth.

2. **Treated Water** | Goldstream Treatment Plant First Customer and Sooke Treatment Plant First Customer, Total Chlorine and Monochloramine

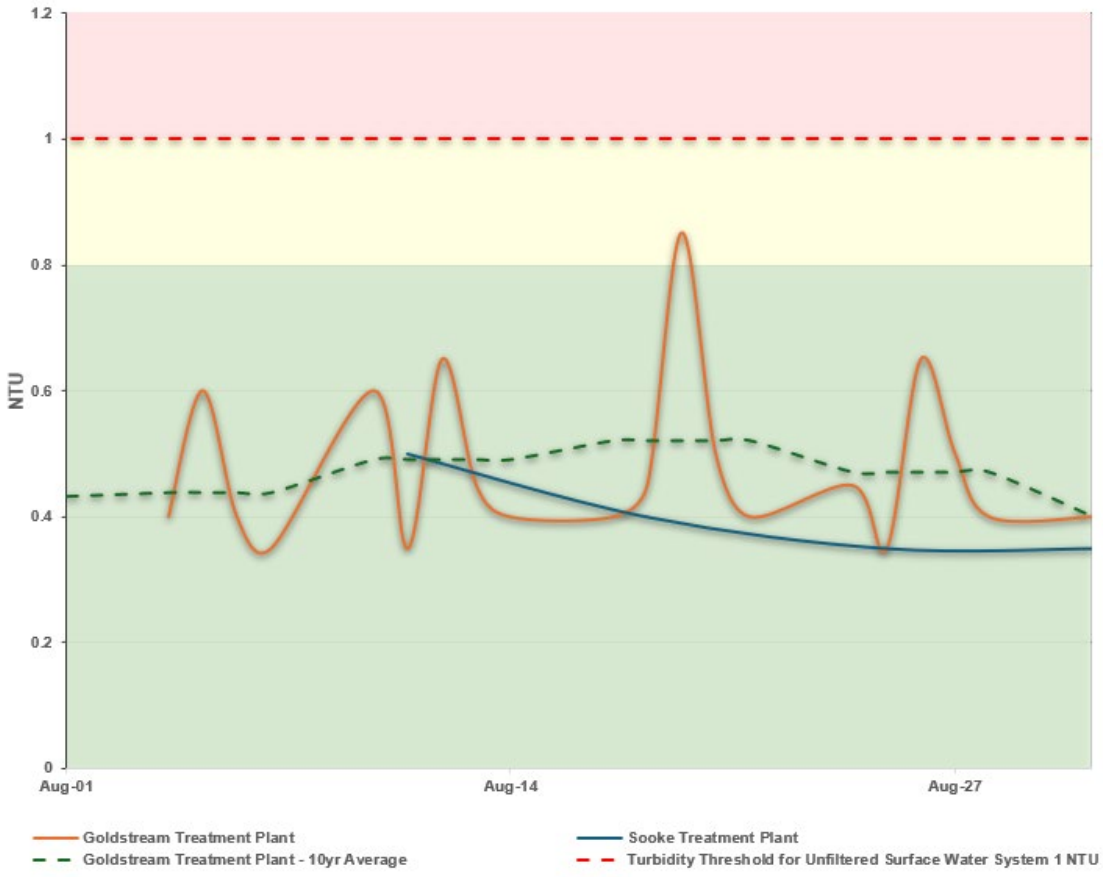
The following graph shows the daily measured total chlorine and monochloramine concentrations at the first treated water sampling stations downstream of the two CRD water treatment plants.



In August 2026, both plants consistently met the target total chlorine concentration of 1.5 mg/L and their respective monochloramine targets, which are important indicators and prerequisites for maintaining effective secondary disinfection in the distribution systems.

3. **Raw Water Turbidity |** Goldstream Treatment Plant and Sooke Treatment Plant

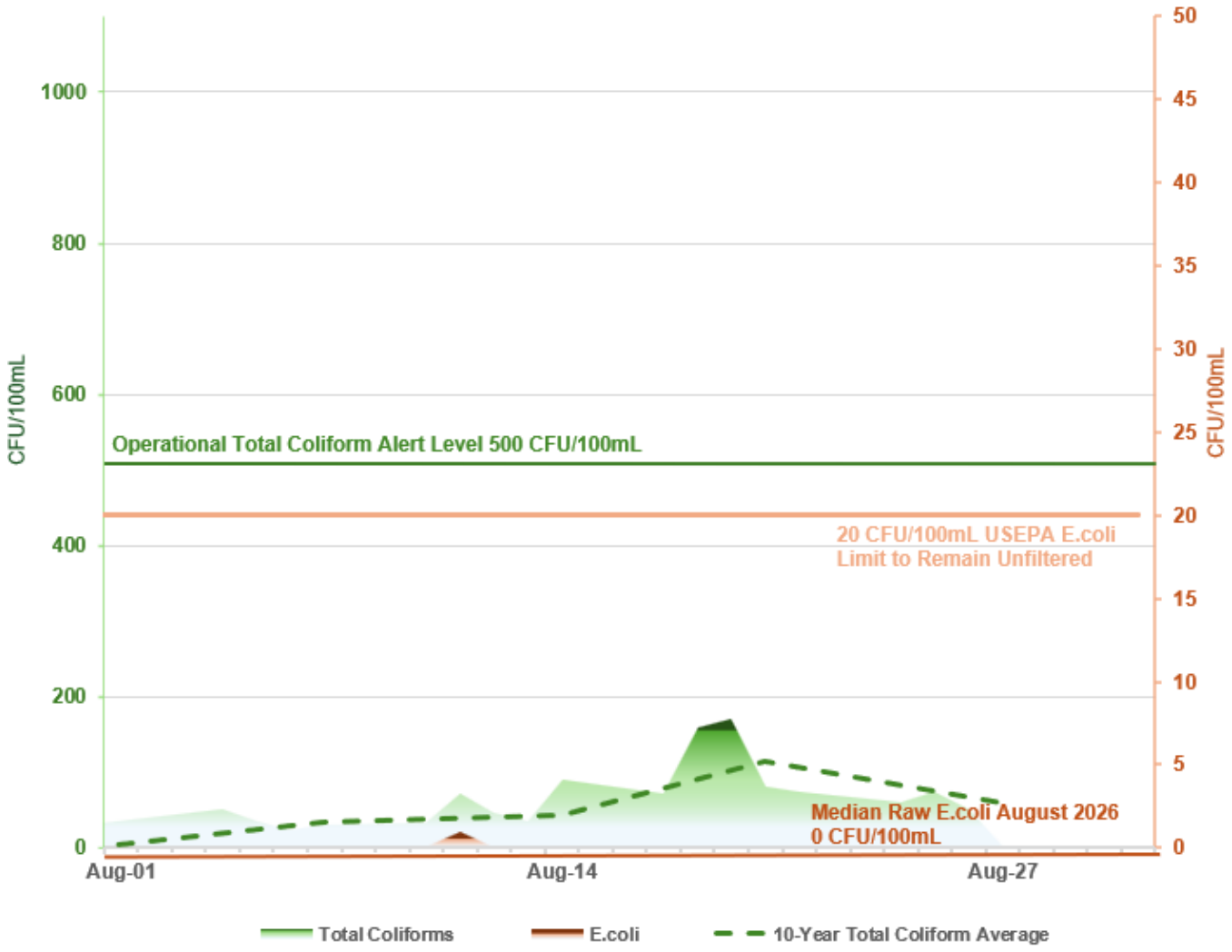
The following graph shows the raw water turbidity measured at both water treatment plants.



The GVDWS, an unfiltered surface water system, must consistently achieve turbidity levels under 1 NTU to meet regulatory standards. Turbidity levels at both treatment plants were consistently within compliance. Short-term minor turbidity spikes were recorded every Wednesday morning at the Goldstream Treatment Plant due to peak flows and watering demands (Aug. 5, 12, 19, 26).

4. Raw Water Biological Parameters | Total Coliforms and E. coli at Goldstream Treatment Plant

The following depicts the concentrations of key bacteria in the raw water.



Overall, the concentrations of total coliform and E.coli bacteria in the raw water remained below the B.C. Ministry of Health and USEPA limit for unfiltered surface water systems. Although total coliform concentrations exceeded 100 CFU/100 mL on two days (August 19 and 20), this threshold is evaluated as a secondary bacteriological criterion based on the 90th percentile of results over a six-month period for assessing surface water filtration requirements. The highest recorded raw water total coliform concentration during the month of August was 170 CFU/100mL. In general, indicator bacteria concentrations remained below typical seasonal levels in Sooke Lake Reservoir during August.

Making a difference...together

REPORT TO REGIONAL WATER SUPPLY COMMISSION
MEETING OF SEPTEMBER 16, 2026

SUBJECT **Regional Water Supply Service 2027 Capital and Operating Budget**

ISSUE SUMMARY

To provide an overview of the draft 2027 Regional Water Supply Service budget, highlighting the 2026 budget variance and the proposed 2027 budget figures. The report generally follows the information provided in the attached draft budget document (Appendix A).

BACKGROUND

The draft 2027 Regional Water Supply Service budget has been prepared for the Regional Water Supply Commission's (Commission) consideration. The proposed budget advances implementation of the Regional Water Supply Strategic Plan and Master Plan through:

- renewal and replacement of aging water infrastructure;
- continued investment in dam safety and watershed protection;
- increased capacity to deliver major capital projects identified in the Master Plan;
- support for reliable drinking water service to a growing region;
- improved resilience to climate-related risks including drought, wildfire and extreme weather; and
- long-term planning to support future growth while maintaining financial sustainability.

The Commission will make budget recommendations to the Capital Regional District (CRD) Board through the Committee of the Whole in September. The budget recommendations are also necessary to establish the wholesale water rate and approve the rate by year end through adopting a rate bylaw. As in previous years, the draft 2027 Regional Water Supply Service budget has been prepared considering the CRD Board's 2027 service planning and financial expectations, which include identifying opportunities to realign or reallocate resources and seek potential efficiencies between departments and services, reviewing service levels and adjustments related to regulatory compliance, and undertaking infrastructure improvements and upgrades to maintain service levels within the Region. In addition, the budget also considers the May 20, 2026 direction from the Commission to staff, "*That staff be directed to include the proposed Master Plan Program Project Engineer position (1 FTE) and Field Operation Centre positions (1.5 FTEs) in the Regional Water Supply Service budget for 2027."* (Appendix D).

The following sets out the key components of the budget.

2026 Year-End Financial Projections

Year-end revenue and expenditure projections have been established, and estimated variances, including the proposed capital fund transfer, are summarized as follows:

Budget Item	Projected Variance Exceed/(Below) Budget ($)	Projected Variance (%)
Expense		
Operating Expenditures	$(408,087)	(1.9)%
Capital Fund Transfers	$(27,190)	(0.1)%
Debt servicing - Principal and Interest	$(336,418)	(10.5)%
Revenue		
Sales and Other Revenue	$252,218	0.5%
Year-end Surplus	**$1,023,913**	**2.1%**

The savings in operating expenditures are primarily due to temporary staff vacancies and the delay of a one-time initiative related to Asset Management. Capital fund and debt servicing costs are lower than budget due to the deferral of debt-funded capital projects to 2027.

Surplus revenue is the result of higher water demand than budgeted. At year-end, this surplus will be transferred to the capital fund to support future capital projects.

2027 Budget

Operating Budget

The 2027 operating budget reflects inflationary increases in non-discretionary expenses, including wage and salary increases and operations and maintenance support, as well as labour augmentation and enhanced Facilities Management support for the new Field Operations Centre and 479 Island Highway. The net increase to the core 2026 operating budget is $414,163 (2.0%).

To meet the needs of the growing and aging system, 1 FTE is proposed to be added in 2027 to support the Regional Water Supply Master Plan. This investment will support advancing critical infrastructure projects, improving long-term asset management, maintaining service reliability, and ensuring the organization has the capacity required to deliver a growing capital program.

The proposed Program Engineer position will support implementation of priority projects identified in the 2022 Master Plan, including transmission system upgrades, storage improvements, dam safety initiatives, and long-term supply planning. As the scale and complexity of the capital program continues to increase, dedicated program support is necessary to maintain project delivery schedules and manage risks associated with aging infrastructure.

Additional Facilities Management resources support the operation and lifecycle management of new Field Operations Centre and the aging 479 Island Hwy, helping protect public assets and ensuring reliable service delivery.

The May 20, 2026, staff report entitled *2027 Service Delivery – Staffing Requirements* summarize the proposed 2027 Initiative Business Cases (IBCs) which have been incorporated into the 2027 budget. Further details of the rational for these additions and service level improvements are included in Appendix D.

Initiative	Staff impacts (2027)	Business Driver - Rational	Incremental cost (2027)	Funding source
2a-2.3 Master Plan Program	1 New Ongoing (Q3 Start)	Sr. Project Engineer to advance Master Plan projects.	$35,232	Capital & Fee-for-Service (100% RWS)
11b-3.2 Staff and O&M to Support Broadened FM Portfolio	1.5 New ongoing (Q3 Start)	Additional Facilities Maintenance resources to support IWS facility management and maintenance.	$102,500	Fee-for-service (100% RWS)

In addition to the groups that support the provision of water service to the various wholesale customers, there are several environmental programs that are critical to the sustainability of the Regional Water Supply Service, these programs are summarized below.

- **Water Quality Operations Program** – As the core component of the Water Quality portfolio, the Program designs and executes the water quality monitoring and reporting for the source water as well as the treated water in the transmission system and across the CRD-owned and municipal distribution systems. The program also provides technical and scientific support to operations, planning and engineering in the Greater Victoria Drinking Water System.
- **Cross Connection Control Program** – Also part of the overall Water Quality portfolio, this Program reduces the risk of drinking water contamination by identifying potential cross connections and enforcing national and provincial plumbing code requirements.
- **Laboratory Services Program** – Provides a wide range of laboratory services for the CRD drinking water and wastewater operations. Lab services for drinking water operations are integral to the Regional Water Supply.
- **Demand Management Program** – Researches and tracks the various water uses in the Greater Victoria Drinking Water System to design and execute targeted initiatives and campaigns aimed at influencing residential, industrial, institutional or agricultural water demand.

Operating budget forecasts for 2028-2031 are presented in Appendix A for information. These are projections subject to refinement in future years.

It is anticipated that the Regional Water Supply Service will become the direct service provider to the seven First Nations who historically received water from the Regional System. Two bulk water service agreements were signed in 2024, while we anticipate transitioning two more First Nations to direct customers in 2027.

The 2027 budget includes $525,000 in conveyance fee payments to fund operating expenses associated with conveying water from the Regional Water Supply system to First Nations reserve boundaries across Greater Victoria. These payments are subject to the completion of water service agreements with participating Nations and operating agreements with the organizations responsible for water conveyance, which may include the Juan de Fuca Water Distribution Service, the Saanich Peninsula Water Service, the District of Central Saanich, and the District of North Saanich.

Capital Budget
Various capital projects are planned for 2027 with a total value of $62,324,000, including $45,959,000 in carry forward projects. The capital program includes investments in asset renewal, dam safety, watershed protection and implementation of priority Master Plan initiatives. These investments help address aging infrastructure, reduce single points of failure, improve resilience to climate-related and seismic risks, maintain regulatory compliance, and support reliable drinking water service for a growing region. Major initiatives planned for 2027 include:

- Goldstream Field Office building project;
- Transmission main upgrade projects;
- Storage Tank Assessments/Improvements;
- Master Plan Planning/Implementation; and,
- Dam safety improvement projects.

There is also $1,483,000 in projects cost-shared 50%/50% with the Juan de Fuca Water Distribution Service (Appendix A, Pages 11-37).

The five-year capital plan is presented for consideration. The five-year capital plan reflects the sequencing and implementation approach identified through the Master Plan Program Implementation Plan. As outlined in that report, many of the projects within the Master Plan are interconnected and have been grouped and sequenced to optimize risk reduction, permitting, project delivery and financial planning. Deferral of key planning and implementation activities may affect future project sequencing, increase implementation risks and delay realization of the reliability and resilience benefits identified in the Master Plan. The value of the five-year (2027-2031) capital plan is currently $307,714,000, plus $4,413,000 in projects cost-shared with the Juan de Fuca Water Distribution Service.

In anticipation of the approval of the RWS Development Cost Charge (DCC) Bylaw the following capital project has a DCC funding allocation:

Project No.	Project Title	Project Description
21-11	RWS Supply Main No. 4 Upgrade & Main No. 1 High Pressurizing	Carry out system improvements to allow operational pressure increase of Main No. 1 and upgrade approximately 2.2km of RWS Supply Main No. 4 from concrete cylinder pipe to a resilient steel pipe system, better able to withstand a seismic event. 2027 Budget - $2.0 Million

Staff will review to identify further projects eligible for DCC funding in the 2028 capital budget and beyond.

Capital and Debt Expenditures
The 2027 capital expenditures will be partially funded through a transfer to the water capital fund budgeted at $23,000,000, with the balance funded from existing cash reserves and borrowed funds (Appendix A, Page 10). The 2027 debt expenditures for existing debt servicing are budgeted to be $3,971,200, an increase of $756,162 (23.5%) over 2026 due to new debt for the Kapoor land purchase ($32,300,000). Additional water sales revenue and the corresponding capital fund will help offset the borrowing needs in 2027.

Loan Authorization Bylaw 4382 authorizing borrowing of $46,000,000 was approved in 2021 to allow continued partial funding of the five-year capital plan. To date, $4,000,000 has been borrowed, leaving $42,000,000 remaining to fund the five-year capital plan. The CRD board approved temporary loan authorization bylaw 4779 on July 8, 2026, to allow timely access to debt funds under bylaw 4382 to finance ongoing capital investment.

The upcoming debt retirements on existing borrowings are summarized below:

Loan Number	Retirement Date	Loan Amount
LA3661-118	April 2027	$4,500,000
LA3661-124	April 2028	$1,700,000
LA3902-131	April 2030	$3,000,000
LA3902-137	April 2031	$1,500,000
LA3902-145	April 2033	$5,000,000
LA4382-159	June 2038	$4,000,000

When assessing key financial health indicators, the service maintains an affordable level of debt over the next five years. The percentage of revenue dedicated to debt costs is forecast to be between 8% and 21%.

Debt funding for capital investment in each of the next five years does not exceed 68% in any year from 2027 to 2031, consistent with the CRD's 60-80% benchmark for engineering infrastructure. While the capital plan includes projects forecasted to occur in the later years for informational purposes, the costs provided are Class D estimates and are refined as part of the capital planning process.

A summary indicator table is provided below:

Year	% Revenue for Debt	Capital Funded by Debt
2027	7.66%	1.08%
2028	7.93%	66.48%
2029	12.68%	58.74%
2030	16.98%	67.92%
2031	21.14%	57.10%

The Regional Water Supply five-year capital plan reflects a long-term infrastructure program developed to maintain reliable drinking water service, address aging infrastructure, improve system resilience and support future growth. Through development of the Development Cost Charge (DCC) program and completion of long-term asset management planning, future capital and debt funding requirements will continue to be refined. Capital and debt funding decisions are aligned with the life span of assets to support inter-generational equity, balancing infrastructure costs between current and future users. The current long-term debt obligations are summarized in Appendix B.

A $818,780 transfer to the vehicle/equipment replacement fund is planned in 2027. The reserve fund balance is estimated at $3,061,721 at year-end 2026 (Appendix A, Page 38).

Agricultural Water Rate Funding
The Regional Water Supply agricultural water rate budget funds the difference between the municipal retail water rate and the CRD agricultural water rate. While the bulk water rate has increased annually, the agricultural rate has been held at $0.2105 per cubic metre since the rates was assessed in 2010. At their meeting of November 26, 2024, the Water Advisory Committee recommended that the Regional Water Supply Commission maintain the current agricultural water rate. This was presented to the Regional Water Supply Commission at their meeting of January 15, 2025.

In the absence of any other direction, the 2027 agricultural water rate is maintained at the same 2025 rate of $0.2105 per cubic metre, subject to the Regional Water Supply Commission's approval. The total budget for the agricultural water rate funding has been increased by $50,000 to $1,950,000.

A summary of agricultural water volumes and agricultural water rate payments from 2011 to 2025 is provided in Appendix C.

Water Demand
Total water demand across the Region has increased year over year, primarily due to continued development and growth. These factors are expected to result in actual demand exceeding budget demand in 2026, with year-end demand projected to be 300,000 m^3 above the budget of 51,400,000 m^3.

The recommended 2027 water rate has been calculated using a budget demand of 51,500,000 m^3 (Appendix A, Page 7), which is a 100,000 m^3 increase above the 2026 budget.

Proposed 2027 Wholesale Water Rate
The wholesale water rate is calculated using the water rate model. The water rate model considers the rate base and revenue requirements, which are determined using the various inputs outlined in the preceding sections of this report.

Rate Base
The rate base includes facilities, equipment, infrastructure and other assets used to provide the Regional Water Supply Service. The 2027 rate base has increased by $34,339,099 from 2026, primarily due to additions to physical plant and work in progress, partially offset by current-year depreciation and revisions to prior-year estimates of additions and disposals. The increase indicates that investment in infrastructure continues to exceed depreciation of the existing asset base. Details of changes to physical plant and work in progress are provided on pages 4 and 5 of the budget document (Appendix A) and are used to project the 2026 year-end physical plant balance and determine the 2027 rate base.

Revenue Requirement
The 2027 revenue requirement has increased by $3,393,529, primarily due an increase in the return on the rate base of $2,839,100, as well as increases in operating expenses and conveyance fees of $509,163 and depreciation expenses of $52,066.

The proposed 2027 wholesale rate is $0.9954/$m^3$, an increase of 6.88% over the 2026 rate. For the average household using 229 m^3 or water per year, this represents an increase in annual bulk water costs of approximately $14.68 (Appendix A, Page 8).

Wholesale Water Rate History and Projection
The wholesale water rate history and projection are provided on Appendix B, Page 1. Future rates may be adjusted reflect actual revenue and expenditure requirements and changes in water demand.

ALTERNATIVES

Alternative 1
The Regional Water Supply Commission recommends that the Committee of the Whole recommend that the Capital Regional District Board:

1. Approve the 2027 Operating and Capital Budget and the Five-Year Capital Plan;
2. Approve the 2027 wholesale water rate of $0.9954 per cubic metre;
3. Approve the 2027 agricultural water rate of $0.2105 per cubic metre;
4. Direct staff to balance the 2026 actual revenue and expense on the transfer to the water capital fund;
5. Direct staff to update carry forward balances in the 2027 Capital Budget for changes after year end; and
6. Direct staff to amend the Water Rates Bylaw accordingly.

Alternative 2
The Regional Water Supply Commission recommends that the Committee of the Whole recommend that the Capital Regional District Board:

1. Approve the 2027 Operating and Capital Budget and the Five-Year Capital Plan as amended;
2. Approve the 2027 wholesale water rate as amended (amended rate);
3. Approve the 2027 agricultural water rate of $0.2105 per cubic metre;
4. Direct staff to balance the 2026 actual revenue and expense on the transfer to the water capital fund;
5. Direct staff to update carry forward balances in the 2027 Capital Budget for changes after year end; and
6. Direct staff to amend the Water Rates Bylaw accordingly.

IMPLICATIONS

Financial Implications

If the proposed budget is amended, the implications will vary depending on the nature of the changes and their impact on new initiatives, ongoing operations, or the capital work program. One-time reductions in reserve fund contributions could be considered by the Commission to help mitigate the budget and rate increases, but additional capital financing could result in the longer term.

Any changes in the recommended wholesale water rate would have to be incorporated in the Juan de Fuca Water Distribution Service and Saanich Peninsula Water Service budgets and rates.

CONCLUSION

The draft 2027 Regional Water Supply Service budget is presented for the Regional Water Supply

Commission's (Commission) consideration. The Commission will make budget recommendations to the Capital Regional District (CRD) Board through the Committee of the Whole in September. The draft 2027 Regional Water Supply Service budget was prepared considering the Commission and CRD Board's 2027 service planning and financial expectations, along with direction provided by this Commission. A proposed increase in operating and capital funding combined with an adjusted revenue budget, is resulting in a recommended wholesale water rate of $0.9954/m^3 per cubic metre, a 6.88% increase over the 2026 rate.

RECOMMENDATION

The Regional Water Supply Commission recommends that the Committee of the Whole recommend that the Capital Regional District Board:

1. Approve the 2027 Operating and Capital Budget and the Five-Year Capital Plan;
2. Approve the 2027 wholesale water rate of $0.9954 per cubic metre;
3. Approve the 2027 agricultural water rate of $0.2105 per cubic metre;
4. Direct staff to balance the 2026 actual revenue and expense on the transfer to the water capital fund;
5. Direct staff to update carry forward balances in the 2027 Capital Budget for changes after year end; and
6. Direct staff to amend the Water Rates Bylaw accordingly.

Submitted by:	Alicia Fraser, P. Eng., General Manager, Infrastructure and Water Services
Concurrence:	Glenn Harris, Ph.D., R.P.Bio., Acting General Manager, Parks, Recreation & Environmental Services
Concurrence:	Nelson Chan, MBA, FCPA, FCMA, Chief Financial Officer & General Manager, Finance & Technology
Concurrence:	Ted Robbins, B. Sc., C. Tech., Chief Administrative Officer

ATTACHMENTS

Appendix A: Draft 2027 Regional Water Supply Service Budget
Appendix B: 2026-2031 Budget Dashboard
Appendix C: Agricultural Water Rate Funding Comparisons 2011-2025
Appendix D: Report to Commission: *2027 Service Delivery – Staffing Requirements* (May 20, 2026)
Presentation: Regional Water Supply Service 2027 Budget Review

CAPITAL REGIONAL DISTRICT

2027 BUDGET

Regional Water Supply

COMMISSION REVIEW

September 2026

Service: 2.670 **Regional Water Supply** **Commission: Regional Water Supply**

DEFINITION:

To finance, install, operate and maintain a water supply local service in the Capital Regional District, as per the Water Supply Local Service Establishment Bylaw No. 2537.

The establishment and operation of a Regional Water Supply Commission is done by Bylaw No. 2539.

SERVICE DESCRIPTION:

Regional Water Supply is responsible for the water supply, treatment and transmission system for the Greater Victoria region, providing wholesale water to municipalities that operate municipal distribution systems. The service administration and operation is provided by the Integrated Water Services Department.

PARTICIPATION:

City of Victoria	Town of Sidney	District of Metchosin
District of Oak Bay	District of North Saanich	District of Sooke
District of Saanich	Town of View Royal	Juan de Fuca Electoral Area
Township of Esquimalt	City of Colwood	District of Highlands
District of Central Saanich	City of Langford	

MAXIMUM LEVY:

No stated limit in establishment bylaw and no ability to requisition.

MAXIMUM CAPITAL DEBT:

Authorized:	Pre Consolidated MFA Loan Authorizations - Regional Water Supply Water Works Facilities		$137,700,000
Borrowed:			$91,400,000
Remaining:	Expired		$46,300,000
Authorized:	LA Bylaw No. 3451 - Regional Water Supply Land Acquisition		$60,000,000
Borrowed:			$60,000,000
Remaining:			$0
Authorized:	LA Bylaw No. 3902 - Regional Water Supply Water Works Facilities	2014	$12,500,000
Borrowed:			$9,500,000
Remaining:	Expired		$3,000,000
Authorized:	LA Bylaw No. 4382 - Regional Water Supply Water Works Facilities	2021	$46,000,000
Borrowed:			$4,000,000
Remaining:	Active		$42,000,000

FUNDING:

Costs are recovered through the sale of wholesale water.

Change in Budget 2026 to 2027 **Service: 2.670 Regional Water Supply**	**Total Expenditure**	**Comments**
2026 Budget	**48,804,152**	
Change in Wages & Benefits:		
General wages & benefits change	305,794	Inclusive of estimated collective agreement changes
Step increase/paygrade change	49,842	
IBCs:		
1.0 FTE - Sr. Project Engineer	176,161	2026 IBC: 2a-2.3: Master Plan Program
	(140,929)	Funded through capital programs
Total IBCs:	35,232	
Total Change in Wages & Benefits	390,868	
Other Changes:		
Transfer to Water Capital Fund	2,000,000	Increased transfer to fund capital program
Principal and Interest on New Debt	1,040,722	Principal and interest on new debt to fund capital program
Principal and Interest on Retired Debt - Early Payout Option	(116,738)	Principal and interest on LA3902-137 - early payout option
Principal and Interest on Maturing Debt	(167,822)	Principal and interest on LA3661-116 & LA3661-118
Enhanced Facility Management Support	102,500	2027 IBC: 11b-3.2 Staff and O&M to Support Broadened FM Portfolio
Conveyance Fee and Agricultural Rate	75,000	Increase to reflect changes in rates and estimated consumption
Operations & Maintenance Support	69,091	Increased support of ongoing water operations
Transfer to Debt Reserve Fund	(343,390)	Change in 1% security deposit upon commencement of new debt.
Total Other Changes	2,659,363	
2027 Budget	**51,854,383**	

Summary of % Expense Increase	
Transfer to Water Capital Fund	4.1%
Base salary and benefit change	0.7%
IBCs	0.3%
Debt Servicing Costs	1.5%
Balance of change	-0.4%
% expense increase from 2026:	***6.2%***

Overall 2026 Budget Performance
(expected variance to budget and surplus treatment)

Water demand is forecasted slightly higher than budget ($279k), while operational costs are forecasted below budget due to temporary vacancies ($210k); and lower debt servicing costs due to the timing of borrowing and deferred capital activity ($336k); and the deferral of one-time initiatives ($150k); and various other costs such as meeting expenses, travel, office supplies ($49k). The forecasted net surplus of $1.02M *will be transferred to the service's Water Capital Fund.*

Rate Base for 2027 Revenue Year

	2025 Application	2026 Application	End of 2026 for '27 Applic.	Change	
Wholesale System					
Physical Plant	$ 229,399,000	$ 241,893,836	$ 271,912,834	$ 30,018,998	*1*
Construction Work in Progress	$ 19,411,782	$ 17,979,375	$ 22,240,593	$ 4,261,218	*1*
Cash Working Capital	$ 2,725,626	$ 2,903,232	$ 2,962,115	$ 58,883	
Inventory	$ 225,000	$ 225,000	$ 225,000	$ -	
Total Wholesale Rate Base	$ 251,761,408	$ 263,001,443	**$ 297,340,542**	$ 34,339,099	

Note 1: Refer to the Schedule of Change in Physical Plan & work in Progress for details.

Schedule of Change in Physical Plant & Work in Progress

Wholesale

Projected Asset Additions	Projected Assets Capitalized
Dam Improvements	$ 2,930,602
Computer Equipment	625,952
Road Upgrade	581,153
Meter Replacement	460,000
GVWSA Bridge Supply & Installation	360,000
Valve Chamber Upgrades	290,000
Watershed Security Enhancements	280,000
Watershed Culvert Replacement	260,000
Water Supply Equipment Upgrades	221,887
Vehicles	220,090
Goldstream IWS Field Office	207,500
Pipe Replacements	205,774
Hydrology Equipment	166,442
Sooke Autogate Upgrade	150,000
SCADA	146,596
Water Quality Equipment	100,000
GVWSA Spill Mgmnt Plan and Implementation	90,000
Transmission System Component Replacement	80,000
Other Projects (6 minor projects below $30k)	119,741
Total Projected Assets Capitalized	$ 7,495,736
Less: Current Year's Depreciation	(7,861,169)
Add: (Less): Change in prior year forecast addition estimates & disposals	30,384,431
Change in Physical Plant	**$ 30,018,998**

Projected Construction Work In Progress (CWIP)	Projected Assets CWIP
Goldstream Field Operations Centre	$ 10,152,881
PIPES	6,510,000
Dam Safety Improvements	1,026,700
Major Main Repairs	650,000
SCADA Upgrades	520,550
Enterprise Asset Management System	400,000
Valve Replacements	398,325
Water Quality Equipment	300,000
EV Charging Stations	300,000
Treatment Plant Improvement Program	280,000
Road Upgrades	263,136
Reservoir	230,000
Mt Tolmie Reservoirs	200,000
Assessments	153,981
Critical Equip Storage Building	150,000
Sooke Dam Safety Improvements	125,000
System Modelling & Analytics	109,950
Strategic Asset Management Plan	90,000
Corrosion Protection Program	80,000
Supply System	61,253
Vehicles	50,000
Program Planning & Delivery	40,242
Cross Connection	47,978
Other Projects (4 minor projects below $35k)	100,597
Projected CWIP	$ 22,240,593
Less: Prior year's projected CWIP	(17,979,375)
Change in CWIP	**$ 4,261,218**

Revenue Requirements for 2027 Year

	2025 Application	2026 Application	2027 Application	Change	
Wholesale system					
Operations & maintenance	$ 22,107,854	$ 23,548,440	$ 24,057,603	$ 509,163	
Depreciation	$ 7,299,832	$ 7,861,169	$ 7,913,235	$ 52,066	
Return on rate base	$ 15,363,900	$ 17,044,400	$ 19,883,500	$ 2,839,100	1
Subtotal	$ 44,771,586	$ 48,454,009	$ 51,854,338	$ 3,400,329	
Non-rate revenue	$ (582,060)	$ (582,060)	$ (588,860)	$ (6,800)	
Total Wholesale	$ 44,189,526	$ 47,871,949	**$ 51,265,478**	$ 3,393,529	

Note 1: Return on rate base is calculated with reference to the long-term Canada bond rate and the average debt rate.

2027 Demand Estimate

Wholesale Demand

Years	Actual Demand cu. metre		Budgeted Demand cu.metre
2021	51,797,082		48,000,000
2022	50,297,409		49,000,000
2023	51,886,834		49,500,000
2024	49,774,663		51,000,000
2025	52,163,021		51,200,000
2026	51,700,000	1	51,400,000
2027 Demand Estimate	**51,500,000**		

1. Projected consumption for 2026

Summary of Wholesale Water Rates

	2023	2024	2025	2026	2027	$ Change	% Change
Wholesale water rate							
Unit cost per cu.m.	$ 0.7698	$ 0.8094	$ 0.8631	$ 0.9314	$ 0.9954	$ 0.0640	6.88%

Wholesale Water Rate Increase
Impact on Residential Water Bill

Average Annual Consumption: * 229 cubic meters

Charge for Twelve Months Consumption	Year	Annual Charge	2027 Annual Change, $
Average Consumption	2026	$ 213.28	
	2027	$ 227.96	$ 14.68
Half Average Consumption	2026	$ 106.64	
	2027	$ 113.98	$ 7.34
Twice Average Consumption	2026	$ 426.56	
	2027	$ 455.92	$ 29.36

** Average Annual Consumption based on 2.202 people per household, per BC Stats 2027 projection*

Schedule A
Asset Useful Life Assignments - PSAB

Classes:	Code	Asset Categories	Useful Life, Years
Land	LAND	Land & Rights of Way * (Note 1)	N/A
Building	BLDG	Building, Permanent	50
	BLOT	Building, Temporary/ Portable	20
	BLFX	Building fixture (*sprinklers)*	20
Equipment	BOAT	Boats & Marine Equipment	10
	COMP	Computer Equipment (*includes software*)	5
	ELEC	Electronic Equipment(*hydromet, weather stn eqpt)*	5
	FIRE	Fire & Safety Equipment	10
	GENT	Generator	20
	HYDR	Hydrants and Standpipes	20
	HYDY	Hydrology	10
	MTRS	Meters	20
	OFFE	Office Equipment	5
	OFFF	Office Furniture	10
	SCDA	SCADA Equipment	10
	SCRN	Intake Screens/Membranes *(stop logs)*	20
	SHOP	Shop Equipment	10
	TELE	Telecommunication Eqpt (*radios, phone systems*)	10
	WEQP	Water Works Eqpt(*W.Quality lab, Wshed eqpt)*	10
	NEW GRP	Weather stn & communication tower	15
Vehicle	VEHC	Vehicles	8
Engineering	BRDG	Bridge	50
Structure	CANL	Canal	50
	DAMS	Dam Structures	100
	PIPE	Pipelines, includes Vaults, Kiosks, Valve chambers	75
	PIPF	Pipelines, fittings	20
	PLPV	Parking lot paved	40
	PSEQ	Pump Station Equipment	20
	PSHS	Pump Station Housing	50
	PRVS	Valves, Flushes & PRV's	20
	RDGR	Roads gravel	20
	RDPV	Roads paved	40
	RESS	Reservoirs (steel & concrete)	50
	REST	Reservoirs (tower/tank)	35
	TANK	Storage tank	40
	TELP	Telephone and Power Lines	50
	TUNN	Tunnel, Culvert and Diversions	50
	WATP	Water Treatment Plant	25
	WELL	Wet well/ Well	50
Other Assets	CSTU	Capital Management Studies	5
	FENC	Fences	15
	LIMP	Land & Yard Improvements	20

Note 1: Land is not depreciated so a useful life assignment is not applicable.

Program Group: CRD-Regional Water Supply

SUMMARY	2026 BOARD BUDGET	2026 ESTIMATED ACTUAL	2027 BUDGET REQUEST: 2027 CORE BUDGET	2027 ONGOING	2027 ONE-TIME	TOTAL (COL 4, 5 & 6)	FUTURE PROJECTIONS: 2028	2029	2030	2031
1	2	3	4	5	6	7	8	9	10	11
GENERAL PROGRAM EXPENDITURES:										
WATERSHED PROTECTION	7,222,113	6,959,415	7,311,125	-	-	7,311,125	7,457,757	7,607,264	7,759,757	7,915,346
WATER OPERATIONS	8,615,028	8,661,932	8,767,969	-	-	8,767,969	8,993,987	9,175,801	9,359,065	9,543,233
WATER QUALITY	2,205,521	2,166,843	2,367,179	-	-	2,367,179	2,433,912	2,503,601	2,575,273	2,648,448
CROSS CONNECTION	872,762	859,282	909,077	-	-	909,077	935,337	962,212	989,872	1,018,352
DEMAND MANAGEMENT	885,034	883,551	907,983	3,800	-	911,783	929,849	950,324	971,485	998,148
INFRASTRUCTURE ENGINEERING	916,100	916,100	872,461	-	-	872,461	911,517	940,001	959,854	978,643
FLEET OPERATION & MAINTENANCE	(670,484)	(656,869)	(818,780)	-	-	(818,780)	(835,150)	(851,860)	(868,890)	(886,270)
ASSET & MAINTENANCE MANAGEMENT & GM SUPPORT	1,122,366	970,099	1,146,785	112,404	2,600	1,261,789	1,357,801	1,397,669	1,433,652	1,464,192
TOTAL OPERATING EXPENDITURES	21,168,440	20,760,353	21,463,799	116,204	2,600	21,582,603	22,185,010	22,685,012	23,180,068	23,680,092
**Percentage increase over prior year's board budget*			1.40%	0.55%	0.01%	1.96%	2.79%	2.25%	2.18%	2.16%
CONVEYANCE FEE FOR SERVICE TO FIRST NATIONS	500,000	500,000	525,000	-	-	525,000	550,000	575,000	600,000	625,000
AGRICULTURAL WATER RATE FUNDING	1,900,000	1,900,000	1,950,000	-	-	1,950,000	2,000,000	2,050,000	2,100,000	2,150,000
			2.63%			2.63%	2.56%	2.50%	2.44%	2.38%
CAPITAL EXPENDITURES & TRANSFERS										
TRANSFER TO WATER CAPITAL FUND	21,000,000	22,023,913	23,000,000	-	-	23,000,000	26,500,000	27,750,000	29,200,000	30,700,000
TRANSFER TO EQUIPMENT REPLACEMENT FUND	670,484	670,484	818,780	-	-	818,780	835,150	851,860	868,890	886,270
TRANSFER TO DEBT RESERVE FUND	350,190	323,000	6,800	-	-	6,800	352,200	348,000	452,000	388,800
TOTAL CAPITAL EXPENDITURES & TRANSFERS	22,020,674	23,017,397	23,825,580	-	-	23,825,580	27,687,350	28,949,860	30,520,890	31,975,070
DEBT SERVICING										
DEBT-INTEREST & PRINCIPAL	3,215,038	2,878,620	3,971,200	-	-	3,971,200	4,515,556	7,880,073	11,535,004	15,661,423
TOTAL DEBT EXPENDITURES	3,215,038	2,878,620	3,971,200	-	-	3,971,200	4,515,556	7,880,073	11,535,004	15,661,423
DEFICIT TRANSFERRED TO FOLLOWING YR										
TRANSFER TO FOLLOWING YEAR DEFICIT CARRY FORWARD										
TOTAL EXPENDITURES	48,804,152	49,056,370	51,735,579	116,204	2,600	51,854,383	56,937,916	62,139,945	67,935,962	74,091,585
			6.01%	0.24%	0.01%	6.25%	9.80%	9.14%	9.33%	9.06%
SOURCES OF FUNDING										
REVENUE - SALES	(47,871,902)	(48,151,310)	(51,146,719)	(116,204)	(2,600)	(51,265,523)	(56,003,656)	(61,209,885)	(66,901,902)	(73,120,725)
REVENUE - OTHER	(932,250)	(905,060)	(588,860)	-	-	(588,860)	(934,260)	(930,060)	(1,034,060)	(970,860)
TOTAL SOURCES OF FUNDING OPERATIONS	(48,804,152)	(49,056,370)	(51,735,579)	(116,204)	(2,600)	(51,854,383)	(56,937,916)	(62,139,945)	(67,935,962)	(74,091,585)
TRANSFER PRIOR YEAR										
TRANSFER TO FOLLOWING YEAR SURPLUS CARRY FORWARD										
TOTAL SOURCES OF FUNDING	(48,804,152)	(49,056,370)	(51,735,579)	(116,204)	(2,600)	(51,854,383)	(56,937,916)	(62,139,945)	(67,935,962)	(74,091,585)
Percentage increase over prior year's board budget			6.01%	0.24%	0.01%	6.25%	9.80%	9.14%	9.33%	9.06%
Water Rate $ per cu. m.	$ 0.9314					$ 0.9954	$ 1.0853	$ 1.1839	$ 1.2915	$ 1.4089
Pencentage increase over prior year	7.91%					6.88%	9.03%	9.08%	9.09%	9.08%

CAPITAL REGIONAL DISTRICT

FIVE YEAR CAPITAL EXPENDITURE PLAN SUMMARY - 2027 to 2031

Service No. 2.670 Regional Water Supply	Carry Forward 2026	2027	2028	2029	2030	2031	TOTAL
EXPENDITURE							
Buildings	$5,150,000	$4,850,000	$300,000	$0	$0	$0	$5,150,000
Equipment	$4,744,000	$7,709,000	$5,640,000	$12,940,000	$17,590,000	$2,325,000	$46,204,000
Land	$1,160,000	$1,880,000	$2,150,000	$2,120,000	$920,000	$1,270,000	$8,340,000
Engineered Structures	$32,855,000	$44,980,000	$43,950,000	$43,495,000	$47,495,000	$63,945,000	$243,865,000
Vehicles	$2,050,000	$2,905,000	$495,000	$355,000	$200,000	$200,000	$4,155,000
	$45,959,000	**$62,324,000**	**$52,535,000**	**$58,910,000**	**$66,205,000**	**$67,740,000**	**$307,714,000**
SOURCE OF FUNDS							
Capital Funds on Hand	$33,059,000	$47,989,000	$16,521,800	$23,553,000	$20,805,000	$28,464,000	$137,332,800
Debenture Debt (New Debt Only)	$0	$680,000	$35,218,200	$34,802,000	$45,200,000	$38,876,000	$154,776,200
Equipment Replacement Fund	$1,400,000	$2,255,000	$495,000	$355,000	$200,000	$200,000	$3,505,000
Grants (Federal, Provincial)	$6,000,000	$6,000,000	$0	$0	$0	$0	$6,000,000
Donations / Third Party Funding	$5,500,000	$5,400,000	$300,000	$200,000	$0	$200,000	$6,100,000
Reserve Fund	$0	$0	$0	$0	$0	$0	$0
	$45,959,000	**$62,324,000**	**$52,535,000**	**$58,910,000**	**$66,205,000**	**$67,740,000**	**$307,714,000**

Definitions for the 5-year Capital Plan

Asset Class	Asset class is used to classify assets for financial reporting in accordance with the Public Sector Accounting Board (PSAB) 3150. **L** - Land **S** - Engineering Structure **B** - Buildings **V** - Vehicles **E** - Equipment
Capital Expenditure Type	Capital expenditure type is used for reporting on asset investments and may be used to justify operational needs for a service. **Study** - Expenditure for feasibility and business case report. **New** - Expenditure for new asset only **Renewal** - Expenditure upgrades an existing asset and extends the service ability or enhances technology in delivering that service **Replacement** - Expenditure replaces an existing asset
Carryforward	Represents the carryforward amount from the prior year capital plan that is remaining to be spent. Forecast this spending over the next 5 years.
Funding Source	**Debt** - Debenture Debt (new debt only) **ERF** - Equipment Replacement Fund **Grant** - Grants (Federal, Provincial) **Cap** - Capital Funds on Hand **Other** - Donations / Third Party Funding **Res** - Reserve Fund **WU** - Water Utility If there is more than one funding source, additional rows are shown for the project.

CAPITAL REGIONAL DISTRICT

5 YEAR CAPITAL PLAN

2027 - 2031

Service #: 2.670

Service Name: Regional Water Supply

PROJECT DESCRIPTION				PROJECT BUDGET & SCHEDULE									
Project Number	Capital Expenditure Type	Capital Project Title	Capital Project Description	Total Project Budget	Asset Class	Funding Source	Carryforward from 2026	2027	2028	2029	2030	2031	5 - Year Total
WATERSHED PROTECTION													
Planning													
25-01	Study	Ecosystem Resilience Studies and Assessments	Modelling, studies and assessments of forest fuels, forest health, wildlife habitat and forest treatments in promoting forest resilience.	**$ 825,000**	L	WU	$ -	**$ 120,000**	**$ 120,000**	**$ 100,000**	**$ 100,000**	**$ 100,000**	$ 540,000
25-02	New	Public Engagement for Regional Water Supply	Public engagement plans and products.	$ 30,000	L	WU	$ 20,000	$ 20,000	**$ -**	**$ -**	$ -	$ -	$ 20,000
25-03	Study	GVWSA Risk Assessments & Procedures	Risk assessments and updating procedures e.g. security, biosecurity, spills	$ 300,000	L	WU	$ 10,000	$ 10,000	$ 100,000	$ -	$ 100,000	$ -	$ 210,000
25-05	Study	Forest Ecosystem Stewardship Plan	Development of a forest ecosystem stewardship plan for the GVWSA to enhance forest resilience and mitigate climate change.	$ 220,000	S	WU	$ 100,000	$ 100,000	$ 100,000	$ -	**$ -**	$ -	$ 200,000
Capital													$ -
09-01	Renewal	Leech River Watershed Restoration	A 17 year project to restore the Leech WSA lands for water supply.	$ 4,875,372	L	WU	$ 100,000	$ 100,000	$ -	$ -	$ -	$ -	$ 100,000
16-06	Renewal	New Field Operations Centre Building	Renewal of Water Quality field office/lab and equipment storage and Watershed Protection office, yard, training space and equipment storage, replacing longstanding temporary facilities.	$ 18,495,000	B	Other	$ 5,000,000	$ 4,700,000	$ 300,000	$ -	$ -	$ -	$ 5,000,000
20-01	Replacement	Kapoor Main Mile 1 Bridge and Asphalt Upgrade	Replacement of the existing undersized culvert with a large bridge as well as subsequent 500 m road asphalt replacement.	$ 1,190,000	S	WU	$ 50,000	$ 50,000	$ -	$ -	$ -	$ -	$ 50,000
25-06	New	Ecosystem Resilience Treatments	Thinning, juvenile spacing, forest fuel management stream restoration treatments to mitigate climate change, reduce wildfire risk and enhance forest resilience.	**$ 2,175,000**	L	WU	$ 25,000	$ 400,000	**$ 300,000**	$ 400,000	**$ 300,000**	**$ 400,000**	$ 1,800,000
25-06	New		Financial Offsets from Forest Thinning Projects	$ 600,000	L	Other	$ -	$ 200,000	$ -	$ 200,000	$ -	**$ 200,000**	$ 600,000
25-07	New	Hydromet Upgrades	Upgrading hydrology and weather sensors and stations.	$ 760,000	E	WU	$ -	**$ 135,000**	**$ 75,000**	**$ 75,000**	**$ 75,000**	$ -	$ 360,000
25-08	Renewal	Road Improvements	Gravel crushing, road deactivation, road upgrades, old bridge removal to service water supply and watershed protection infrastructure and activities in the GVWSA	**$ 3,170,000**	L	WU	$ -	**$ 450,000**	**$ 550,000**	**$ 400,000**	**$ 400,000**	**$ 550,000**	$ 2,350,000
25-09	New	Climate Change Mitigations	Equipment, infrastructure and upgrades to harden water supply infrastructure from climate related risks in the GVWSA	**$ 910,000**	E	WU	$ 270,000	$ 270,000	$ 150,000	$ 150,000	**$ 150,000**	**$ 100,000**	$ 820,000
25-10	Renewal	Property Management - Assessments and Upgrades	Assessments, planning and implementation of upgrades aimed at newly acquired GVWSA lands.	$ 783,000	E	WU	$ 200,000	$ 200,000	**$ 150,000**	**$ 50,000**	**$ 50,000**	**$ 50,000**	$ 500,000
25-11	Renewal	GVWSA Bridge Supply & Installation	Replacement of undersized culverts with climate ready bridges which allow for fish passage.	**$ 1,955,000**	S	WU	$ 100,000	$ 100,000	$ 475,000	**$ 475,000**	**$ 50,000**	**$ 475,000**	$ 1,575,000
27-03	**Decommission**	**Safety Improvements & Removal of Decommissioned Water Infrastructure**	**Projects to improve safety and/or remove old infrastructure in the GVWSA - (e.g. Sooke Trestle Improvements)**	**$ 710,000**	**E**	**WU**	**$ -**	**$ 60,000**	**$ 200,000**	**$ 50,000**	**$ 400,000**	**$ -**	$ 710,000
Watershed Protection Sub-Total				**$ 36,998,372**			**$ 5,875,000**	**$ 6,915,000**	**$ 2,520,000**	**$ 1,900,000**	**$ 1,625,000**	**$ 1,875,000**	**$ 14,835,000**
STRATEGIC PROGRAM INITIATIVES													
26-01	Study	Master Plan Program Management	Initiation and implementation of the RWS 2022 Master Plan Capital Improvement Program.	$ 16,400,000	S	WU	$ 400,000	$ 1,500,000	$ 1,500,000	$ 1,500,000	$ 1,500,000	$ 1,500,000	$ 7,500,000
26-02	New	Master Plan Project(s) Delivery	Continued planning, investigation and design of projects identified in the RWS 2022 Master Plan. This program will include development of the Project Definition Report and development of a piloting program.	$ 37,325,000	S	WU	$ 1,675,000	$ 1,675,000	$ 4,450,000	$ 7,950,000	$ 8,400,000	$ 14,850,000	$ 37,325,000
21-11	Replacement	RWS Supply Main No. 4 Upgrade & Main No. 1 High Pressurizing	Carry out system improvements to allow operatoinal pressure increase of Main No. 1 and upgrade approximately 2.2km of RWS Supply Main No. 4 from concrete cylinder pipe to a resilient steel pipe system, better able to withstand a seismic event.	$ 93,000,000	S	WU	$ 4,750,000	$ 1,320,000	**$ 14,355,000**	$ 17,160,000	$ 19,800,000	$ 7,524,000	$ 60,159,000
21-11			***DCC Eligible Funding Component (DCC Items W12 & W14) - Debt***		**S**	**Debt**	**$ -**	**$ 680,000**	**$ 7,395,000**	**$ 8,840,000**	**$ 10,200,000**	**$ 3,876,000**	$ 30,991,000

CAPITAL REGIONAL DISTRICT

5 YEAR CAPITAL PLAN

2027 - 2031

Service #: 2.670

Service Name: Regional Water Supply

PROJECT DESCRIPTION				PROJECT BUDGET & SCHEDULE									
Project Number	Capital Expenditure Type	Capital Project Title	Capital Project Description	Total Project Budget	Asset Class	Funding Source	Carryforward from 2026	2027	2028	2029	2030	2031	5 - Year Total
23-17	Replacement	Main No. 4 - Mt Newton to Highway 17 & Bear Hill Trunk Extension (RWS Contribution to SPWS Project)	Approximately 2.9km of Main No. 4 concrete cylinder tranmission main to replacement from Mt Newton Cross Rd/Central Saanich Rd to Island View Rd and Lochside Drive. This project is also being expanded to partially fund the extension of the Bear Hill Tunk Sewer on East Saanich Road from Wallace Drive to Dean Lower Tank.	$ 39,000,000	S	WU	$ 10,000,000	$ 18,000,000	$ 5,700,000	$ -	$ -	$ -	$ 23,700,000
23-17	Replacement					Grant	$ 6,000,000	$ 6,000,000	$ -	$ -	$ -	$ -	$ 6,000,000
27-01	**Renewal**	**Supply Main No. 3 Storage & Twinning Assessment & Upgrades**	**Assesses long range options for storage and twinning of Supply Main No. 3, including Mount Tolmie Tank, Smith Hill Reservoir and Main No. 3 Twinning. Development of preferred option and conceptual design will support future planning and implementation.**	**$ 750,000**	**S**	**WU**	**$ -**	**$ 500,000**	**$ 250,000**	**$ -**	**$ -**	**$ -**	$ 750,000
20-04	Study	Sooke Lake HyDy Model Development	Critical data collection, model building+calibration, model utilization for 3 different scenarios	$ 520,000	E	WU	$ 50,000	$ 50,000	$ -	$ -	$ -	$ -	$ 50,000
25-04	Study	Master Plan Projects - Watershed Hydrology Support	Additional hydrology/water quality data collection and analyses to inform Master Plan infrastructure projects.	$ 700,000	S	WU	$ 25,000	$ 155,000	$ 100,000	$ 100,000	$ 75,000	$ -	$ 430,000
26-03	Study	Water Utility Rate Model	Review and assessment of current water rate model to assess best practice going forward.	$ 250,000	S	WU	$ 50,000	$ 200,000	$ 50,000	$ -	$ -	$ -	$ 250,000
27-02	Replacement	Supply Main No. 11 Concrete Pipe Replacement and bridge crossing	Replacement of segment of Concrete Cylinder Pipe from Sooke Lake Dam to Head Tank. Incorporate bridge replacement at spillway crossing. Future budget for this will be further refined based on outcomes of Project Definition Report for projects within the Watershed.	$ 25,000,000	E	WU	$ -	$ -	$ 500,000	$ 10,000,000	$ 14,500,000	$ -	$ 25,000,000
28-01	Renewal	Transmission Main Upgrade Program	Identify, conceptually design, detail design and construct transmission main upgrades.	$ 160,000,000	S	WU	$ -	$ -	$ -	$ -	$ -	$ 30,000,000	$ 30,000,000
Strategic Program Initiatives Sub-Total				**$ 372,945,000**			**$ 22,950,000**	**$ 30,080,000**	**$ 34,300,000**	**$ 45,550,000**	**$ 54,475,000**	**$ 57,750,000**	**$ 222,155,000**
INFRASTRUCTURE ENGINEERING AND OPERATIONS													
Planning													
16-10	New	Post Disaster Emergency Water Supply	Identify and procure emergency systems for post disaster preparedness.	**$ 2,995,000**	S	WU	$ 250,000	$ 450,000	$ 200,000	$ 200,000	$ 200,000	$ 100,000	$ 1,150,000
17-13	Study	Asset Management Planning	Development of a plan to inform future areas of study and highlight critical infrastructure improvements.	$ 1,120,000	S	WU	$ 430,000	$ 300,000	$ 330,000	$ -	$ -	$ -	$ 630,000
19-04	Study	Seismic Assessment of Critical Facilities Phase 2	Second phase seismic assessment of critical facilities will now be undertaken.	**$ 1,175,000**	S	WU	$ 100,000	$ 200,000	$ 200,000	$ 200,000	$ 200,000	$ 200,000	$ 1,000,000
20-08	Study	Regional Water DCC Program	Design of a Regional DCC Program	**$ 910,000**	S	WU	$ 150,000	$ 300,000	$ 100,000	$ -	$ 100,000	$ -	$ 500,000
26-04	Study	Kapoor Tunnel Assessment and Inspections	Development of inspection and monitoring plan for ongoing asset management.	$ 750,000	E	WU	$ 250,000	$ 250,000	$ 500,000	$ -	$ -	$ -	$ 750,000
21-05	Study	Level of Service and Transfer Agreements	Develop level-of-service agreements for participating municipalities to address hydraulic capacity of infrastructure.	$ 400,000	S	WU	$ 265,000	$ 365,000	$ 50,000	$ -	$ -	$ -	$ 415,000
Capital													$ -
18-08	Replacement	Bulk Supply Meter Replacement and Backflow Prevention Program	Planned replacement of aging bulk meter replacement based upon a condition assessment and water audit.	$ 2,700,000	E	WU	$ 400,000	$ 600,000	$ 250,000	$ 250,000	$ 250,000	$ 250,000	$ 1,600,000
18-15	Renewal	Corrosion Protection Program	Study deficiencies in the current material protection and implement recommendations.	**$ 1,735,000**	S	WU	$ 10,000	$ 110,000	$ 100,000	$ 100,000	$ 100,000	$ 100,000	$ 510,000
19-23	New	Critical Spare Equipment Storage & Pipe Yard	Plan, design and construct a critical equipment storage building.	$ 4,050,000	S	WU	$ 3,750,000	$ 3,750,000	$ -	$ -	$ -	$ -	$ 3,750,000
20-17	Replacement	Interim Smith Hill Reservoir Decommissioning Works	Plan for interim decommissioning and improvements at the Smith Hill Reservoir site. Budget to be refined based on outcomes of asssessments and long term planning.	$ 750,000	S	WU	$ 500,000	$ 500,000	$ -	$ -	$ -	$ -	$ 500,000
21-10	Replacement	SCADA Masterplan and System Upgrades	Update the SCADA Master Plan in conjunction with the Juan de Fuca Water Distribution, Saanich Peninsula Water and Wastewater, and Core Area Wastewater Services.	$ 1,350,000	E	WU	$ 800,000	$ 400,000	$ 200,000	$ 100,000	$ 100,000	$ 100,000	$ 900,000
22-15	New	Microwave Radio Upgrades	To provide a high bandwidth communications backbone to the RWS system, a microwave communications system will be installed.	$ 1,100,000	S	WU	$ 830,000	$ 830,000	**$ -**	$ -	$ -	$ -	$ 830,000
24-11	Replacement	IT Core Infrastructure Replacement and Cyber Security Upgrades	Replacement and upgrades to Core IT infrastructure such as servers, network switches, UPS, etc for equipment end of life and cyber security upgrades. Includes IT equipment located at tower sites within the RWS system.	$ 420,000	E	WU	$ 15,000	$ 145,000	$ 250,000	$ -	$ -	$ -	$ 395,000

CAPITAL REGIONAL DISTRICT

5 YEAR CAPITAL PLAN

2027 - 2031

Service #: 2.670

Service Name: Regional Water Supply

PROJECT DESCRIPTION				PROJECT BUDGET & SCHEDULE									
Project Number	Capital Expenditure Type	Capital Project Title	Capital Project Description	Total Project Budget	Asset Class	Funding Source	Carryforward from 2026	2027	2028	2029	2030	2031	5 - Year Total
24-12	Renewal	Head Tank Valve & Main No. 4&5 Valve Replacement	Supply and installation of valves and actuators at Head Tank and Main #4&5. Includes flushing plan and coordination efforts.	$ 1,750,000	E	WU	$ 200,000	$ 500,000	$ 800,000	$ -	$ -	$ -	$ 1,300,000
24-19	Renewal	Mount Tolmie Tank Assessment and Interim Improvements	Structural, infiltration and other miscellaneous improvements at Mt Tolmie Tank. Budget to be refined based on outcomes of asssessments and long term planning.	$ 1,600,000	E	WU	$ 600,000	$ 600,000	$ -	$ -	$ -	$ -	$ 600,000
25-24	Renewal	Water Treatment Plant Improvements Program	Ongoing program to address multiple, small to mid-scale capital improvements required at the Goldstream WTP and Sooke River Road WTP.	**$ 1,650,000**	E	WU	$ 300,000	**$ 500,000**	**$ 200,000**	**$ 200,000**	**$ 200,000**	**$ 200,000**	$ 1,300,000
Infrastructure Engineering and Operations Sub-Total				**$ 24,455,000**			**$ 8,850,000**	**$ 9,800,000**	**$ 3,180,000**	**$ 1,050,000**	**$ 1,150,000**	**$ 950,000**	**$ 16,130,000**
DAM SAFETY PROGRAM													
19-07	New	Integrate Dam Performance and Hydromet to SCADA	IT driven project to integrate the dam safety instrumentation/surveillance (i.e. piezometers and weirs) and HydroMet stations to report to WIO through the existing SCADA system.	**$ 4,050,000**	E	WU	$ 50,000	**$ 1,200,000**	**$ 800,000**	**$ 500,000**	**$ 300,000**	$ -	$ 2,800,000
19-13	New	Dam Safety Instrumentation	The existing dam safety instrumentation/surveillance equipment is getting older and will need to be replaced/rehabilitated (does not include pending SCADA effort). IT Driven Project	$ 250,000	E	WU	$ 250,000	$ 250,000	$ -	$ -	$ -	$ -	$ 250,000
25-13	Study	Sooke Lake & Deception Water Supply Area Dams - Regulatory Compliance, Dam Safety Planning & Analyses	Ongoing projects involving studies, dam safety planning and regulatory requirements activities for the various dams within the Sooke Lake Watershed. Outcomes from the various studies will inform future capital improvements.	**$ 6,515,000**	S	WU	$ 935,000	$ 1,850,000	$ 1,300,000	$ 800,000	$ 600,000	$ 1,000,000	$ 5,550,000
25-14	Renewal	Sooke Lake & Deception Water Supply Area Dams - Upgrades and Improvements Program	Ongoing program to complete dam upgrades and improvements from the Dam Safety Risk Register, which have been identified through the Sooke Lake Water Supply Area Dams - Regulatory, Planning & Analysis Program.	$ 18,250,000	S	WU	$ 1,445,000	$ 2,000,000	$ 3,750,000	$ 3,500,000	$ 3,000,000	$ 1,000,000	$ 13,250,000
25-15	Study	Goldstream Water Supply Area Dams - Regulatory Compliance, Dam Safety Planning & Analyses	Ongoing projects involving studies, dam safety planning and regulatory requirements activities for the various dams within the Goldstream Watershed. Outcomes from the various studies will inform future capital improvements.	$ 7,200,000	S	WU	$ 300,000	**$ 1,200,000**	$ 1,500,000	$ 250,000	$ 200,000	$ 200,000	$ 3,350,000
25-16	Renewal	Goldstream Water Supply Area Dams - Upgrades and Improvements Program	Ongoing program to complete dam upgrades and improvements from the Dam Safety Risk Register, which have been identified through the Goldstream Water Supply Area Dams - Regulatory, Planning & Analysis Program.	**$ 6,885,000**	S	WU	$ 465,000	**$ 1,350,000**	$ 500,000	$ 1,000,000	$ 1,500,000	$ 1,500,000	$ 5,850,000
25-17	Study	Charters Dam - Regulatory Compliance, Dam Safety Planning & Analyses	Ongoing projects involving studies, dam safety planning and regulatory requirements activities for Charters Dam. Outcomes from the various studies will inform future capital improvements.	**$ 400,000**	S	WU	$ 100,000	$ -	$ 50,000	$ 50,000	$ 50,000	$ 250,000	$ 400,000
25-18	Renewal	Charters Dam - Upgrades and Improvements Program	Ongoing program to complete dam upgrades and improvements from the Dam Safety Risk Register, which have been identified through the Charters Dam - Regulatory, Planning & Analysis Program.	$ 200,000	S	WU	$ 25,000	$ 25,000	$ 25,000	$ -	$ 150,000	$ -	$ 200,000
Dam Safety Program Sub-Total				**$ 43,750,000**			**$ 3,570,000**	**$ 7,875,000**	**$ 7,925,000**	**$ 6,100,000**	**$ 5,800,000**	**$ 3,950,000**	**$ 31,650,000**
WATER QUALITY													
24-15	**Replacement**	**Laboratory Renovations**	**Renovation for main lab cabinetry, floor, aquatic ecology lab and prep room.**	**$**	**B**	**WU**	**$ 150,000**	**$ 150,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 150,000**
25-19	Study	WQ Studies and Research Projects	Ongoing program budget for water quality studies and operation of Sooke Lake Hydrodynamic Model.	**$ 200,000 1,400,000**	S	WU	$ 150,000	$ 350,000	$ 250,000	$ 250,000	$ 250,000	$ 250,000	$ 1,350,000
28-02	**New**	**Permanent Sensor Moorings**	**Permanent moorings to allow water quality to access sensors in Sooke Lake.**	**$ 100,000**	**S**	**WU**			**$100,000**	**$ -**	**$ -**	**$ -**	**$ 100,000**
Water Quality Sub-Total				**$ 1,700,000**			**$ 300,000**	**$ 500,000**	**$ 350,000**	**$ 250,000**	**$**	**$ 250,000**	**$ 1,600,000**

250,000

CAPITAL REGIONAL DISTRICT

5 YEAR CAPITAL PLAN

2027 - 2031

Service #: 2.670

Service Name: Regional Water Supply

PROJECT DESCRIPTION				PROJECT BUDGET & SCHEDULE									
Project Number	Capital Expenditure Type	Capital Project Title	Capital Project Description	Total Project Budget	Asset Class	Funding Source	Carryforward from 2026	2027	2028	2029	2030	2031	5 - Year Total
ANNUAL PROVISIONAL													
17-28	Replacement	Watershed Security Infrastructure Upgrade & Replacement	New, upgrade and replacement of security infrastructure in the GVWSA.	$ 1,000,000	E	WU	$ -	$ 200,000	$ 200,000	$ 200,000	$ 200,000	$ 200,000	$ 1,000,000
17-29	Replacement	Water Supply Area Equipment & Replacement	Hydrometeorological, fireweather and wildfire suppression equipment replacement.	$ 760,000	E	WU	$ -	$ 140,000	$ 140,000	$ 140,000	$ 140,000	**$ 200,000**	$ 760,000
17-30	Replacement	Transmission Main Repairs	Emergency repairs to the transmission mains.	$ 1,000,000	S	WU	$ -	$ 200,000	$ 200,000	$ 200,000	$ 200,000	$ 200,000	$ 1,000,000
17-31	Replacement	Transmission System Components Replacement	Replacement and repair of transmission components.	$ 750,000	S	WU	$ -	**$ 150,000**	$ 150,000	$ 150,000	$ 150,000	$ 150,000	$ 750,000
17-33	Replacement	Disinfection Equipment and other Water Treatment Components and Parts Replacement	Replacement of incidental equipment and parts associated with the water treatment facilities.	$ 1,500,000	E	WU	$ -	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 1,500,000
17-34	Study	Supply System Computer Model Update	Annual update of the regional hydraulic model.	$ 100,000	S	WU	$ -	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 100,000
19-16	Replacement	Dam Improvements	Items not covered by Dam Safety Reviews, but brought up in Dam Safety Inspections and Dam Safety Reviews and address items in the dam safety database/risk registry and to support operations.	$ 1,500,000	S	WU	$ -	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 1,500,000
19-22	Replacement	SCADA Repairs, Equipment Replacement and Comms upgrades	Items not covered by the SCADA Replacement and SCADA Master Plan, but integral in maintaining the SCADA System and revenue meter system.	$ 1,200,000	E	WU	$ -	$ 200,000	$ 250,000	$ 250,000	$ 250,000	$ 250,000	$ 1,200,000
21-15	Replacement	Corrosion Protection	Replace corrosion protection assets, such as coatings, for the transmission system when identified.	$ 250,000	S	WU	$ -	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 250,000
21-16	Replacement	Valve Chamber Upgrades	Replace failing valves and appurtenances along the RWS supply system.	$ 2,000,000	S	WU	$ -	**$ 400,000**	$ 400,000	$ 400,000	$ 400,000	$ 400,000	$ 2,000,000
21-17	Replacement	Water Quality Equipment Replacement	Replacement of water quality equipment for the water quality lab and water quality operations	$ 1,250,000	E	WU	$ -	$ 250,000	$ 250,000	$ 250,000	$ 250,000	$ 250,000	$ 1,250,000
21-18	Renewal	LIMS support	Support for LIMS database	$ 125,000	E	WU	$ -	$ 25,000	$ 25,000	$ 25,000	$ 25,000	$ 25,000	$ 125,000
23-20	Study	Land Exchange/Acquisition	Land surveys, appraisals to support decisions regarding land exchange, acquisition or disposition to increase catchment area, buffer water supply areas and other possible land exchange and acquisition within the RWS system.	$ 220,000	L	WU	$ -	**$ 80,000**	**$ 80,000**	$ 20,000	$ 20,000	**$ 20,000**	$ 220,000
Annual Provisional Sub-Total				**$ 11,655,000**			**$ -**	**$ 2,315,000**	**$ 2,365,000**	**$ 2,305,000**	**$**	**$ 2,365,000**	**$ 11,655,000**
											2,305,000		

CAPITAL REGIONAL DISTRICT

5 YEAR CAPITAL PLAN

2027 - 2031

Service #: 2.670

Service Name: Regional Water Supply

PROJECT DESCRIPTION				PROJECT BUDGET & SCHEDULE									
Project Number	Capital Expenditure Type	Capital Project Title	Capital Project Description	Total Project Budget	Asset Class	Funding Source	Carryforward from 2026	2027	2028	2029	2030	2031	5 - Year Total
CORPORATE ASSET AND MAINTENANCE MANAGEMENT (CAMM)													
17-35	Replacement	Vehicle & Equipment Replacement (Funding from Replacement Fund)	This is for replacement of vehicles and equipment used by CRD Water Services for the day-to-day operation and maintenance of the supply system.	$ 4,169,250	V	ERF	$ 1,400,000	$ 2,255,000	$ 495,000	$ 355,000	$ 200,000	$ 200,000	$ 3,505,000
23-21	New	EV Charging Stations Electrical Infrastructure	Electrical System upgrades at 479 Island Hwy to power up 44 charging stations	**$ 850,000**	E	WU	$ 184,000	$ 184,000	$ -	$ -	$ -	$ -	$ 184,000
23-22	New	Fuel Truck	Fuel tender truck	**$ 400,000**	E	WU	$ 275,000	$ 350,000	$ -	$ -	$ -	$ -	$ 350,000
23-31	New	Land and Site Works	Purchasing of land and site works to support RWS facilities.	$ 2,500,000	L	WU	$ 1,005,000	$ 500,000	$ 1,000,000	$ 1,000,000	$ -	$ -	$ 2,500,000
25-22	New	New Vehicles - Watershed & Water Operations	4 New Electric Vehicles for Watershed & Water Operations	$ 360,000	V	WU	**$ 90,000**	**$ 90,000**	$ -	$ -	$ -	$ -	$ 90,000
25-23	New	Enterprise Asset Management System	Development of EAM system, including software and process implementation, for services to maintain assets and report on asset performance.	$ 4,600,000	E	WU	$ 400,000	$ 100,000	$ 400,000	$ 400,000	$ 400,000	$ 400,000	$ 1,700,000
25-23	New	Enterprise Asset Management System			E	Other	$ 500,000	$ 500,000	$ -	$ -	$ -	$ -	$ 500,000
26-05	New	New Electric Vehicles Watershed, Fleet Pool	New electric vehicles for Watershed and Fleet pool.	$ 360,000	V	WU	$ 180,000	$ 180,000	$ -	$ -	$ -	$ -	$ 180,000
26-06	New	Fleet Service Trucks	One new heavy pickup truck and transfer Regional Parks Ops fleet mechanic service truck to Corporate Fleet.	$ 380,000	V	WU	$ 380,000	$ 380,000	$ -	$ -	$ -	$ -	$ 380,000
27-04	**New**	**Enterprise Data Historian Management System**	**A data historian is required to store large amounts of data that is required for compliance reporting to regulators, operational performance reports, cost allocation, and engineering analysis.**	**$ 300,000**	**E**	**WU**	**$ -**	**$ 300,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 300,000**
CAMM Sub-Total				**$ 13,919,250**			**$ 4,414,000**	**$ 4,839,000**	**$ 1,895,000**	**$ 1,755,000**	**$ 600,000**	**$ 600,000**	**$ 9,689,000**
			Grand Total	**$ 505,422,622**			**$ 45,959,000**	**$ 62,324,000**	**$ 52,535,000**	**$ 58,910,000**	**$ 66,205,000**	**$ 67,740,000**	**$ 307,714,000**

Service:	2.670	Regional Water Supply

Project Number	25-01	**Capital Project Title**	Ecosystem Resilience Studies and Assessments	**Capital Project Description**	Modelling, studies and assessments of forest fuels, forest health, wildlife habitat and forest treatments in promoting forest resilience.
Project Rationale	Watershed Protection is undertaking and working collaboratively with academic institutions and federal and provincial agencies on a variety of assessments and research studies relating to the health of forests and other ecosystems in the GVWSA, how projected climate change could affect forest health and wildfire in the GVWSA, how forest management could reduce potential threats to forests, and the effects of forest thinning and fuel management activities. The results of these assessments and studies will be used to inform the forest management plan for the GVWSA (Project 25-05).				

Project Number	25-02	**Capital Project Title**	Public Engagement for Regional Water Supply	**Capital Project Description**	Public engagement plans and products.
Project Rationale	The Watershed Protection division provides educational tours of the GVWSA and Regional Water Supply infrastructure and is seeking new ways to making this information available to a broader portion of the service area population.				

Project Number	25-03	**Capital Project Title**	GVWSA Risk Assessments & Procedures	**Capital Project Description**	Risk assessments and updating procedures e.g. security, biosecurity, spills
Project Rationale	Assessments such as biosecurity and physical security are required to determine how best to reduce risks to water quality in the GVWSA. The results of assessments are used to develop and implement plans and procedures.				

Project Number	25-05	**Capital Project Title**	Forest Ecosystem Stewardship Plan	**Capital Project Description**	Development of a forest ecosystem stewardship plan for the GVWSA to enhance forest resilience and mitigate climate change.
Project Rationale	Development of a plan for the forest ecosystems of the GVWSA to enhance forest resilience and mitigate climate change based on modelling, risk assessment, input from subject matter experts and First Nations.				

Project Number	09-01	**Capital Project Title**	Leech River Watershed Restoration	**Capital Project Description**	A 17 year project to restore the Leech WSA lands for water supply.
Project Rationale	A 17 year project to restore the Leech WSA lands for water supply. A close out report was completed and presented to RWSC in January 2026. Remaining project work will be completed and closed in 2027. Going forward restoration projects in the Leech WSA will be funded as part of other capital line items.				

Service:	2.670	Regional Water Supply

Project Number	Capital Project Title	Capital Project Description
16-06	New Field Operations Centre Building	Renewal of Water Quality field office/lab and equipment storage and Watershed Protection office, yard, training space and equipment storage, replacing longstanding temporary facilities.

Project Rationale Watershed Protection staff (27 FTE and 8 seasonal auxiliaries) are currently located in 2 trailers and a house at the Goldstream Gate entrance to the water supply area, and in office space at the Integrated Water Services office in View Royal. The trailers were considered temporary office space since their implementation over 15 years ago. The trailers are old, prone to leaks and a concern for mold. Water Quality field staff are located in another temporary facility, since their field office was on the gravel pit property that was sold to Langford. In addition, there are insufficient facilities for operational training, equipment storage, emergency management and public education. The separation of staff between various Goldstream facilities and the View Royal location causes inefficiencies and organizational difficulties. The IWS office is also above capacity and moving Watershed Protection staff out will extend the existing office space. A design build contract was executed in fall 2025 with construction beginning in early 2026. Funding of $ 5 million to the project was obtained through sale of the IWS gravel pit to City of Langford. Additional funding of $3 million is transferred to the project from CRD Corporate for Emergency Operations Centre and office space. As part of the project a sanitary line is being built with some City of Langford reimbursement to connect to the closest wastewater system.

Project Number	Capital Project Title	Capital Project Description
20-01	Kapoor Main Mile 1 Bridge and Asphalt Upgrade	Replacement of the existing undersized culvert with a large bridge as well as subsequent 500 m road asphalt replacement.

Project Rationale In 2025 the existing culvert at Mile 1 on Kapoor Main (which is the primary access road to Sooke Lake Reservoir and Dam) was replaced with a bridge to improve water carrying capacity at peak flows, fish passage and bank stability. The asphalt section uphill of the bridge is to be replaced in 2026 with final closeout in early 2027.

Project Number	Capital Project Title	Capital Project Description
25-06	Ecosystem Resilience Treatments	Thinning, juvenile spacing, forest fuel management stream restoration treatments to mitigate climate change, reduce wildfire risk and enhance forest resilience.

Project Rationale This project is used to fund a variety of forest and fuel maanagement treatments to reduce wildfire risk and enhance forest resilience in the GVWSA in a changing climate. The specific approaches and methodolgies will be informed by the results of a variety of landscape level inventories and assessments and learnings from forest and fuel management trials to date.

Project Number	Capital Project Title	Capital Project Description
25-07	Hydromet Upgrades	Upgrading hydrology and weather sensors and stations.

Project Rationale Watershed Protection manages a network of 13 weather stations and 23 hydrometric (stream monitoring) stations in the GVWSA. Data from these stations are used to inform decision making relating to reservoir inflows, reservoir management, wildfire restrictions and wildfire response, flood and emergency repnse, and for assessments, modelling, analyses, and strategic and operational planning. The network was started in 1995 and new standards, technologies, and data needs require new stations and the upgrade and expansion of existing stations and data download, management, and distribution capabilities for continual improvement.

Service:	2.670	Regional Water Supply

Project Number	Capital Project Title	Capital Project Description
25-08	Road Improvements	Gravel crushing, road deactivation, road upgrades, old bridge removal to service water supply and watershed protection infrastructure and activities in the GVWSA

Project Rationale The network of roads within the GVWSA provide access to water supply facilities and infrastructure and for emergency response, security patrols, watershed management activities as well as research and monitoring. It is important that these roads be upgraded to accommodate the increased intensity, frequency, duration of major rainfall events with projected climate change, that new roads are developed where needed, and that unneccessary an/or poorly located roads are deactivated to reduce maintenance costs and reduce environmental and water quality impact.

Project Number	Capital Project Title	Capital Project Description
25-09	Climate Change Mitigations	Equipment, infrastructure and upgrades to harden water supply infrastructure from climate related risks in the GVWSA

Project Rationale This fund consolidates a number of smaller projects to purchase equipment, develop or update infrastructure within the GVWSA to improve response to extreme weather events, adapt to increased variation in the level of Sooke Lake Reservoir, and reduce risk to key infrastructure. A focus for 2027 is implementing a dock for Sooke Lake Reservoir and in subsequent years carrying out detailed peak flow analyses for drainage structures.

Project Number	Capital Project Title	Capital Project Description
25-10	Property Management - Assessments and Upgrades	Assessments, planning and implementation of upgrades aimed at newly acquired GVWSA lands.

Project Rationale When new properties are aquired, there are assessments required to determine the condition of roads and drainage structures, identify security needs, and other land/forest management issues, and then plan and implement improvements to meet CRD requirements and integrate these lands into Watershed Protection management programs. A focus in 2027 will be the newly acquired Kapoor lands as well as the Malahat Estates parcel.

Project Number	Capital Project Title	Capital Project Description
25-11	GVWSA Bridge Supply & Installation	Replacement of undersized culverts with climate ready bridges which allow for fish passage.

Project Rationale Watershed Protection has inventoried all drainage structures (culverts) within the GVWSA and is systematically replacing undersized structures on major streams with bridges to meet current environmental and flow standards and accommodate the projected increases in stream flows with a changing climate. This fund will be used for the costs associated with assessments, engineering, construction and installation of bridge projects in the GVWSA. The funds allocated implement typically one bridge project per year with some design only years.

Project Number	Capital Project Title	Capital Project Description
27-03	Safety Improvements & Removal of Decommissioned Water Infrastructure	Projects to improve safety and/or remove old infrastructure in the GVWSA - (e.g. Sooke Trestle Improvements)

Project Rationale The Regional Water Supply System includes a number of redundant structures that require planning to safely remove or decommission them. This inludes the Sooke River flowline trestle that has environmental and security risk, Cabin Pond dam and other flowline trestles. The 44 km flowline also requires refreshed signage to reduce CRD liability.

Service:	2.670	Regional Water Supply

Project Number	26-01	**Capital Project Title**	Master Plan Program Management	**Capital Project Description**	Initiation and implementation of the RWS 2022 Master Plan Capital Improvement Program.
Project Rationale	Funding to cover program management costs.				

Project Number	26-02	**Capital Project Title**	Master Plan Project(s) Delivery	**Capital Project Description**	Continued planning, investigation and design of projects identified in the RWS 2022 Master Plan. This program will include development of the Project Definition Report and development of a piloting program.
Project Rationale	Further, conceptualization of the projects identified in the RWS 2022 Master Plan based on the program risk management strategy, program vision, goal, and guiding principles, and updated project prioritization. This budget will include development of a Comprehensive Project Definition Report to address many topics for all of the proposed projects including siting studies, long term water supply planning, land acquisition requirements, conceptual design, geotechnical investigations, permitting, schedule development, cost estimating, pilot plant testing, subsequent Master Plan Updates and Adaptive Planning considerations. This budget will be further defined and broken out in subsequent years as early program development progresses.				

Project Number	21-11	**Capital Project Title**	RWS Supply Main No. 4 Upgrade & Main No. 1 High Pressurizing	**Capital Project Description**	Carry out system improvements to allow operatoinal pressure increase of Main No. 1 and upgrade approximately 2.2km of RWS Supply Main No. 4 from concrete cylinder pipe to a resilient steel pipe system, better able to withstand a seismic event.
Project Rationale	Supply Main No. 1 High Pressurizing: Increase operating pressure of Supply Main No. 1 from 116m to 169m HGL between Humpback PCS and Watkiss PCS. This work identified in Phase 1 of Transmission Main projects outlined in the 2022 RWS Master Plan and will increase capacity and operational flexibility in the water transmission system. As part of this work, CRD is also looking into reclaiming energy at Humpback PCS for what is still being reduced on Main No. 3. Supply Main No. 4 Upgrade: This work focuses on a critical concrete cylinder pipe section of RWS Supply Main No. 4 along Goldstream Ave from Leigh Rd to VMP, and will replace this section of main with resilient steel piping on an alternative alignment and increased capacity. This scope is aligned with part of the works identified in in Phase 3 of the Transmission Main projects outlined the 2022 RWS Master Plan.				

Service:	2.670	Regional Water Supply

Project Number	23-17	**Capital Project Title**	Main No. 4 - Mt Newton to Highway 17 & Bear Hill Trunk Extension (RWS Contribution to SPWS Project)	**Capital Project Description**	Approximately 2.9km of Main No. 4 concrete cylinder tranmission main to replacement from Mt Newton Cross Rd/Central Saanich Rd to Island View Rd and Lochside Drive. This project is also being expanded to partially fund the extension of the Bear Hill Tunk Sewer on East Saanich Road from Wallace Drive to Dean Lower Tank.
Project Rationale	Main No. 4 project portion: Replacement of concrete cylinder pipe on Main No. 4 is deemed critical for resiliency of the water supply to the Saanich Peninsula. A Strategic Priorities Fund grant was approved to fund a portion of this work. CRD have since expanded the scope and adjusted the alignment so that approximately 450meters of additional concrete cylinder pipe can be removed under a single contract private property and environmental impacts can be better mitigated through alignment adjustment. Bear Hill Trunk project portion: This project portion is to be shared with Saanich Peninsula Water Supply but is proposed to be partially funded by RWS, since this will provide better water supply redundancy to the Saanich Peninsula and will also reduce some of the future scope requirements for RWS to proceed with Project M11 as identified in the Master Plan.				

Project Number	27-01	**Capital Project Title**	Supply Main No. 3 Storage & Twinning Assessment & Upgrades	**Capital Project Description**	Assesses long range options for storage and twinning of Supply Main No. 3, including Mount Tolmie Tank, Smith Hill Reservoir and Main No. 3 Twinning. Development of preferred option and conceptual design will support future planning and implementation.
Project Rationale	In depth hydraulic modelling and assessment for long range storage assessment opportunities on Main No. 3, including a focus on existing CRD sites of Mount Tolmie Tank and Smith Hill Reservoir and future twinning of Main No. 3. This assessment is aligned with Master Plan projects M10, M13 & M14. The assessment will also support shorter interim improvements at the Smith Hill and Mount Tolmie sites, which can be addressed under Capital Projects #20-17 & 24-19.				

Project Number	20-04	**Capital Project Title**	Sooke Lake HyDy Model Development	**Capital Project Description**	Critical data collection, model building+calibration, model utilization for 3 different scenarios
Project Rationale	This project involves building and calibrating a hydrodynamic model of Sooke Lake Reservoir using key data inputs. The model will be applied to assess three different scenarios, providing valuable insight for future management and operational strategies.				

Project Number	25-04	**Capital Project Title**	Master Plan Projects - Watershed Hydrology Support	**Capital Project Description**	Additional hydrology/water quality data collection and analyses to inform Master Plan infrastructure projects.
Project Rationale	Additional hydrology and water quality data and analyses are needed to provide a good quality dataset to inform Master Plan infrastructure projects.				

Service:	2.670	Regional Water Supply

Project Number	26-03	**Capital Project Title**	Water Utility Rate Model	**Capital Project Description**	Review and assessment of current water rate model to assess best practice going forward.
Project Rationale	Necessary to keep ahead of service financial sustainability.				

Project Number	27-02	**Capital Project Title**	Supply Main No. 11 Concrete Pipe Replacement and bridge crossing	**Capital Project Description**	Replacement of segment of Concrete Cylinder Pipe from Sooke Lake Dam to Head Tank. Incorporate bridge replacement at spillway crossing. Future budget for this will be further refined based on outcomes of Project Definition Report for projects within the
Project Rationale	Critical segment of main with vulnerability due to concrete cylinder pipe crossing of spillway channel. Review to replace this segment of pipe and all of this concrete cylinder pipe alignment. Following early planning, this scope will be refined and the project may be combined with other upgrades identified in the Master Plan.				

Project Number	28-01	**Capital Project Title**	Transmission Main Upgrade Program	**Capital Project Description**	Identify, conceptually design, detail design and construct transmission main upgrades.
Project Rationale	Transmission mains that are nearing end of life due to long service require condition assessments and then design and construction of replacement mains where needed. Budget is a future placeholder but project details and budgets will be further refined as the delivery year approaches.				

Project Number	16-10	**Capital Project Title**	Post Disaster Emergency Water Supply	**Capital Project Description**	Identify and procure emergency systems for post disaster preparedness.
Project Rationale	In the event of a disaster, it is proposed to have in place the ability to source, treat (if required) and distribute drinking water during the initial and sustained response and recovery phases to the public. This item will see the study of the issue in 2016 and 2017 with the anticipated purchase of one or more emergency distribution systems in 2017. Initial investigation has highlighted areas, such as having hardened hydrants/standpipes that the CRD should be investing in. Additional funds are required to continue implementing these additional works and equipment.				

Project Number	17-13	**Capital Project Title**	Asset Management Planning	**Capital Project Description**	Development of a plan to inform future areas of study and highlight critical infrastructure improvements.
Project Rationale	Asset Management Planning necessary to effectively manage asset life cycles and plan for future improvement works.				

Project Number	19-04	**Capital Project Title**	Seismic Assessment of Critical Facilities Phase 2	**Capital Project Description**	Second phase seismic assessment of critical facilities will now be undertaken.
Project Rationale	Initially identified as a priority froman earlier iteration of the Strategic Plan, a second phase seismic assessment of critical facilities will now be undertaken.				

Service:	2.670	Regional Water Supply

Project Number	20-08	**Capital Project Title**	Regional Water DCC Program	**Capital Project Description**	Design of a Regional DCC Program
Project Rationale	Development and implementation of a Developer Cost Charge (DCC) program for the Regional Water Supply system. This program will help identified where projects are required for future growth and help fund those costs from developments.				

Project Number	26-04	**Capital Project Title**	Kapoor Tunnel Assessment and Inspections	**Capital Project Description**	Development of inspection and monitoring plan for ongoing asset management.
Project Rationale	Development of plan for ongoing tunnel monitoring plan. Work with external experts to develop best management practices for monitoring this tunnel asset.				

Project Number	21-05	**Capital Project Title**	Level of Service and Transfer Agreements	**Capital Project Description**	Develop level-of-service agreements for participating municipalities to address hydraulic capacity of infrastructure.
Project Rationale	Develop level-of-service agreements for participating municipalities to address hydraulic capacity of infrastructure.				

Project Number	18-08	**Capital Project Title**	Bulk Supply Meter Replacement and Backflow Prevention Program	**Capital Project Description**	Planned replacement of aging bulk meter replacement based upon a condition assessment and water audit.
Project Rationale	This item is to replace, upgrade and install new bulk water meters and related equipment that measure flow and volumes of water delivered to the wholesale customers. Many of the meter stations are in need of upgrading. Funding is required to replace the flow meter and appurtenances.				

Project Number	18-15	**Capital Project Title**	Corrosion Protection Program	**Capital Project Description**	Study deficiencies in the current material protection and implement recommendations.
Project Rationale	This item is to assess, design and implement cathodic protection for the various infrastructure, including steel pipes, that are susceptible to corrosion. The supply system has various implementations of cathodic protection ranging from interior/exterior coatings for pipe and passive anodes to impressed current systems with variable results and condition. Funding is required for ongoing improvements as recommended by a cathodic protection specialist.				

Project Number	19-23	**Capital Project Title**	Critical Spare Equipment Storage & Pipe Yard	**Capital Project Description**	Plan, design and construct a critical equipment storage building.
Project Rationale	Additional and accessible storage is required at the pipe yard for critical spare equipment such as repair bands and clamps. Funds are required to pland, design and construct an equipment storage building accessible by loading vehicles.				

Service:	2.670	Regional Water Supply

Project Number	Capital Project Title	Capital Project Description
20-17	Interim Smith Hill Reservoir Decommissioning Works	Plan for interim decommissioning and improvements at the Smith Hill Reservoir site. Budget to be refined based on outcomes of asssessments and long term planning.

Project Rationale The Smith Hill reservoir has not been in operation for many years. Consideration for decommissioning now has to be factored in with recent suggestions in the 2022 Master Plan.

Project Number	Capital Project Title	Capital Project Description
21-10	SCADA Masterplan and System Upgrades	Update the SCADA Master Plan in conjunction with the Juan de Fuca Water Distribution, Saanich Peninsula Water and Wastewater, and Core Area Wastewater Services.

Project Rationale The SCADA and radio system utilized by the RWS comprises of components ranging from 2-25 years in age. A planned replacement of assets, to be coordinated with the Juan de Fuca Water Distribution and Saanich Peninsula Water & Wastewater Systems is required to create a more resilient and cohesive communications system

Project Number	Capital Project Title	Capital Project Description
22-15	Microwave Radio Upgrades	To provide a high bandwidth communications backbone to the RWS system, a microwave communications system will be installed.

Project Rationale To provide a high bandwidth communications backbone to the RWS system, a microwave communications system will be installed. Supports current and future fire detection cameras.

Project Number	Capital Project Title	Capital Project Description
24-11	IT Core Infrastructure Replacement and Cyber Security Upgrades	Replacement and upgrades to Core IT infrastructure such as servers, network switches, UPS, etc for equipment end of life and cyber security upgrades. Includes IT equipment located at tower sites within the RWS system.

Project Rationale Replacement of Core IT infrastructure such as servers, network switches, UPS, etc for equipment end of life. Includes IT equipment located at tower sites within the RWS system.

Project Number	Capital Project Title	Capital Project Description
24-12	Head Tank Valve & Main No. 4&5 Valve Replacement	Supply and installation of valves and actuators at Head Tank and Main #4&5. Includes flushing plan and coordination efforts.

Project Rationale Supply and installation of valves and actuators at Head Tank and Main #4&5. Includes flushing plan and coordination efforts.

Service:	2.670	Regional Water Supply

Project Number	24-19	**Capital Project Title**	Mount Tolmie Tank Assessment and Interim Improvements	**Capital Project Description**	Structural, infiltration and other miscellaneous improvements at Mt Tolmie Tank. Budget to be refined based on outcomes of asssessments and long term planning.
Project Rationale	Initial budget for multiple improvements to Mount Tolmie Tank, including structural repairs to address leakage and structural repairs discovered at Mount Tolmie Tank in Q4 2023, control valve and piping upgrades, assessment of adjacent buried pipe work.				

Project Number	25-24	**Capital Project Title**	Water Treatment Plant Improvements Program	**Capital Project Description**	Ongoing program to address multiple, small to mid-scale capital improvements required at the Goldstream WTP and Sooke River Road WTP.
Project Rationale	Program Level budget to allow staff to implement small to mid-scale capital improvements required at the Goldstream and Sooke River Road Water Treatment Plants. This budget is initiated from funds left over from the Goldstream UV and Controls Upgrades project but will be carreid forward and built upon as a program for term projects needing to be coordinated at the two Regional treatment facilities. Some intial projects include improvements to workstations, buried pipe replacement to replace injection line to mech room bypass, systems control training, GWTP #5 Injection Chamber Analyzer Lines improvements, other small scale piping and monitoring improvements.				

Project Number	19-07	**Capital Project Title**	Integrate Dam Performance and Hydromet to SCADA	**Capital Project Description**	IT driven project to integrate the dam safety instrumentation/surveillance (i.e. piezometers and weirs) and HydroMet stations to report to WIO through the existing SCADA system.
Project Rationale	Based on capital project 18-19, dam performance piezometers and weirs and Hydromet/Dam Safety Instrumentation stations will be integrated through the SCADA system.				

Project Number	19-13	**Capital Project Title**	Dam Safety Instrumentation	**Capital Project Description**	The existing dam safety instrumentation/surveillance equipment is getting older and will need to be replaced/rehabilitated (does not include pending SCADA effort). IT Driven Project
Project Rationale	Aging Hydromet/Dam Safety Instrumentation stations maintained by Infrastructure Engineering require replacement so that ongoing monitoring within the watersheds can be maintained. Funds are required for upgrades and replacement of existing Hydromet Stations.				

Service:	2.670	Regional Water Supply

Project Number	25-13	**Capital Project Title**	Sooke Lake & Deception Water Supply Area Dams - Regulatory Compliance, Dam Safety Planning & Analyses	**Capital Project Description**	Ongoing projects involving studies, dam safety planning and regulatory requirements activities for the various dams within the Sooke Lake Watershed. Outcomes from the various studies will inform future capital improvements.
Project Rationale	Capital funding will be used to resolve a prioritized list of issues from the Dam Safety Risk Register, identified during dam surveillance activities, Dam Safety audits, and legislated Dam Safety Reviews. The issues to be resolved relate to dam safety analyses, dam safety planning and program work, and regulatory compliance.				

Project Number	25-14	**Capital Project Title**	Sooke Lake & Deception Water Supply Area Dams - Upgrades and Improvements Program	**Capital Project Description**	Ongoing program to complete dam upgrades and improvements from the Dam Safety Risk Register, which have been identified through the Sooke Lake Water Supply Area Dams - Regulatory, Planning & Analysis Program.
Project Rationale	This is an ongoing program to be adaptable to addressing projects in the Sooke Lake Watershed Dams from the Dam Safety Risk Register. Some key projects in the near term include: Sooke Lake Dam (SLD) Instrumentation Improvements, SLD Spillway crack repairs (wet side), SLD Spillway crack repairs (Ogee/Wing Walls), Deception Dam Low Level Overflow Replacement, SLD Gate Controls/automation, SLD Stop Logs Replacements, SLD Log Booms (Narrows and Main Dam), future butressing of Deception Dam and various other improvements that may be prioritized based on risk.				

Project Number	25-15	**Capital Project Title**	Goldstream Water Supply Area Dams - Regulatory Compliance, Dam Safety Planning & Analyses	**Capital Project Description**	Ongoing projects involving studies, dam safety planning and regulatory requirements activities for the various dams within the Goldstream Watershed. Outcomes from the various studies will inform future capital improvements.
Project Rationale	Capital funding will be used to resolve a prioritized list of issues from the Dam Safety Risk Register, identified during dam surveillance activities, Dam Safety audits, and legislated Dam Safety Reviews. The issues to be resolved relate to dam safety analyses, dam safety planning and program work, and regulatory compliance.				

Project Number	25-16	**Capital Project Title**	Goldstream Water Supply Area Dams - Upgrades and Improvements Program	**Capital Project Description**	Ongoing program to complete dam upgrades and improvements from the Dam Safety Risk Register, which have been identified through the Goldstream Water Supply Area Dams - Regulatory, Planning & Analysis Program.
Project Rationale	This is an ongoing program to be adaptable to addressing projects in the Goldstream Watershed Dams from the Dam Safety Risk Register. Some key projects in the near term include: Goldstream gates (High Level and 3 Low Level) being assessed and potentially replaced, Concrete repairs, instrumentation implementation and project management efforts at the program level to prioritize capital works as studies are being completed.				

Service:	2.670	Regional Water Supply

Project Number	25-17	**Capital Project Title**	Charters Dam - Regulatory Compliance, Dam Safety Planning & Analyses	**Capital Project Description**	Ongoing projects involving studies, dam safety planning and regulatory requirements activities for Charters Dam. Outcomes from the various studies will inform future capital improvements.
Project Rationale	Capital funding will be used to resolve a prioritized list of issues from the Dam Safety Risk Register, identified during dam surveillance activities, Dam Safety audits, and legislated Dam Safety Reviews. The issues to be resolved relate to dam safety analyses, dam safety planning and program work, and regulatory compliance.				

Project Number	25-18	**Capital Project Title**	Charters Dam - Upgrades and Improvements Program	**Capital Project Description**	Ongoing program to complete dam upgrades and improvements from the Dam Safety Risk Register, which have been identified through the Charters Dam - Regulatory, Planning & Analysis Program.
Project Rationale	Budget to addredss capital improvements identified through the dam safety risk register.				

Project Number	24-15	**Capital Project Title**	Laboratory Renovations	**Capital Project Description**	Renovation for main lab cabinetry, floor, aquatic ecology lab and prep room.
Project Rationale	Renovation for main lab cabinetry, floor, aquatic ecology lab and prep room.				

Project Number	25-19	**Capital Project Title**	WQ Studies and Research Projects	**Capital Project Description**	Ongoing program budget for water quality studies and operation of Sooke Lake Hydrodynamic Model.
Project Rationale	Managing WQ Studies and Research projects under a program will allow CRD more operational flexibility managing priorities and adapting to changing operational needs.				

Project Number	28-02	**Capital Project Title**	Permanent Sensor Moorings	**Capital Project Description**	Permanent moorings to allow water quality to access sensors in Sooke Lake.
Project Rationale	Permanent moorings are planned for multiple water quality sensors in Sooke Lake Reservoir. This project includes the design and installation of these permanent moorings plus the potential addition of telemetry equipment to transmit data to CRD office in real-time.				

Project Number	17-28	**Capital Project Title**	Watershed Security Infrastructure Upgrade & Replacement	**Capital Project Description**	New, upgrade and replacement of security infrastructure in the GVWSA.
Project Rationale	The outer boundary of the Leech, Sooke and Goldstream Water Supply Areas is approximately 119 kilometers in length. Main access roads are gated and there are 11 kilometers of existing security fencing. A constant effort is needed to maintain a closed watershed. Through monitoring, high incident areas are identified, security plans are developed, and security infrastructure (fencing, gates and signage) is installed or upgraded where required.				

Service:	2.670	Regional Water Supply

Project Number	17-29	**Capital Project Title**	Water Supply Area Equipment & Replacement	**Capital Project Description**	Hydrometeorological, fireweather and wildfire suppression equipment replacement.
Project Rationale	This provides annual funding for the replacement or upgrading of equipment for wildfire suppression and spill response, fire weather stations, hydro-meteorological monitoring and water quality sampling and monitoring equipment.				

Project Number	17-30	**Capital Project Title**	Transmission Main Repairs	**Capital Project Description**	Emergency repairs to the transmission mains.
Project Rationale	Each year a visual inspection of this critical supply tunnel is carried out by CRD staff. This capital item allows for minor repairs that are discovered during these inspections. This also allows for annual funding for repair of emergency breaks on large diameter supply mains.				

Project Number	17-31	**Capital Project Title**	Transmission System Components Replacement	**Capital Project Description**	Replacement and repair of transmission components.
Project Rationale	This is an annual allowance for the capital costs for the replacement and repair of supply system components that fail under normal operation and maintenance during the year.				

Project Number	17-33	**Capital Project Title**	Disinfection Equipment and other Water Treatment Components and Parts Replacement	**Capital Project Description**	Replacement of incidental equipment and parts associated with the water treatment facilities.
Project Rationale	The annual work includes the replacement of the plastic gas feed piping that has become very brittle, installing air valves on the ammonia solution lines, installing and replacing shut off valves on the booster pumps supply piping, installing indicator stems on UV cooling water valves, relocating the UV cooling water feed pipes, improving the landscaping around the UV building to reduce dust and other minor upgrades.				

Project Number	17-34	**Capital Project Title**	Supply System Computer Model Update	**Capital Project Description**	Annual update of the regional hydraulic model.
Project Rationale	This item is to allow for staff and consultant time each year to keep the hydraulic computer model current.				

Project Number	19-16	**Capital Project Title**	Dam Improvements	**Capital Project Description**	Items not covered by Dam Safety Reviews, but brought up in Dam Safety Inspections and Dam Safety Reviews and address items in the dam safety database/risk registry and to support operations.
Project Rationale	Dam Safety Inspections are carried out throughout the year and result in minor improvements at each dam annually. This budget is intended for smaller scale improvements, typically to be completed by operations staff in a short duration and which are not captured under the larger "Term" programs.				

Service:	2.670	Regional Water Supply

Project Number	19-22	**Capital Project Title**	SCADA Repairs, Equipment Replacement and Comms upgrades	**Capital Project Description**	Items not covered by the SCADA Replacement and SCADA Master Plan, but integral in maintaining the SCADA System and revenue meter system.
Project Rationale	This item is to allow for unplanned SCADA repairs and equipment replacement not covered by the capital projects SCADA Replacement.				

Project Number	21-15	**Capital Project Title**	Corrosion Protection	**Capital Project Description**	Replace corrosion protection assets, such as coatings, for the transmission system when identified.
Project Rationale	There are numerous assets with varying levels of corrosion protection throughout the RWS system. Funds are required to ensure that corrosion protection assets are replaced or rehabilitated when identified.				

Project Number	21-16	**Capital Project Title**	Valve Chamber Upgrades	**Capital Project Description**	Replace failing valves and appurtenances along the RWS supply system.
Project Rationale	The RWS system has numerous isolation and air valves along the transmission system, usually in underground chambers. Funds are required for replacement of valves and chamber upgrades as they are identified.				

Project Number	21-17	**Capital Project Title**	Water Quality Equipment Replacement	**Capital Project Description**	Replacement of water quality equipment for the water quality lab and water quality operations
Project Rationale	This provides annual funding for the replacement or upgrading of equipment for the water quality lab, sampling, and operations. Of this provisional budget, $20,000 was previously included in item 17-29 (Water Supply Area annual provisional budget)				

Project Number	21-18	**Capital Project Title**	LIMS support	**Capital Project Description**	Support for LIMS database
Project Rationale	Provides for support for the laboratory information management system				

Project Number	23-20	**Capital Project Title**	Land Exchange/Acquisition	**Capital Project Description**	Land surveys, appraisals to support decisions regarding land exchange, acquisition or disposition to increase catchment area, buffer water supply areas and other possible land exchange and acquisition within the RWS system.
Project Rationale	There are opportunities to increase the catchment and critical buffer areas of Sooke, Goldstream and the Leech WSA by purchase or land exchange with surrounding land owners. From time to time, the RWS System requires acquisition of lands for infrastructure purposes. Funds will be used when needed to undertake appraisals, legal surveys, and legal fees for work to develop agreements to purchase or exchange lands for the Regional Water Supply Area or System.				

Service:	2.670	Regional Water Supply

Project Number	Capital Project Title	Capital Project Description
17-35	Vehicle & Equipment Replacement (Funding from Replacement Fund)	This is for replacement of vehicles and equipment used by CRD Water Services for the day-to-day operation and maintenance of the supply system.

Project Rationale This is for replacement of vehicles and equipment used by CRD Water Services for the day-to-day operation and maintenance of the supply system. The Equipment Replacement Fund is used to fund the expenditure. The requests have been adjusted to align with the pricing for electric vehicles.

Project Number	Capital Project Title	Capital Project Description
23-21	EV Charging Stations Electrical Infrastructure	Electrical System upgrades at 479 Island Hwy to power up 44 charging stations

Project Rationale In support of the CRD's Climate Action Strategy to reduce the corporate GHG emissions. The CRD Fleet of vehicles is one of the larger contributors to the generation of GHG's. Integrated Water Services identified 44 of the approx. 100 vehicles that operate out of the 479 Island location for replacement with Electrical Vehicles by 2030. I preparation for providing the proper charging network at 479 an Electric Vehicle Fleet Conversion Study was completed in 2021.The results of the study was to upgrade the electrical infrastructure to accommodate the power needs of 44 charging points. It is proposed that phase 1 is started in 2023 to upgrade the electrical distribution system and provide 17 charging points. The larger portion of the costs will be to upgrade the electrical system. Phase 2 to allow for a further 27 charging points can be planned to accommodate the balance of EV vehicles pending their purchasing and delivery.

Project Number	Capital Project Title	Capital Project Description
23-22	Fuel Truck	Fuel tender truck

Project Rationale New fuel truck.

Project Number	Capital Project Title	Capital Project Description
23-31	Land and Site Works	Purchasing of land and site works to support RWS facilities.

Project Rationale Land acquisition and site works to support RWS facilities.

Project Number	Capital Project Title	Capital Project Description
25-22	New Vehicles - Watershed & Water Operations	4 New Electric Vehicles for Watershed & Water Operations

Project Rationale 1 New EV AWD SUV for water treatment ops
2 Replacement EV Pickup trucks for Watershed Prot. Ops, Security & Emerg Response
1 New EV Pickup truck for Watershed Prot. Resource Planning, Wildlife Program

Project Number	Capital Project Title	Capital Project Description
25-23	Enterprise Asset Management System	Development of EAM system, including software and process implementation, for services to maintain assets and report on asset performance.

Project Rationale There are opportunities to increase the catchment and critical buffer areas of Sooke, Goldstream and the Leech WSA by purchase or land exchange with surrounding land owners. From time to time, the RWS System requires acquisition of lands for infrastructure purposes. Funds will be used when needed to undertake appraisals, legal surveys, and legal fees for work to develop agreements to purchase or exchange lands for the Regional Water Supply Area or System.

Service:	2.670	Regional Water Supply

Project Number	26-05	**Capital Project Title**	New Electric Vehicles Watershed, Fleet Pool	**Capital Project Description**	New electric vehicles for Watershed and Fleet pool.
Project Rationale	2026 - 2 EV Pickup trucks for Watershed Prot. Ops, Security & Emerg Response to replace old life-extended vehicles (180k) 2027 - 1 EV truck for Watershed Prot. Ops, Security & Emerg Response to support IBC 2027 2a-5.2 Equipment/Operato Watershed (90k) 2028 - 1 EV truck Forest Management Plan Implementation Forester position in WP requiring a pickup. IBC 2a5.4 for 2028 (90k)				

Project Number	26-06	**Capital Project Title**	Fleet Service Trucks	**Capital Project Description**	One new heavy pickup truck and transfer Regional Parks Ops fleet mechanic service truck to Corporate Fleet.
Project Rationale	2026 - Transfer Regional Parks Ops fleet mechanic service truck to Corporate Fleet (60K). One new heavy pickup truck to replace old life-extended vehicle (120k).				

Project Number	27-04	**Capital Project Title**	Enterprise Data Historian Management System	**Capital Project Description**	A data historian is required to store large amounts of data that is required for compliance reporting to regulators, operational performance reports, cost allocation, and engineering analysis.
Project Rationale	A data historian is required to store large amounts of data that is required for compliance reporting to regulators, operational performance reports, cost allocation, and engineering analysis.				

CAPITAL REGIONAL DISTRICT

FIVE YEAR CAPITAL EXPENDITURE PLAN SUMMARY - 2027 to 2031

Service No.	2.670/2.680 Regional Water Supply & JDF Water Distribution Combo	Carry Forward 2026	2027	2028	2029	2030	2031	TOTAL
EXPENDITURE								
Buildings		$200,000	$500,000	$400,000	$200,000	$200,000	$200,000	$1,500,000
Equipment		$478,000	$908,000	$411,000	$409,000	$405,000	$405,000	$2,538,000
Land		$0	$0	$0	$0	$0	$0	$0
Engineered Structures		$0	$75,000	$75,000	$75,000	$75,000	$75,000	$375,000
Vehicles		$0	$0	$0	$0	$0	$0	$0
		$678,000	**$1,483,000**	**$886,000**	**$684,000**	**$680,000**	**$680,000**	**$4,413,000**
SOURCE OF FUNDS								
Capital Funds on Hand		$615,000	$1,420,000	$886,000	$684,000	$680,000	$680,000	$4,350,000
Debenture Debt (New Debt Only)		$0	$0	$0	$0	$0	$0	$0
Equipment Replacement Fund		$0	$0	$0	$0	$0	$0	$0
Grants (Federal, Provincial)		$0	$0	$0	$0	$0	$0	$0
Donations / Third Party Funding		$63,000	$63,000	$0	$0	$0	$0	$63,000
Reserve Fund		$0	$0	$0	$0	$0	$0	$0
		$678,000	**$1,483,000**	**$886,000**	**$684,000**	**$680,000**	**$680,000**	**$4,413,000**

Definitions for the 5-year Capital Plan

Asset Class	Asset class is used to classify assets for financial reporting in accordance with the Public Sector Accounting Board (PSAB) 3150. **L** - Land **S** - Engineering Structure **B** - Buildings **V** - Vehicles **E** - Equipment
Capital Expenditure Type	Capital expenditure type is used for reporting on asset investments and may be used to justify operational needs for a service. **Study** - Expenditure for feasibility and business case report. **New** - Expenditure for new asset only **Renewal** - Expenditure upgrades an existing asset and extends the service ability or enhances technology in delivering that service **Replacement** - Expenditure replaces an existing asset
Carryforward	Represents the carryforward amount from the prior year capital plan that is remaining to be spent. Forecast this spending over the next 5 years.
Funding Source	**Debt** - Debenture Debt (new debt only) **ERF** - Equipment Replacement Fund **Grant** - Grants (Federal, Provincial) **Cap** - Capital Funds on Hand **Other** - Donations / Third Party Funding **Res** - Reserve Fund **WU** - Water Utility If there is more than one funding source, additional rows are shown for the project.

CAPITAL REGIONAL DISTRICT

5 YEAR CAPITAL PLAN

2027 - 2031

Service #: 2.670/2.680

Service Name: Regional Water Supply & JDF Water Distribution Combo

PROJECT DESCRIPTION				PROJECT BUDGET & SCHEDULE									
Project Number	Capital Expenditure Type	Capital Project Title	Capital Project Description	Total Project Budget	Asset Class	Funding Source	Carryforward from 2026	2027	2028	2029	2030	2031	5 - Year Total
SYSTEM REPLACEMENT AND UPGRADES THAT BENEFIT REGIONAL WATER SUPPLY AND JUAN DE FUCA DISTRIBUTION													
16-01	Renewal	Upgrades to Buildings at 479 Island Highway	Maintenance and changes to buildings, office layouts, meeting rooms, yard improvements, lab improvements and technology upgrades.	$ 2,330,000	B	WU	$ 200,000	$ 500,000	$ 400,000	$ 200,000	$ 200,000	$ 200,000	$ 1,500,000
17-01	Renewal	Voice Radio Upgrade	Replacement of end of life voice radio system repeaters, office, vehicle and handheld radios.	$ 2,325,000	E	WU	$ 245,000	$ 245,000		$ -	$ -	$ -	$ 245,000
24-01	Replacement	IT Core Infrastructure Replacement	Replacement of Core IT infrastructure such as servers, network switches, UPS, etc for equipment end of life	$ 250,000	E	WU	$ 70,000.00	$ 95,000	$ 6,000	$ 4,000	$ -	$ -	$ 105,000
25-02	New	SCADA System Cybersecurity	Shared project budget to improve cyber security in the SCADA system.	$ 400,000	E	Other	$ 63,000.00	$ 63,000	$ -	$ -	$ -	$ -	$ 63,000
26-01	New	479 Island Highway Autogates	Supply and installation of autogates with intercom and FOB at 479 Island Highway Office.	$ 150,000	E	WU	$ 100,000	$ 100,000	$ -	$ -	$ -	$ -	$ 100,000
Sub-Total System Replacement and Upgrades That Benefit Regional Water Supply and Juan de Fuca Distribution				**$ 5,455,000**			**$ 678,000**	**$ 1,003,000**	**$ 406,000**	**$ 204,000**	**$ 200,000**	**$ 200,000**	**$ 2,013,000**
ANNUAL PROVISIONAL CAPITAL ITEMS													
17-03	Replacement	Office Equipment, Upgrades and Replacements	Upgrade and replacement of office equipment as required.	$ 450,000	E	WU	$ -	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 450,000
17-04	Replacement	Computer Upgrades	Annual upgrade and replacement program for computers, copiers, printers, network equipment as required.	$ 950,000	E	WU	$ -	$ 190,000	$ 190,000	$ 190,000	$ 190,000	$ 190,000	$ 950,000
17-06	Replacement	Small Equipment & Tool Replacement (Water Operations)	Replacement of tools and small equipment for Water Operations as required.	$ 500,000	E	WU	$ -	$ 100,000	$ 100,000	$ 100,000	$ 100,000	$ 100,000	$ 500,000
17-07	Replacement	Small Equipment & Tool Replacement (Corporate Fleet)	Replacement of tools and small equipment for Fleet as required.	$ 125,000	E	WU	$ -	$ 25,000	$ 25,000	$ 25,000	$ 25,000	$ 25,000	$ 125,000
24-02	Study	Capital Projects Delivery Optimization	Ongoing internal improvement of templates, tools and processes used in the delivery of capital projects.	$ 375,000	S	WU	$ -	$ 75,000	$ 75,000	$ 75,000	$ 75,000	$ 75,000	$ 375,000
Sub-Total for Annual Provisional Capital Items				**$ 2,400,000**			**$ -**	**$ 480,000**	**$ 480,000**	**$ 480,000**	**$ 480,000**	**$ 480,000**	**$ 2,400,000**
			Grand Total	**$ 7,855,000**			**$ 678,000**	**$ 1,483,000**	**$ 886,000**	**$ 684,000**	**$ 680,000**	**$ 680,000**	**$ 4,413,000**

Service:	2.670/2.680	Regional Water Supply & JDF Water Distribution Combo

Project Number	Capital Project Title	Capital Project Description
16-01	Upgrades to Buildings at 479 Island Highway	Maintenance and changes to buildings, office layouts, meeting rooms, yard improvements, lab improvements and technology upgrades.

Project Rationale The budget includes the following funds to upgrade and renew the buildings at 479 Island Highway, including:
- Improvements,Repairs, upgrades and changes to the buildings
- Painting of the buildings
- Repair and replacement of carpets, floors and walls
- Climate Action initiatives and feasibility studies
- Improvements to Meeting Rooms, including technology upgrades

Project Number	Capital Project Title	Capital Project Description
17-01	Voice Radio Upgrade	Replacement of end of life voice radio system repeaters, office, vehicle and handheld radios.

Project Rationale Service Life and projected replacement:
- The service life of the mobile and portable units was forecast as 10 years at minimum, 15 years at maximum in 2005.
- The present radio models used in the system have just been taken out of production by the manufacturer, there will be no new units available for purchase as of July 1, 2015.
- Support for repairs and maintenance of the present radio will continue for the next 3 years at least.
- There are no pressing issues with equipment maintenance or repairs, present repair rates suggest we can maintain the system for the next few years, and perhaps reach a 12-15 year lifespan on the present equipment.

Project Number	Capital Project Title	Capital Project Description
24-01	IT Core Infrastructure Replacement	Replacement of Core IT infrastructure such as servers, network switches, UPS, etc for equipment end of life

Project Rationale Ongoing end of life replacement program for IT Core Infrastructure, including servers, network switches, UPS', and other equipment.

Project Number	Capital Project Title	Capital Project Description
25-02	SCADA System Cybersecurity	Shared project budget to improve cyber security in the SCADA system.

Project Rationale Project budget to improve cyber security in the SCADA System. CRD IT Department to lead and provide implementation support.

Project Number	Capital Project Title	Capital Project Description
26-01	479 Island Highway Autogates	Supply and installation of autogates with intercom and FOB at 479 Island Highway Office.

Project Rationale Funds will be used to improve site security and access control at the 479 Island Highway office through the installation of automated gates, intercom systems, and FOB-controlled entry.

Service:	2.670/2.680	Regional Water Supply & JDF Water Distribution Combo

Project Number	Capital Project Title	Capital Project Description
17-03	Office Equipment, Upgrades and Replacements	Upgrade and replacement of office equipment as required.

Project Rationale Funds will be used for the replacement and upgrading of office equipment and furniture, as required.

Project Number	Capital Project Title	Capital Project Description
17-04	Computer Upgrades	Annual upgrade and replacement program for computers, copiers, printers, network equipment as required.

Project Rationale This is an annual upgrading and replacement program of computers, photocopiers, network, monitoring and associated equipment, as required. This item has been increased from $160,000 to $170,000 annually to reflect actual costs.

Capital Budget
Network Switch Maintenance $10,000
Additional Wireless Access Points and Maintenance $15,000
Photocopier Replacement $20,000
Additional Data Storage $15,000
Replacement Computers $75,000
Equipment Maintenance (contingency) $23,000
Replace Access Control System - Gates/ Video Cameras $12,000
Total Capital $170,000

Project Number	Capital Project Title	Capital Project Description
17-06	Small Equipment & Tool Replacement (Water Operations)	Replacement of tools and small equipment for Water Operations as required.

Project Rationale Funds will be used for replacement of a variety of Operations and Welding equipment such as cutting saws, portable generators, gas detectors, Hilti drills,plasma cutter, wire welder, etc.

Project Number	Capital Project Title	Capital Project Description
17-07	Small Equipment & Tool Replacement (Corporate Fleet)	Replacement of tools and small equipment for Fleet as required.

Project Rationale Funds will be used for replacement of a variety of Fleet small equipment and tools as required. This includes provision to replace the Vehicle OBD reader for reading engine codes and the shop air compressor.

Project Number	Capital Project Title	Capital Project Description
24-02	Capital Projects Delivery Optimization	Ongoing internal improvement of templates, tools and processes used in the delivery of capital projects.

Project Rationale Ongoing program for small scale optimization of project delivery methods and tools.

2.670 Regional Water Supply
Asset / Reserve Schedule
2027 - 2031 Financial Plan

Asset Profile

Regional Water Supply

System assets include the lands, dams and source water reservoirs within the water supply areas, intake and source conduits, two water treatment plants, pressure regulating facilities, nine supply mains, three balancing reservoirs and revenue water meters in the water transmission system.

Equipment Replacement Reserve Schedule

Reserve Fund: 2.670 Regional Water Supply Equipment Replacement Reserve (covered by CRD-ERF Bylaw)

Fund: 1022 Fund Center: 101454	**Estimated**	**Budget**				
	2026	**2027**	**2028**	**2029**	**2030**	**2031**
Beginning Balance	2,391,237	3,061,721	1,963,801	2,378,251	2,928,411	3,627,301
Equipment purchases (Based on Capital Plan)	-	(2,255,000)	(495,000)	(355,000)	(200,000)	(200,000)
Transfer from Operating Budget	670,484	818,780	835,150	851,860	868,890	886,270
Proceeds on disposals	-	338,300	74,300	53,300	30,000	30,000
Ending Balance $	**3,061,721**	**1,963,801**	**2,378,251**	**2,928,411**	**3,627,301**	**4,343,571**

General Comments:
Reserve Fund is used for the purpose of replacing fleet vehicles including heavy equipment and associated mobile components, as outlined in the capital plan. Proceeds from disposals are estimated at 15% of replacement equipment purchases. Note not all vehicles are sold within the year in which they are replaced.

* Interest should be included in determining the estimated ending balance for the current year. Interest in planning years nets against inflation which is not included.

REGIONAL WATER SUPPLY (RWS)

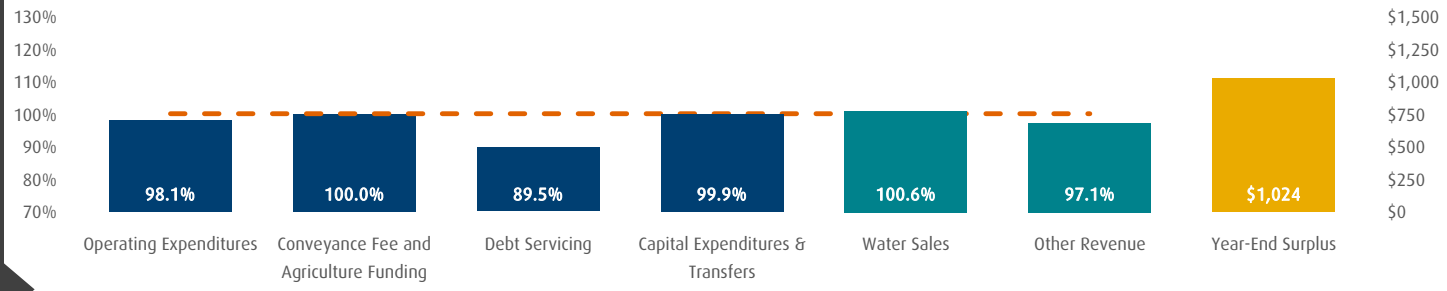
2026-2031 BUDGET DASHBOARD

AT A GLANCE

2026 FORECAST YEAR-END RESULT	2027 WATER REVENUE		2027 FORECAST CONSUMPTION		2027 WATER RATE
$1.0M	$51.3M	÷	51.5M m^3	=	$0.9954/$m^3$
Surplus	+3.4M (7.1%)		+0.1M m^3 (0.2%)		+$0.0640/$m^3$ (6.88%)
2026 Forecast	*vs. 2026 Budget*		*vs. 2026 Forecast*		*vs. 2026*

2026 EST. YEAR-END RESULTS

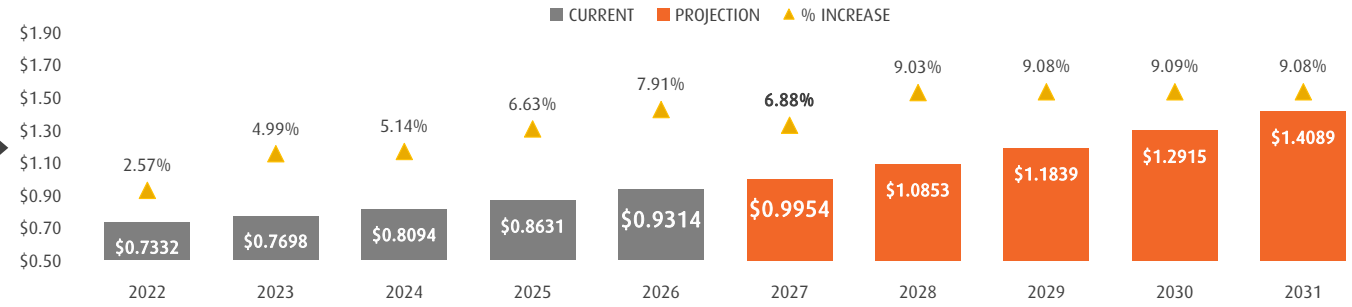
EXPENSE - (% of Budget) | **REVENUE - (% of Budget)** | **SURPLUS ($'000)**



EXPENSE	BUDGET	EST. ACTUALS		VARIANCE, $	VARIANCE, %	DRIVER OF VARIANCE
Operating Expenditures	$ 21,168,440	$ 20,760,353	▲	($ 408,087)	-1.9%	Staff vacancies and deferral of one-time initiatives
Conveyance Fee and Agriculture Funding	$ 2,400,000	$ 2,400,000		$ 0	0.0%	No material variance forecasted
Debt Servicing	$ 3,215,038	$ 2,878,620		($ 336,418)	-10.5%	Debt for Kapoor land purchase deferred to spring 2027
Capital Expenditures & Transfers	$ 22,020,674	$ 21,993,484		($ 27,190)	-0.1%	Lower transfer to debt reserve fund
REVENUE						
Water Sales	$ 47,871,902	$ 48,151,310	▲	$ 279,408	0.6%	Increased water sales due to higher demand
Other Revenue	$ 932,250	$ 905,060	▼	($ 27,190)	-2.9%	Service fee revenue and debt reserve fund
YEAR-END SURPLUS						
Transfer to Water Capital Fund				$ 1,023,913		Surplus transferred to water capital fund

2022 - 2031 WATER RATE

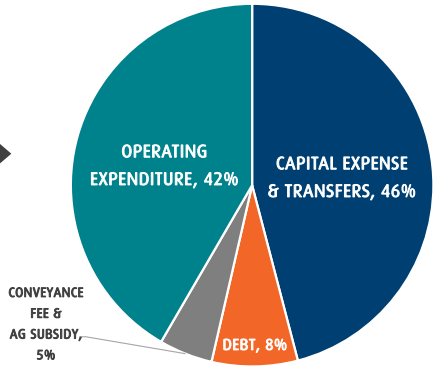
HISTORICAL & PROJECTED ($/$m^3$)



*Projected rates from 2027-2031 reflect increased capital investment to replace aging infrastructure and improve system resilience.

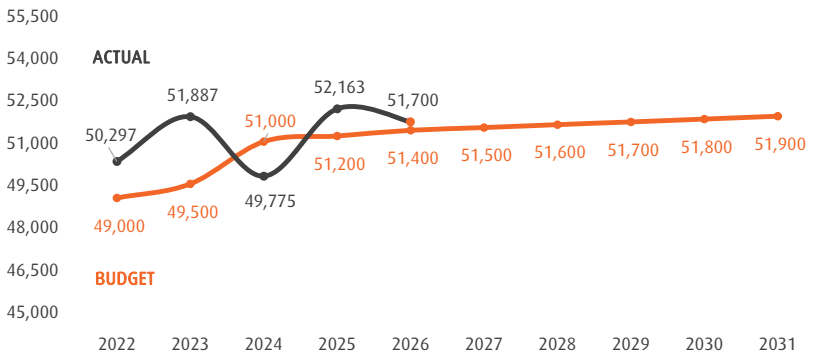
2027 BUDGET BREAKDOWN

EXPENSE by CATEGORY (% of Total)



2022 - 2031 WATER CONSUMPTION

HISTORICAL & PROJECTED ('000 m^3)

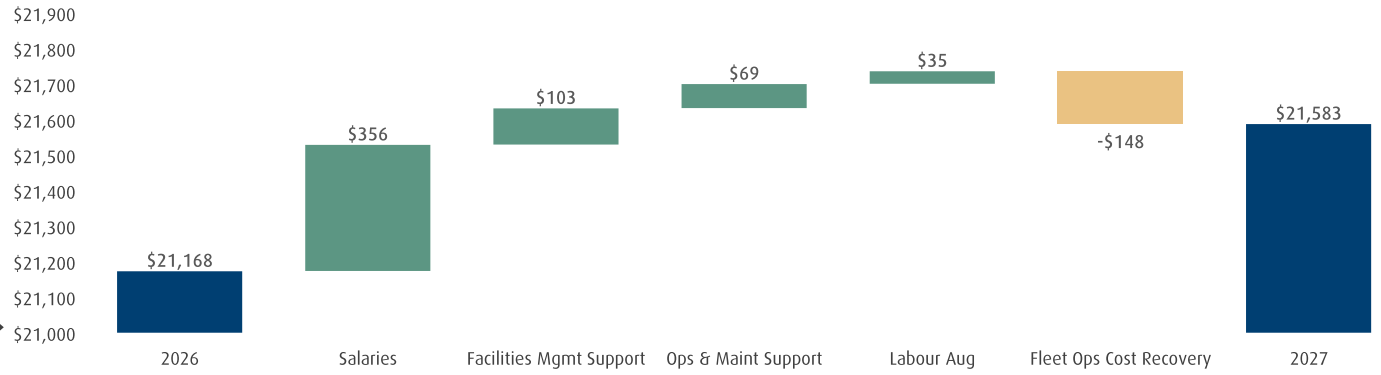


REGIONAL WATER SUPPLY (RWS)

2026-2031 BUDGET DASHBOARD *Cont.*

2026 VS. 2027 OPERATING EXPENSES

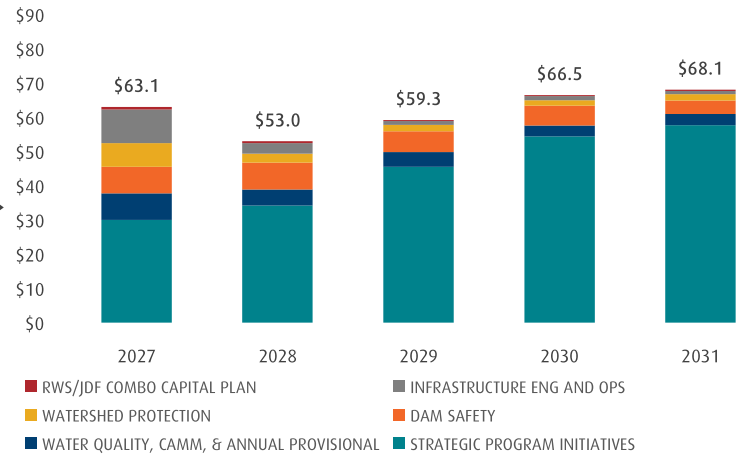
OPERATING EXPENSES - ($'000)



BUDGET CATEGORY	AMOUNT	BUDGET DRIVERS
2026 OPERATING BUDGET	$ 21,168,440	
Salaries	$ 355,636	Inflationary increase to existing salaries inclusive of estimated collective agreement changes
Facilities Mgmt Support	$ 102,500	2027 IBC: 11b-3.2 Staff and O&M to Support Broadened FM Portfolio
Ops & Maint Support	$ 69,091	Increased support of ongoing water operations
Labour Augmentation	$ 35,232	+1.0 FTE for ops support: 2026 IBC:2a-2.3 Master Plan Program net of cost recovery
Fleet Ops Cost Recover	($ 148,296)	Increased cost recovery to fund ERF in support of fleet maintenance and vehicle replacements
2027 OPERATING BUDGET	$ 21,582,603	

2027 - 2031 CAPITAL PLAN

CAPITAL PLAN by CATEGORY - ($M)

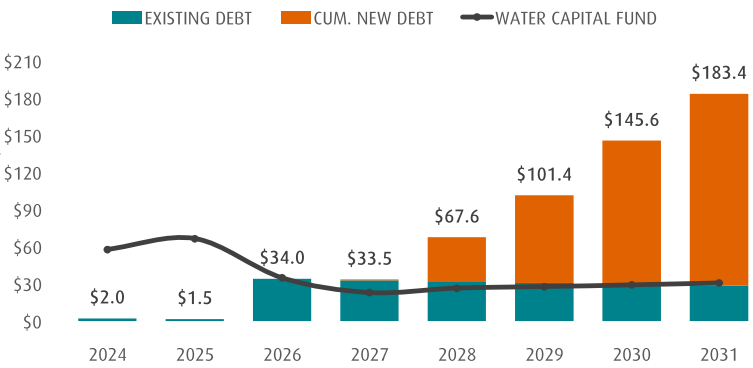


NOTABLE CAPITAL INITIATIVES in 2027

INFRASTRUCTURE ENGINEERING & OPERATIONS	
19-23 Critical Spare Equipment Storage & Pipe Yard	$ 3,750,000
24-19 Mount Tolmie Tank Assmt and Interim Improvements	$ 600,000
18-08 Bulk Supply Meter Replace and Backflow Prevention	$ 600,000
WATERSHED PROTECTION	
16-06 New Field Operations Centre Building	$ 4,700,000
DAM SAFETY	
25-13/25-15/25-18 Upgrades and Improvements Program	$ 3,375,000
25-13/25-15 Regulatory Compliance, Planning, & Analysis	$ 3,050,000
19-07 Integrate Dam Performance and Hydromet to SCADA	$ 1,200,000
STRATEGIC PROGRAM INITIATIVES	
23-17 Main No. 4 - Mt Newton to Hwy 17 & Bear Hill	$ 24,000,000
21-11 Main No. 4 Upgrade & Main No. 1 High Pressurizing	$ 2,000,000
26-02 Master Plan Project(s) Delivery	$ 1,675,000
26-01 Master Plan Program Management	$ 1,500,000

2024 - 2031 DEBT & CAPITAL

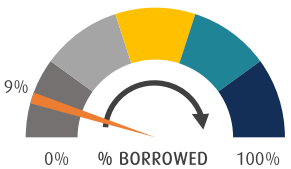
DEBT & WATER CAPITAL FUND BALANCE - ($M)



BORROWING AUTHORITY

LA BYLAW 4382

AUTHORIZED	$ 46,000,000
BORROWED	$ 4,000,000
CREDIT REMAINING	$ 42,000,000



TEMP LA BYLAW 4779

Temporary Borrowing Bylaw No. 4779 was approved by the CRD board on July 8, 2026, to enable short-term borrowing under Bylaw No. 4382 to finance capital expenditures.

REGIONAL WATER SUPPLY COMMISSION
Agricultural Water Rate Funding Comparisons 2011 - 2025

		No. of AR Accounts	No. of AG Accounts	AR Volume m3	AG Volume m3	Avg AR Volume m3 (Vol/Accts)	Avg AG Volume m3	Agri Rate Consumption Costs	Agri Fixed Charge Costs	Total Agri Subsidy Paid out (Cons + Fixed)	Avg Agri Cost $ (Paid/Accts)	%age of Total Paid out	Rate Differential: Municipal Rate m3 A	Agri Rate m3 B	Muni-CRD Diff m3 A - B
Western Communities & Sooke *															
	2025	84	21	44673	67469	532	3,213	$ 294,821	$ -	$ 294,821	$ 2,808	11.9%	$ 2.8395	$ 0.2105	$ 2.6290
	2024	85	21	38,614	53,786	454	2,561	$ 229,355	$ -	$ 229,355	$ 2,164	11.9%	$ 2.6927	$ 0.2105	$ 2.4822
	2023	86	16	46,589	62,912	542	3,932	$ 255,805	$ -	$ 255,805	$ 2,508	11.6%	$ 2.5466	$ 0.2105	$ 2.3361
	2022	85	17	45,564	37,292	536	2,194	$ 181,612	$ -	$ 181,612	$ 1,781	10.6%	$ 2.4024	$ 0.2105	$ 2.1919
	2021	84	16	53,773	63,222	640	3,951	$ 245,409	$ -	$ 245,409	$ 2,454	12.3%	$ 2.3081	$ 0.2105	$ 2.0976
	2020	84	15	42,432	51,118	505	3,408	$ 187,605	$ -	$ 187,605	$ 1,895	11.9%	$ 2.2159	$ 0.2105	$ 2.0054
	2019	86	14	36,598	50,277	426	3,591	$ 165,297	$ -	$ 165,297	$ 1,653	11.1%	$ 2.1132	$ 0.2105	$ 1.9027
	2018	95	18	40,657	19,669	428	1,093	$ 112,411	$ -	$ 112,411	$ 995	7.9%	$ 2.0739	$ 0.2105	$ 1.8634
	2017	81	11	33,458	11,628	413	1,057	$ 76,754	$ -	$ 76,754	$ 834	5.6%	$ 1.9129	$ 0.2105	$ 1.7024
	2016	80	11	41,248	8,652	516	787	$ 84,950	$ -	$ 84,950	$ 934	5.9%	$ 1.9129	$ 0.2105	$ 1.7024
	2015	79	11	33,537	7,078	425	643	$ 64,968	$ -	$ 64,968	$ 722	5.1%	$ 1.8101	$ 0.2105	$ 1.5996
	2014	79	11	29,419	9,074	372	825	$ 60,769	$ -	$ 60,769	$ 675	5.6%	$ 1.7892	$ 0.2105	$ 1.5787
	2013	80	11	25,532	5,578	319	507	$ 46,438	$ -	$ 46,438	$ 510	4.7%	$ 1.7032	$ 0.2105	$ 1.4927
	2012	79	13	23,617	5,932	299	456	$ 40,828	$ -	$ 40,828	$ 444	4.3%	$ 1.5922	$ 0.2105	$ 1.3817
	2011	75	11	27,910	4,893	372	445	$ 43,641	$ -	$ 43,641	$ 507	5.2%	$ 1.5409	$ 0.2126	$ 1.3283
Central Saanich															
	2025	298	49	591,590	349,902	1,985	7,141	$ 1,395,652	$ 6,909	$ 1,402,561	$ 4,042	56.6%	$ 2.0540	$ 0.2105	$ 1.8435
	2024	297	49	485,371	234,707	1,634	4,790	$ 1,086,758	$ 4,606	$ 1,091,364	$ 3,154	56.8%	$ 1.9460	$ 0.2105	$ 1.7355
	2023	266	48	539,888	283,819	2,030	5,913	$ 1,269,148	$ 6,674	$ 1,275,822	$ 4,063	57.8%	$ 1.9240	$ 0.2105	$ 1.7135
	2022	277	50	398,069	279,385	1,437	5,588	$ 1,005,694	$ 7,050	$ 1,012,744	$ 3,097	59.3%	$ 1.8600	$ 0.2105	$ 1.6495
	2021	277	50	466,809	307,970	1,685	6,159	$ 1,150,198	$ 7,050	$ 1,157,248	$ 3,539	57.9%	$ 1.8600	$ 0.2105	$ 1.6495
	2020	278	49	375,646	233,214	1,351	4,759	$ 873,579	$ 6,768	$ 880,347	$ 2,692	56.0%	$ 1.8047	$ 0.2105	$ 1.5942
	2019	276	47	421,804	210,499	1,528	4,479	$ 862,430	$ 2,162	$ 864,592	$ 2,677	58.0%	$ 1.7260	$ 0.2105	$ 1.5155
	2018	278	49	378,593	297,433	1,362	6,070	$ 866,699	$ 7,003	$ 873,702	$ 2,672	61.3%	$ 1.6350	$ 0.2105	$ 1.4245
	2017	296	49	398,087	298,522	1,345	6,092	$ 792,125	$ 7,003	$ 799,128	$ 2,316	58.7%	$ 1.5575	$ 0.2105	$ 1.3470
	2016	297	51	446,241	303,419	1,502	5,949	$ 879,396	$ 7,191	$ 886,587	$ 2,548	61.1%	$ 1.5139	$ 0.2105	$ 1.3034
	2015	294	51	412,060	246,292	1,402	4,829	$ 739,282	$ 7,144	$ 746,426	$ 2,164	58.4%	$ 1.4582	$ 0.2105	$ 1.2477
	2014	294	49	361,801	190,895	1,231	3,896	$ 596,515	$ 6,808	$ 603,323	$ 1,759	55.7%	$ 1.4033	$ 0.2105	$ 1.1928
	2013	296	45	321,518	194,848	1,086	4,330	$ 542,837	$ 4,186	$ 547,023	$ 1,604	55.7%	$ 1.3799	$ 0.2105	$ 1.0525
	2012	280	41	325,663	210,906	1,163	5,144	$ 518,454	$ 5,658	$ 524,112	$ 1,633	55.6%	$ 1.2841	$ 0.2105	$ 0.9662
	2011	210	38	312,702	169,206	1,489	4,453	$ 462,183	$ 5,244	$ 467,427	$ 1,885	56.1%	$ 1.2867	$ 0.2126	$ 0.9667
North Saanich **															
	2025	103	14	97,137	128,496	943	9,178	$ 333,845	$ -	$ 333,845	$ 2,853	13.5%	$ 1.9400	$ 0.2105	$ 1.7295
	2024	104	21	83,051	113,138	799	5,388	$ 269,215	$ -	$ 269,215	$ 2,154	14.0%	$ 1.8562	$ 0.2105	$ 1.6457
	2023	103	20	56,716	119,706	551	5,985	$ 281,923	$ -	$ 281,923	$ 2,292	12.8%	$ 1.8085	$ 0.2105	$ 1.5980
	2022	107	19	52,167	107,838	488	5,676	$ 235,367	$ -	$ 235,367	$ 1,868	13.8%	$ 1.6815	$ 0.2105	$ 1.4710
	2021	105	18	62,904	126,579	599	7,032	$ 265,276	$ -	$ 265,276	$ 2,157	13.3%	$ 1.6105	$ 0.2105	$ 1.4000
	2020	102	16	57,433	108,453	563	6,778	$ 223,532	$ -	$ 223,532	$ 1,894	14.2%	$ 1.5580	$ 0.2105	$ 1.3475
	2019	94	15	58,278	95,030	620	6,335	$ 201,370	$ -	$ 201,370	$ 1,847	13.5%	$ 1.5240	$ 0.2105	$ 1.3135
	2018	100	16	97,574	70,726	976	4,420	$ 220,982	$ -	$ 220,982	$ 1,905	15.5%	$ 1.5240	$ 0.2105	$ 1.3135
	2017	100	13	151,773	53,551	1,518	4,119	$ 245,456	$ -	$ 245,456	$ 2,172	18.0%	$ 1.4643	$ 0.2105	$ 1.2538
	2016	100	12	148,450	36,774	1,485	3,065	$ 230,697	$ -	$ 230,697	$ 2,060	15.9%	$ 1.4560	$ 0.2105	$ 1.2455
	2015	106	14	151,656	38,066	1,431	2,719	$ 230,948	$ -	$ 230,948	$ 1,925	18.1%	$ 1.4278	$ 0.2105	$ 1.2173
	2014	98	14	133,853	30,372	1,366	2,169	$ 194,919	$ -	$ 194,919	$ 1,740	18.0%	$ 1.3974	$ 0.2105	$ 1.1869
	2013	102	13	141,845	30,647	1,391	2,357	$ 200,004	$ -	$ 200,004	$ 1,739	20.4%	$ 1.3700	$ 0.2105	$ 1.1595
	2012	99	13	117,497	45,227	1,187	3,479	$ 188,679	$ -	$ 188,679	$ 1,685	20.0%	$ 1.3700	$ 0.2105	$ 1.1595
	2011	101	13	106,393	34,921	1,053	2,686	$ 163,558	$ -	$ 163,558	$ 1,435	19.6%	$ 1.3700	$ 0.2126	$ 1.1574
Saanich															
	2025	61	66	38,531	181,602	632	2,752	$ 418,583	$ 29,735	$ 448,318	$ 3,530	18.1%			
	2024	62	58	42,377	126,972	684	2,189	$ 322,017	$ 10,934	$ 332,952	$ 2,775	17.3%	$ 2.1120	$ 0.2105	$ 1.9015
	2023	76	54	47,961	168,198	631	3,115	$ 382,061	$ 10,230	$ 392,291	$ 3,018	17.8%	$ 1.9780	$ 0.2105	$ 1.7675
	2022	66	56	36,146	129,467	548	2,312	$ 267,879	$ 11,330	$ 279,209	$ 2,289	16.3%	$ 1.8280	$ 0.2105	$ 1.6175
	2021	74	55	49,933	158,309	675	2,878	$ 318,923	$ 11,050	$ 329,973	$ 2,558	16.5%	$ 1.7420	$ 0.2105	$ 1.5315
	2020	68	53	40,416	144,443	594	2,725	$ 268,877	$ 10,867	$ 279,745	$ 2,312	17.8%	$ 1.6650	$ 0.2105	$ 1.4545
	2019	68	51	37,086	140,512	545	2,755	$ 249,436	$ 10,278	$ 259,714	$ 2,182	17.4%	$ 1.6150	$ 0.2105	$ 1.4045
	2018	70	49	37,503	111,896	536	2,284	$ 208,786	$ 9,996	$ 218,782	$ 1,839	15.3%	$ 1.5910	$ 0.2105	$ 1.3805
	2017	80	50	38,201	132,092	478	2,642	$ 229,604	$ 9,719	$ 239,324	$ 1,841	17.6%	$ 1.5600	$ 0.2105	$ 1.3495
	2016	71	53	36,409	139,764	513	2,637	$ 237,745	$ 10,056	$ 247,802	$ 1,998	17.1%	$ 1.5600	$ 0.2105	$ 1.3495
	2015	75	51	74,841	129,225	998	2,534	$ 226,276	$ 9,727	$ 236,003	$ 1,873	18.5%	$ 1.5420	$ 0.2105	$ 1.3315
	2014	72	53	46,230	177,633	642	3,352	$ 213,981	$ 9,883	$ 223,863	$ 1,791	20.7%	$ 1.4560	$ 0.2105	$ 1.2455
	2013	65	50	35,745	122,456	550	2,449	$ 179,004	$ 9,655	$ 188,659	$ 1,641	19.2%	$ 1.3420	$ 0.2105	$ 1.1315
	2012	68	47	38,212	138,455	562	2,946	$ 180,466	$ 9,235	$ 189,701	$ 1,650	20.1%	$ 1.2320	$ 0.2105	$ 1.0215
	2011	71	46	101,235	121,896	1,426	2,650	$ 149,584	$ 9,118	$ 158,703	$ 1,356	19.0%	$ 1.1530	$ 0.2126	$ 0.9404
Totals															
	2025	298	49	591,590	349,902	1,985	7,141	$ 2,442,901	$ 36,644	$ 2,479,545	$ 7,146	100%			
	2024	548	149	649,413	528,603	1,185	3,548	$ 1,907,345	$ 15,540	$ 1,922,885	$ 2,759	100%			
	2023	531	138	691,154	634,635	1,302	4,599	$ 2,188,937	$ 16,904	$ 2,205,842	$ 3,297	100%			
	2022	535	142	531,946	553,982	994	3,901	$ 1,690,553	$ 18,380	$ 1,708,933	$ 2,524	100%			
	2021	540	139	633,419	656,080	1,173	4,720	$ 1,979,806	$ 18,100	$ 1,997,906	$ 2,942	100%			
	2020	532	133	515,927	537,228	970	4,039	$ 1,553,594	$ 17,635	$ 1,571,229	$ 2,363	100%			
	2019	524	127	553,766	496,318	1,057	3,908	$ 1,478,533	$ 12,440	$ 1,490,973	$ 2,290	100%			
	2018	543	132	554,327	499,724	1,021	3,786	$ 1,408,879	$ 16,999	$ 1,425,878	$ 2,112	100%			
	2017	557	123	621,519	495,793	1,116	4,031	$ 1,343,940	$ 16,722	$ 1,360,663	$ 2,001	100%			
	2016	548	127	672,348	488,609	1,227	3,847	$ 1,432,788	$ 17,247	$ 1,450,036	$ 2,148	100%			
	2015	554	127	672,094	420,661	1,213	3,312	$ 1,261,474	$ 16,871	$ 1,278,344	$ 1,877	100%			
	2014	543	127	571,304	407,973	1,052	3,212	$ 1,066,184	$ 16,691	$ 1,082,874	$ 1,616	100%			
	2013	543	119	524,640	353,529	966	2,971	$ 968,283	$ 13,841	$ 982,124	$ 1,484	100%			
	2012	526	114	504,989	400,520	960	3,513	$ 928,426	$ 14,893	$ 943,320	$ 1,474	100%			
	2011	457	108	548,240	330,916	1,200	3,064	$ 818,967	$ 14,362	$ 833,329	$ 1,475	100%			

* **Western Communities do not charge a fixed charge**

** **North Saanich charges the fixed charge on property taxes**

*** **AR - Agriculture/Residential customers receive a rebate on consumption over 455 cubic meters annual as the meter feeds both premise and land.**
AG - Agriculture customers receive a rebate on the entire consumption annually as the meter is dedicated only for land.

Making a difference...together

REPORT TO REGIONAL WATER SUPPLY COMMISSION
MEETING OF MAY 20, 2026

SUBJECT **2027 Service Delivery – Staffing Requirements**

ISSUE SUMMARY

To report back on the 2027 service plans and projected staffing requirements for meeting the commitments outlined in the 2025 Regional Water Supply Strategic Plan.

BACKGROUND

At the April 8, 2026, Capital Regional District (CRD) Board meeting, the Chief Administrative Officer (CAO) informed the Board that staff had been directed to limit requests for staffing resources and other budget requests to initiatives that have been: a) explicitly directed to advance by the CRD Board to support Board priorities, new service establishment or major project delivery, or b) critical programs where deferral would result in significant service disruptions or negative impacts (e.g., legal, safety or risk impacts). This was to maintain a proactive focus on fiscal discipline and to pave the way for a period of transition in late 2026 when a new Board will set its priorities for the next term. It was also noted that programs and associated resources that have been prioritized and recommended by a Commission or Standing Committee could also be incorporated in the 2027 financial planning process for the Board's consideration.

As part of the annual service planning process, the CRD Board receives information in the fall about proposed new initiatives that have resource and staffing implications for the subsequent year and considers the provisional Five-Year Financial Plan.

At the December 17, 2025, Regional Water Supply Commission (Commission) meeting, the Commission approved the 2025 Regional Water Supply Strategic Plan (Strategic Plan). The Strategic Plan outlines 11 priorities and proposes short-, medium- and long-term actions to be implemented in the next five to eight years to advance the commitments identified. The actions span all aspects of service delivery, including operations and capital delivery, demand management, asset management, public engagement, First Nations engagement and watershed protection. Though many of these identified actions will be supported by existing resources, the full extent of the effort required goes beyond existing capacity in certain areas.

In preparation for 2027, Infrastructure & Water Services (IWS) staff have reviewed the potential impacts of system growth and aging infrastructure on service delivery, in combination with Strategic Priorities outlined in the 2025 Strategic Plan. This report outlines the staffing needs required to mitigate service level risks in 2027 while progressing the key strategic priorities related to the implementation of the 2022 Regional Water Supply Master Plan (Master Plan). The following sections outline proposed initiatives that have impacts on the Regional Water Supply budget. This includes 2.5 new positions (2.5 Full-Time Equivalent (FTE)) proposed for 2027 which was highlighted as a forecast in last year's planning cycle. Staff are also forecasting an additional 5.5 FTE positions in 2028. Forecasted positions will be brought forward for consideration in a future planning cycle. Summaries of each initiative are included below and in Table 1.

Initiatives Planned for 2027

The following provides further details on the key programs that have staffing implications in 2027. The impact of deferring the staffing plans associated with these programs in 2026 is highlighted in the Service Delivery Implications section of this report.

2a-2.3 Master Plan Program: The Master Plan Program outlines the staffing requirements to advance the planning and implementation of 21 major projects recommended by the 2022 Master Plan. These projects are critical to improving the resiliency of the Regional Water Supply system and providing sufficient drinking water to support the growing region and climate change adaptation. In 2026, four new FTEs were approved to support the implementation and are listed below for information as a reminder:

2026 (4 FTEs)	***Senior Manager (filled)*** *(Infrastructure Planning and Engineering)*
	Operations Supervisor (filled) *(Water Operations)*
	First Nations Liaison (recruitment underway) *(First Nations Relations, Corporate Services)*
	Paralegal (recruitment underway) *(Legal Services & Risk Management, Corporate Services)*

For 2027, an additional 1.0 FTE is proposed, while another 1.0 FTE is forecasted for 2028:

2027 (1 FTEs)	***Project Engineer*** *(Infrastructure Planning and Engineering)* – Required to support the planning required for the Master Plan projects – i.e. Filtration Siting study, Environment Assessment, Archaeological Assessment, First Nations engagement.
2028 (1 FTEs)	***Senior Project Manager*** *(Infrastructure Planning and Engineering)* – Required to lead growing program of projects related to the Master Plan.

2b-1.1 Dam Safety Program: The Dam Safety Program was started in 2024 to create a dedicated Dam Safety section within the Infrastructure Planning and Engineering division to manage dam safety risks proactively. The program will address the challenges of maintaining 23 water supply dams, ensuring compliance with the Dam Safety Regulation, and improving the resiliency of these critical assets. In order to address the growing list of dam-related deficiencies and undertake the ongoing operational activities, the CRD needs to continue to build the necessary in-house expertise and capacity. This capacity development is being proposed through additional staffing in 2028. Staffing adjustments were approved between 2024 and 2026 and the roles, which have been filled, are listed below are a reminder:

2024 (2 FTEs)	***Manager, Dam Safety*** *(Infrastructure Planning and Engineering)*
	Team Lead *(Water Infrastructure Operations)*
2025 (3 FTEs)	***Project Engineer – Dam Safety Regulatory Compliance*** *(Infrastructure Planning and Engineering)*
	Project Engineer - Dam Surveillance and Hydrology *(Infrastructure Planning and Engineering)*
	Dam Operator (*Water Infrastructure Operations)*
2026 (2 FTEs)	***Project Engineer*** *(Corporate Capital Delivery Services)* ***Technologist*** ~~***Project Engineer***~~ *(Infrastructure Planning and Engineering)*

In last year's report to the Commission, staff indicated their intent to propose an additional 1.0 FTE Technologist position in 2027. In response to ongoing financial pressures facing CRD services, staff have elected to advance this position by reallocating one of the two Project Engineer positions approved for 2026 and deferring the recruitment of the Project Engineer role to 2028. Staff are confident that this adjustment can be accommodated without compromising progress towards full regulatory compliance.

2028 (1 FTE)	***Project Engineer*** ~~***Technologist***~~ *(Infrastructure Planning and Engineering)*

Ongoing management of CRD dams is critical to meeting the commitments outlined in the Strategic Plan, particularly the actions outlined in Commitment 3 “to provide efficient, effective and innovative operations of our water system infrastructure”.

11b-3.2 Staff and O&M Funding to Support Broadened Facilities Management Portfolio: The CRD’s Facilities Management team, which is part of the Real Estate & Facilities Management division, is an in-house, full-service team responsible for the management, operation and maintenance of the CRD headquarters in downtown Victoria, as well as several other satellite buildings. The team ensures that facilities within the corporate portfolio are safely maintained, operate efficiently, and remain serviceable assets that support critical operations and occupant safety.

Starting in 2023, the Facilities Management team expanded its scope of service to provide increased building operations support at 17 water treatment facilities across the region. In 2025, the team also assumed full-service facility management responsibilities for the building at 479 Island Highway, which primarily houses Infrastructure & Water Services (IWS) operations. This facility presented significant challenges, as many building systems are at or near end of their effective service life and require enhanced maintenance support to remain functional. These service expansions were accommodated without additional staffing through workload redistribution.

Construction of IWS’ new 13,100 square-foot Field Operation Centre (FOC) is scheduled for completion in mid-2027, with system commissioning, development of maintenance manuals and schedules and other preparations for occupancy beginning in early 2027. This major capital project will support IWS’ field and technical operations for decades. To ensure this facility is properly managed and maintained, additional operating and maintenance funding will be required. Given the cumulative service increases, additional staffing is also needed to ensure Facilities Management can deliver services at a sustainable level.

This initiative proposes the creation of two new regular, ongoing positions (1.5 FTE) within Facilities Management. These roles will provide the essentials functions including office moves support, general facility clean-up, pest control and coordination of janitorial and other contracted services. They will also ensure that the building systems are maintained in accordance with manufacturer specifications and warranty requirements, including the structure, building envelope, roofing, HVAC, elevator, electrical, grounds, and fire safety systems.

The initiative also proposes an incremental increase to the operating budget to support the ongoing operations and maintenances of the FOC. The proposed funding increase is based on industry-standard guidelines for managed-care performance levels and on the operating costs of similarly sized facilities within the existing portfolio.

If the initiative does not proceed, Facilities Management will be unable to provide adequate support to its growing portfolio of facilities. This could result in maintenance delays, deferred maintenance, reduced asset lifespan, invalidation of building and/or system warranties and increased emergency repairs and capital costs over the long term.

Initiatives Planned for Future Years (2028-2029)

In addition to the initiatives listed above that have staffing implications in 2027, the following six initiatives have staffing implications in 2028 or beyond:

2028 (4.5 FTE)	2a-5.2 Equipment/Watershed Operator (1 FTE, Watershed Protection)
	2a-5.3 Seasonal Watershed Protection (2.25 FTE, Watershed Protection)
	2b-2.7 Contract Support Service (0.25, FTE shared with other services)
	2b-2.5 Utility Operator (1 FTE, Water Operations)
2029 (1 FTE)	2a-5.4 Forest Management Plan Implementation (1 FTE, Watershed Protection)

Given the current operational context, priorities and fiscal pressures, the following phasing adjustments have been made since last year:

- The Equipment/Watershed Operator, Seasonal Watershed Protection and Contract Support Service positions have been deferred from 2027 to 2028
- The Forest Management Plan Implementation position has been deferred from 2028 to 2029

Descriptions for these initiatives have been included in Appendix A.

Projected Future Initiatives

This report summarizes the staffing requirements to achieve the commitments of the 2025 Strategic Plan, based on the information currently available. Within the 2025 Strategic Plan, there are longer-term initiatives that have not yet been fully scoped, and additional information will be required to determine if existing resources can be optimized to undertake these initiatives or if additional skills or resources will be required.

NEXT STEPS

The 2027 Service Planning process began in February 2026. Following Board approval of the 2027 Service and Financial Planning Guideline, staff evaluated initiatives with staffing implications and reviewed potential downstream service implications. These initiatives were phased over a three-year period (2027-2029) and costed, in alignment with the Commission's interest in understanding the implementation path for the 2025 Strategic Plan and 2022 Master Plan. The proposed initiatives were subsequently reviewed by both the IWS leadership and the Executive Leadership Team. If the Commission wishes to proceed with any initiatives requiring staffing in 2027, a motion should be recommended for consideration by the Board. The provisional budget will be presented to the Board in September 2026.

IMPLICATIONS

Financial Implications

The proposed staffing additions in support of the 2025 Strategic Plan reflect an estimated incremental cost increase of $180,000 in 2027, based on approved initiative business cases. This cost represents only new FTEs proposed for 2027 and are apportioned between operating and capital budgets. Due to the upcoming general election, the provisional CRD budgets are required to be presented earlier than in a typical year. This has resulted in a compressed service and financial planning timeline. To make effective use of the time and organizational capacity available, projected initiatives for 2028 and 2029, including their funding requirements and associated staffing needs, have been documented for planning purposes but will not be included in the provisional budget for Regional Water Supply this year.

A high-level estimate of projected salaries and associated costs for 2027 is presented in Table 1.

Table 1:

Cost Distribution by IBC	2027
2026 IBC: 2a-2.3 Master Plan Program (1 FTE)	180,000
Total Cost Increase	**$ 180,000**

These costs will be integrated into both capital and operating budgets. The operating portion represents a 0.2% increase in total ongoing operating expenditure compared to 2026. The capital portion amounts to approximately 0.2% of the 2026 capital budget. Funding will be sourced through a combination of water sales revenue and Municipal Finance Authority (MFA) debt financing, with the intent to support rate stability and long-term financial sustainability.

A breakdown of projected funding sources is summarized in Table 2.

Table 2:

Funding Breakdown	2027
Operating Budget (Water sales revenue)	36,000
Capital Budget (Water sales revenue & debt)	144,000
Total Funding	**$ 180,000**

In addition to the costs above, the RWSC would also support $177,000 in additional labour allocation to support Facilities Services expanded facilities management portfolio and $120,000 in other operating costs related to utilities, equipment and contracted services so support the new Field Operations Center. The labour costs will be charged to Regional Water based on a fee-for-service model.

Environmental & Climate Action

Advancing the actions identified in the 2025 Strategic Plan, which include moving forward with the implementation of the 2022 Master Plan, directly supports the CRD's Climate Action Strategy by embedding climate resilience and environmental stewardship into the long-term planning and operation of the region's water system. The 2025 Strategic Plan emphasizes the need to protect and adapt the watershed and critical water infrastructure in response to increasing climate variability, including more extreme weather events, prolonged droughts, and wildfire risks. By

prioritizing risk-based infrastructure investment, these plans align with and operationalize the CRD's broader climate mitigation and adaptation goals.
Key projects, such as the addition of water filtration and a second deep intake in the Sooke Lake Reservoir, are proactive climate adaptation measures. Filtration will strengthen the system's ability to maintain water quality in the face of increased turbidity events tied to severe storms, wildfire runoff, and ecological shifts, events that are projected to become more frequent and severe with climate change. Similarly, a second deep intake improves system redundancy and operational flexibility, enabling a more stable supply under changing seasonal patterns and potential water quality disruptions. Together, these investments are not just technical upgrades—they are foundational climate adaptation tools that reinforce the CRD's commitment to delivering safe, reliable drinking water in an increasingly uncertain environmental future.

First Nations Reconciliation

The 2025 Strategic Plan directly supports the CRD Board's 2023–2026 Priority of "strong relationships with First Nations based on trust and mutual respect, partnerships, and working together on shared goals" by advancing tangible, ongoing actions that build stronger relationships with First Nations and reflect the region's commitment to shared stewardship. The Plan recognizes that the lands and waters within the Regional Water Supply Area lie within the traditional territories of numerous First Nations, and commits to working collaboratively with them to protect, manage and access these critical areas. This approach is in alignment with the Board's objective to "foster strong relationships with First Nations" and to "invite, respect and incorporate Indigenous leadership and traditional knowledge to enhance initiatives and strategies".

Service Delivery Implications

The service delivery implications of deferring the implementation of the 2027 initiatives are outlined below.

2a-2.3 Master Plan Program: The infrastructure investments outlined in the 2022 Master Plan ensure IWS continues to meet the commitments made in the 2025 Strategic Plan while adapting to the needs of the growing population, climate adaptation and improved seismic resiliency. If the Project Engineer position does not proceed, this will ultimately impact the planning efforts required to move forward with the implementation of the 2022 Master Plan and will delay realizing the goal of improving the overall resiliency of the Regional Water Supply system.

The following planning projects would be impacted by a removal or deferral of the position:

1. Filtration Plant Planning and Preliminary Design – includes initial studies such as:
    - Project definition study outlining the project's purpose, scope and objectives, including integration with other system components and review of current and future technologies.

2. Deep Northern Intake and Sooke Lake Pump Station Planning and Conceptual Design – includes initial studies such as:
    - Project definition study outlining the project's purpose, scope and objectives, including integration with other system components and review of current and future technologies (including floating intake versus fixed, tunneled versus overland etc.).

CONCLUSION

This report outlines the five-year staffing requirements needed to support the implementation of the 2025 Regional Water Supply Strategic Plan and provides information on the potential implications of deferring these staffing additions. The proposed positions address anticipated gaps in capacity related to project planning and delivery, dam safety and operations support.

Delaying or removing the addition of the 2.5 Full-Time Equivalents proposed for 2027 may impact timelines for initiating major capital projects identified in the 2022 Regional Water Supply Master Plan. These implications have been identified based on current service needs, resourcing levels and the projected scope of work.

This phased staffing plan is intended to align with strategic priorities and provide the internal capacity needed to support ongoing service delivery, infrastructure planning and regulatory compliance over the next five years.

RECOMMENDATION

There is no recommendation. This report is for information only.

Submitted by:	Alicia Fraser, P. Eng., General Manager, Infrastructure and Water Services
Concurrence:	Nelson Chan, MBA, FCPA, FCMA, Chief Financial Officer & General Manager, Finance & Technology
Concurrence:	Ted Robbins, B. Sc., C. Tech., Chief Administrative Officer

ATTACHMENT(S)

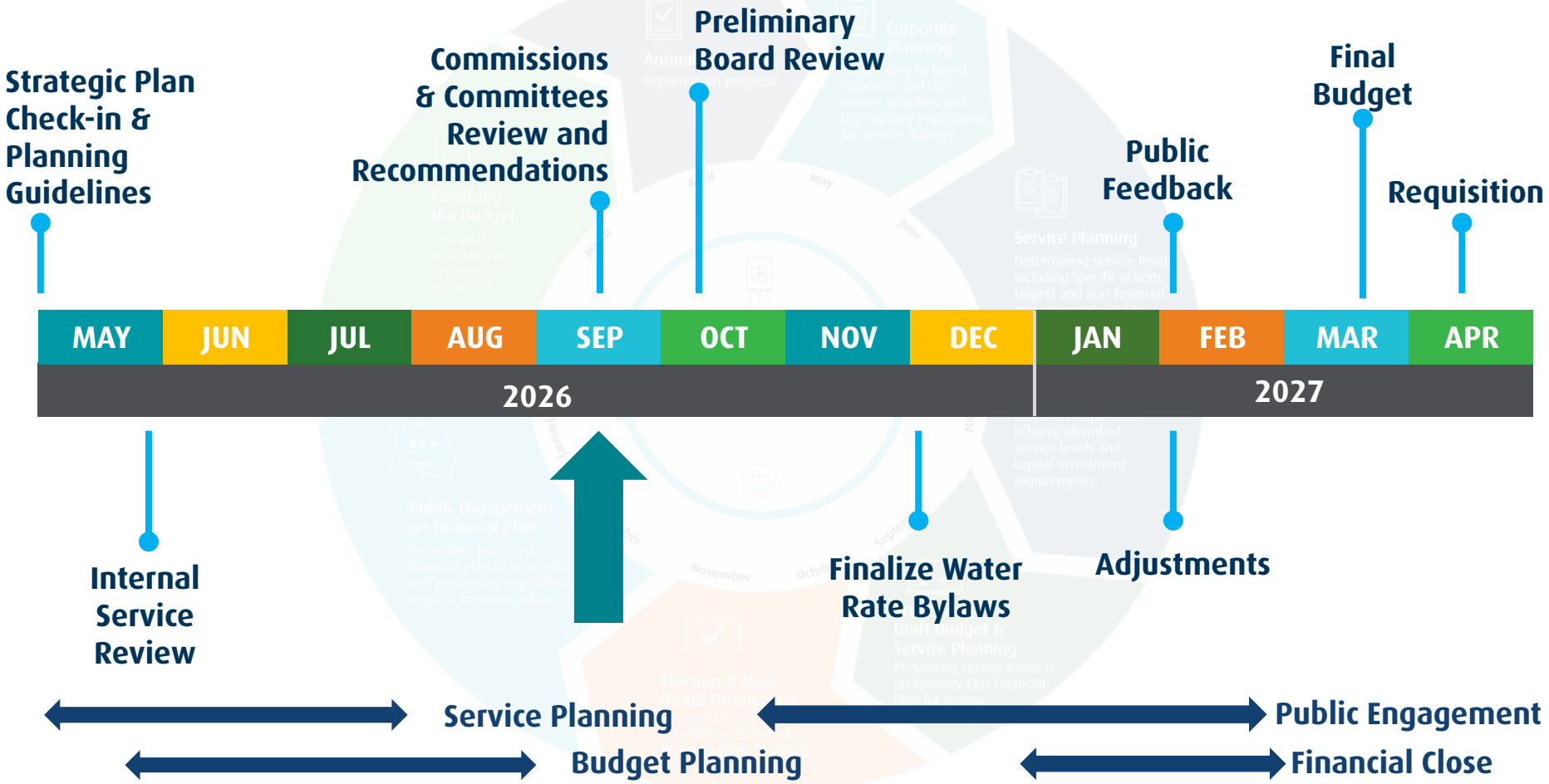
Appendix A: Summary of Initiatives Planned for Future Years



Regional Water Supply Service 2027 Budget Review

Regional Water Supply Commission
September 16, 2026

Budget Process Overview





2027 Budget Considerations

- Community Needs Summary and proposed Regional Water Supply Strategic Plan
- Existing Asset Condition, Infrastructure Growth and Resiliency Needs
- Operating budget adjustments
- Capital funding & debt servicing
- Water demand projection and trends
- Motion Arising from the May 20, 2026, Regional Water Supply Commission Meeting:

  The Regional Water Supply Commission recommends to the Capital Regional District Board:

  That staff be directed to include the proposed Master Plan Program Project Engineer position (1 FTE) and Field Operation Centre positions (1.5 FTEs) in the Regional Water Supply Service budget for 2027.

Current System Overview

Treat over 52,500 ML/yr



122.5 kilometers of Transmission Main



26 RWS Operations Staff





Manage 15 Dams



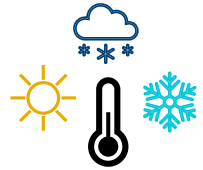
22,416 ha of Protected Watershed

Current Service Priorities

Commitments:

1. Provide high quality, safe drinkable water
2. Provide adequate, reliable, long-term supply of drinkable water
3. Provide efficient, effective and innovative operations of our water system infrastructure

Guiding Principles:



Respecting and adapting to the changing environment



Empowering staff for sustainable water management



Proactively managing and balancing internal and external risks



Managing our resources effectively and efficiently



Supporting a growing region with reliable service



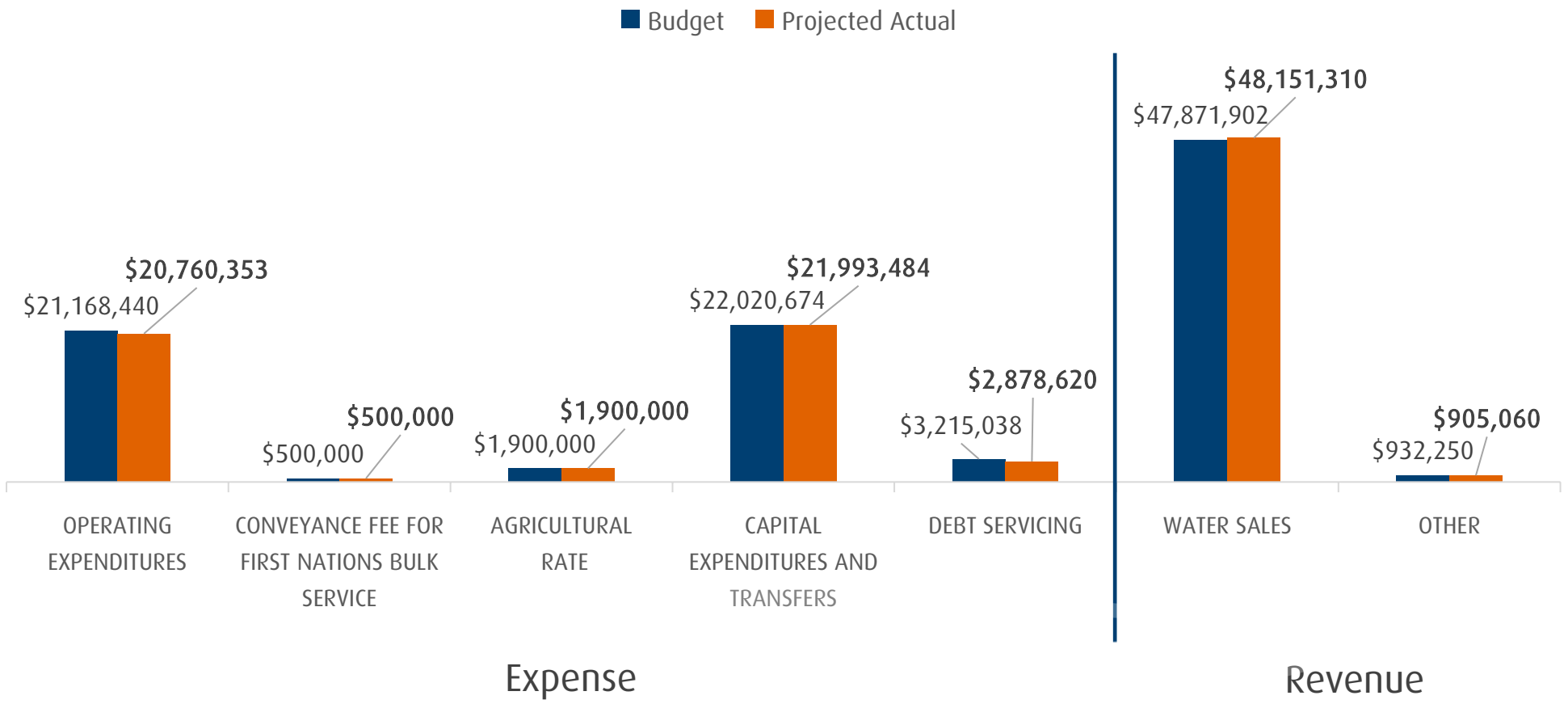
Fostering collaborative relationships with customers and partners to improve our service



Advancing reconciliation through shared water stewardship

2026 Year End Projections

Revenue	Budget | $48.8M	Actual* | $49.1M	+ $1.0M | 2.1%
Expenditures	Budget | $48.8M	Actual* | $48.1M	Transfer to Water Capital Fund



* Projected Actuals estimated in April/May 2026.

How the RWS Budget Works...

Wholesale Water Rate

×

Consumption rate

=

Revenue

Revenue

Saanich Peninsula Water Service

Sidney

north saanich

Central Saanich

JdF Water Distribution Service

District of Highlands

District of Sooke

Town of View Royal

District of Metchosin

Langford

Colwood

CRD

Municipalities

City of Victoria

Saanich

Township of Esquimalt

District of Oak Bay

Other Participants

- First Nations Bulk Water Supply
- Westhills Supply

Expenditure

- Capital Transfers
- Operations
- Debt Servicing
- Agricultural Conveyance

Capital Investment

5-year Capital Plan includes:

- ✓ System growth
- ✓ Increased system resilience
- ✓ Asset renewal

Funding sources:

internal
- Reserves
- Capital funds on hand

external
- Debt
- Extra grants

Operations

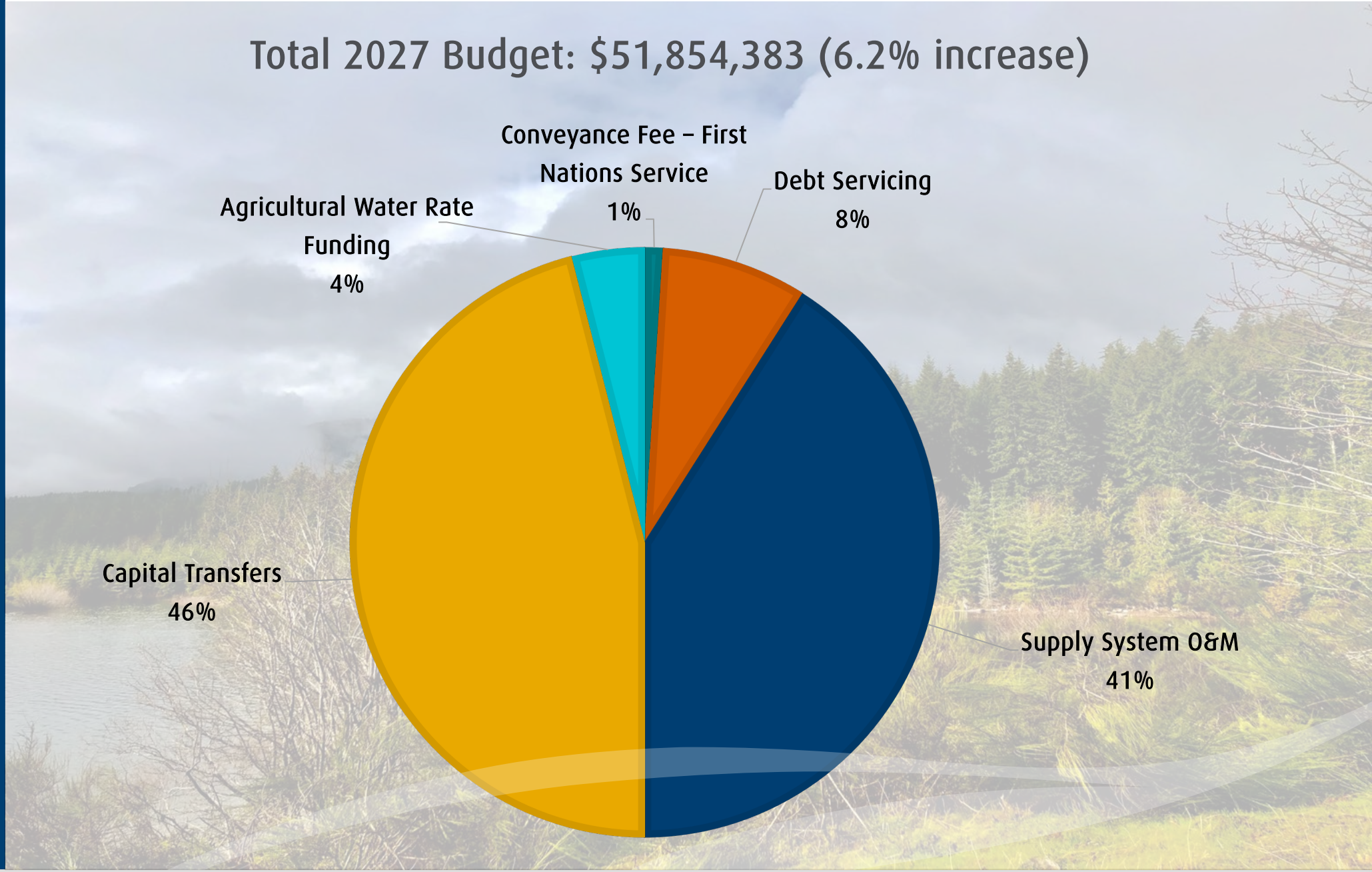
Operation and maintenance of infrastructure and programs to meet service demands for:

- Watershed Protection
- Water Operations
- Water Quality
- Cross Connection
- Demand Management
- Infrastructure Engineering
- Fleet Operation & Maintenance
- Admin Support
- Asset Management

Wholesale Water Rate

2027 Budget Overview:

Breakdown of Expenditures

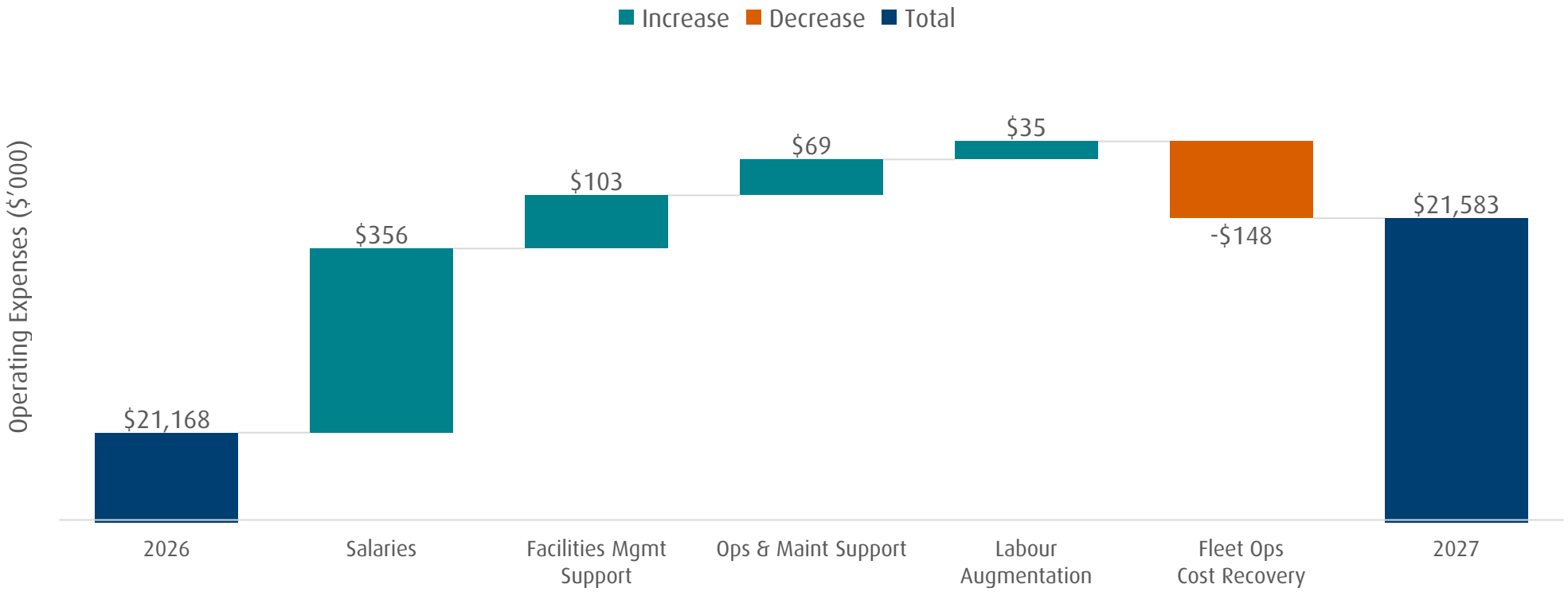


Overview:

Core Operations: $21,582,603 (1.96%)

Highlights:

- Increases resulting from inflationary pressures and collective agreement obligations
- Increased ongoing support from Facilities Management for IWS facilities
- Increased Fleet cost recovery and transfer to ERF for vehicle and equipment replacement



2027 Budget Overview:

Staff Augmentation

Overview:

- **Commission direction, May 20, 2026:** the Commission recommended to the CRD Board that the Master Plan Project Engineer (1 FTE) and Field Operation Centre positions (1.5 FTEs) be included in the 2027 Regional Water Supply Service budget.
- 2.5 new FTEs for 2027 — 1.0 for the Master Plan Program and 1.5 for the new Field Operation Centre — totalling **$477,000**.
- Requested under the Board's direction to limit new staffing: three watershed positions deferred to 2028, forest management to 2029, and the Dam Safety technologist absorbed within approved positions with deferral to 2028.

Initiative Reference	Program Area	Business Driver & Risk of Deferral	Staff Impact (2027)	Funding Source
2a 2.3	**Master Plan Program** Project Engineer Infrastructure Planning & Engineering	Advances planning for the 21 major projects recommended by the 2022 Master Plan — filtration siting study, deep northern intake and Sooke Lake pump station concept design, environmental and archaeological assessment, and First Nations engagement. **If deferred:** filtration and intake studies slip, delaying improved system resiliency and pushing construction timelines right.	**1.0 FTE** New ongoing	Water sales revenue & MFA debt $36K operating / $144K capital
11b 3.2	**Field Operation Centre** 2 positions, Facilities Management Real Estate & Facilities Management	Operates and maintains the new 13,100 sq. ft. Field Operation Centre from mid-2027, with commissioning, maintenance manuals and occupancy preparation beginning early 2027. Covers building envelope, roofing, HVAC, elevator, electrical, grounds and fire safety, plus janitorial and contracted service coordination. **If deferred:** warranty invalidation, deferred maintenance, reduced asset life and higher emergency repair and capital costs.	**1.5 FTE** Held in Facilities Management, not RWS establishment	Fee-for-service charge to RWS $177K labour / $120K O&M
Total 2027 impact to Regional Water Supply			**2.5 FTE**	**$333K operating / $144K capital**

2027 Budget Overview

Water Rate Funding

First Nations Regional Water Service

2027 Conveyance Fee Budget

$525,000 (+5.0%)

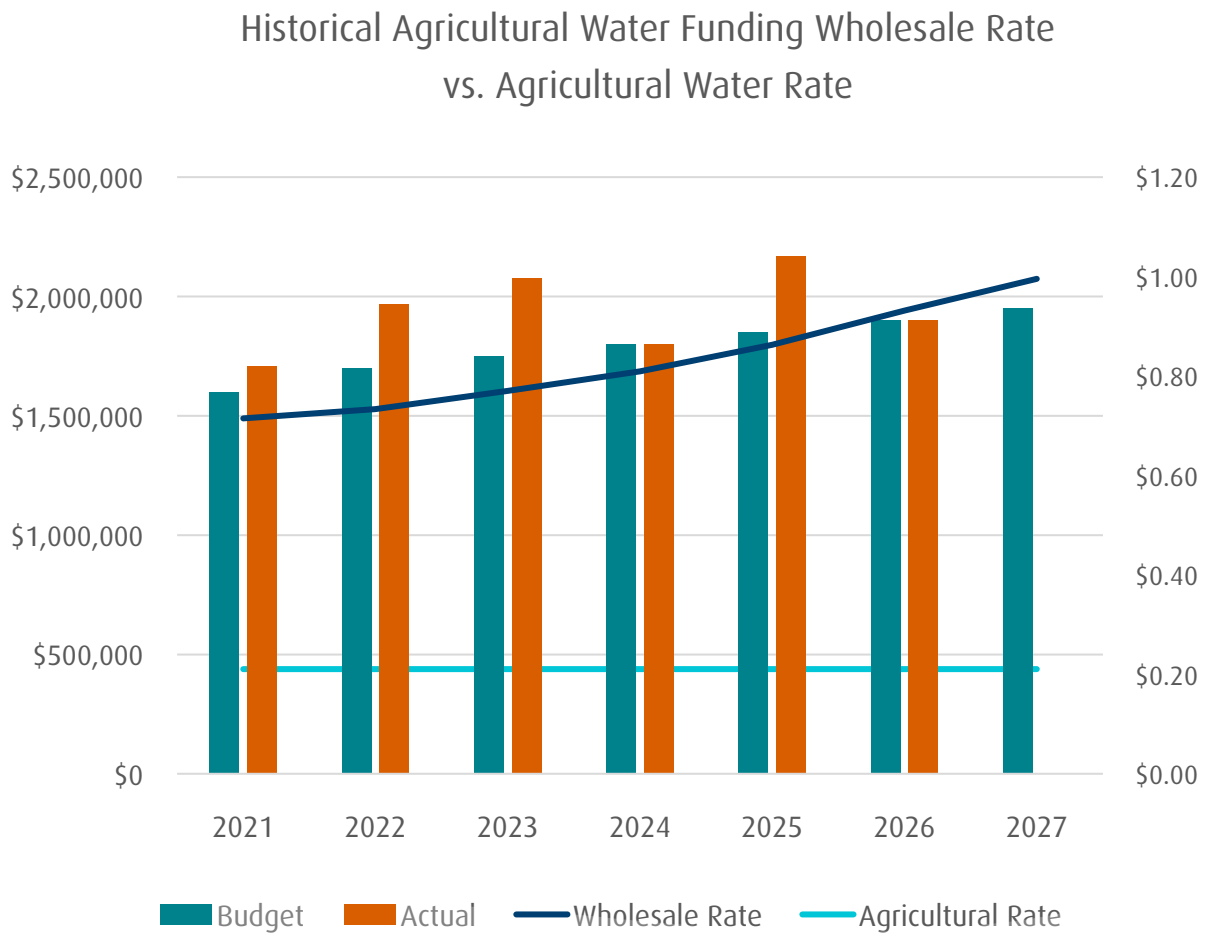
Agricultural Water Rate

2027 Agricultural Water Rate

$0.2105 / m^3 (0%)

2027 Agricultural Water Rate Budget

$1,950,000 (+2.63%)



2027 Budget Overview

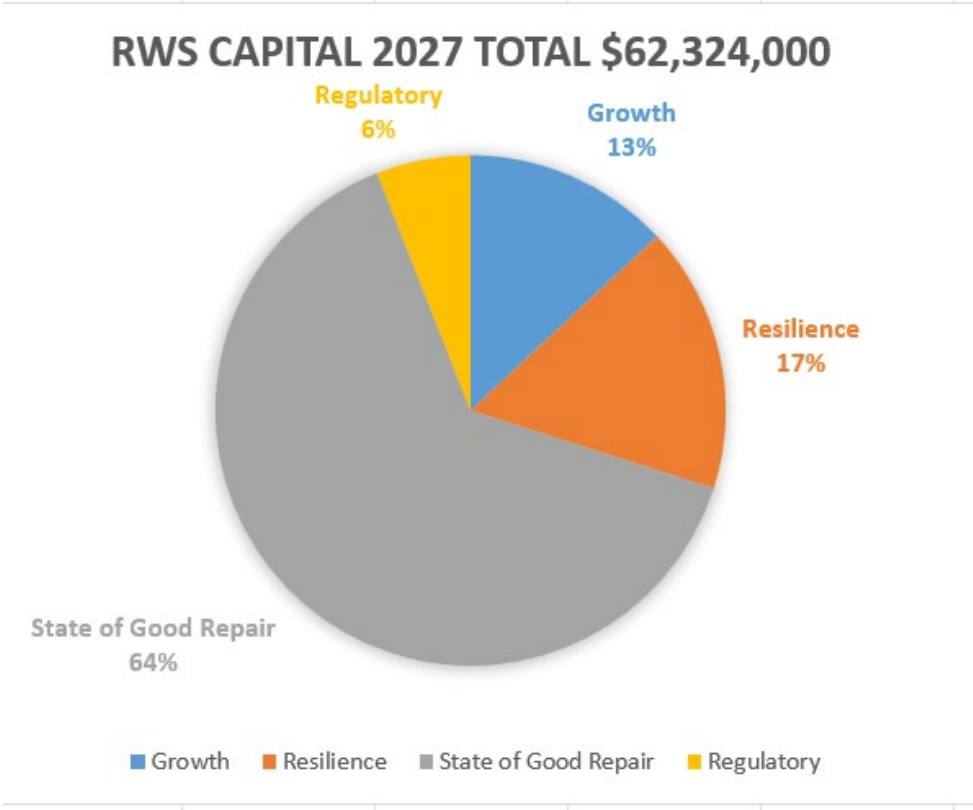
Capital Plan

Overview	RWS (millions)	50% of JDF/RWS Combo (millions)	Total (millions)
Projects in Progress	$46.0	$ 0.3	$ 46.3
2027 Capital Budget	$62.3	$ 0.7	$ 63.1
5-Year Capital Budget	$307.7	$ 2.2	$ 309.9

2027 Key Projects:

- Transmission Main 4 (Mt Newton to Highway 17 & Bear Hill Trunk Extension)*
- Transmission Main 1 High Pressurizing
- Mount Tolmie Tank Assessment
- Bulk Supply Meter Placement and Black Flow
- Master Plan Program Implementation
- Critical Spare Equipment Storage and Pipe Yard
- Sooke Lake & Deception Watershed Dams - Upgrades and Improvements Program
- Field Operation Center

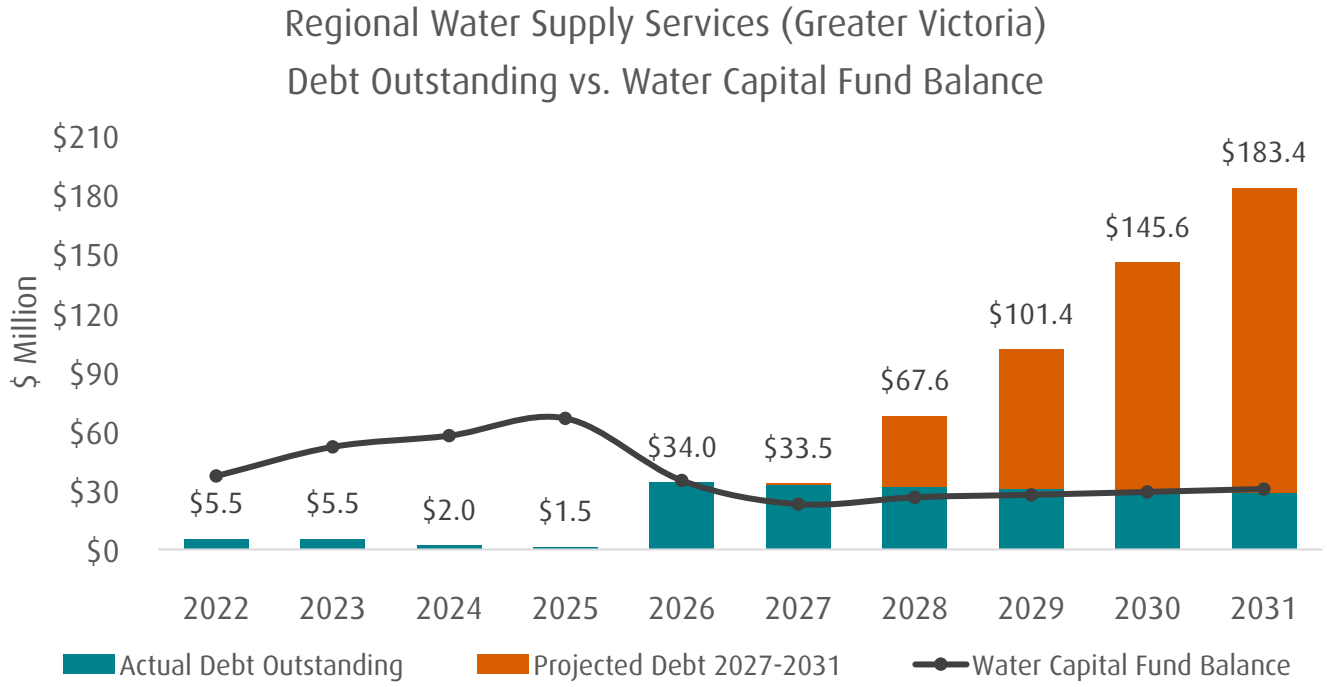
*In 2027, a portion of funding will be allocated from the new RWS Development Cost Charge Program



2027 Budget Overview

Outstanding Debt & Capital Funding

2027 Transfer	2027 Budget	Budget change (over 2026 Budget)
Water Capital Fund	$23,000,000	$2,000,000
Debt Reserve Fund	$6,800	($316,200)
Equipment Replacement Fund	$818,780	$148,296
Total Capital Transfers	**$23,825,580**	**$1,804,906**
Debt Servicing	**$3,971,200**	**$756,162**



Debt Servicing Costs are increasing 23.52% as a result of principal payments beginning on the $32.3M Kapoor Lands investment.

2027 Budget Overview

Rate Base & Revenue Requirement

Water Rate Model:

Using the various 2027 budget inputs detailed previously, the water rate is calculated using the water rate model. The model considers annual O&M, the increase in rate base which drives asset deprecation and future capital needs and debt servicing cost for the utility.

2027 Rate Base: $34,339,099 increase	
2025 new assets capitalized (projected)	$7,495,736
2025 depreciation & asset value adjustments	$22,523,262
Resulting 2025 change in physical plant	**$30,018,998**
2025 construction work in progress (projected)	$22,240,593

2027 Revenue Requirement: $3,682,423 Increase	
2026 - 2027 O&M expense (change)	$509,163
2026 - 2027 depreciation (change)	$52,066
Return on rate base (change)	$2,839,100

2027 Budget Overview

Wholesale Rate History & Projection

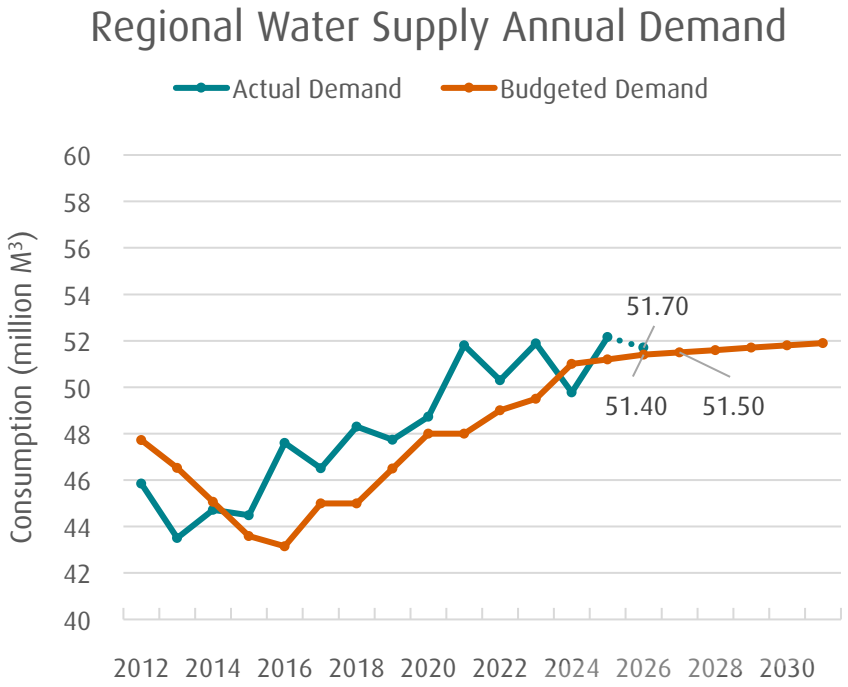
Overview:

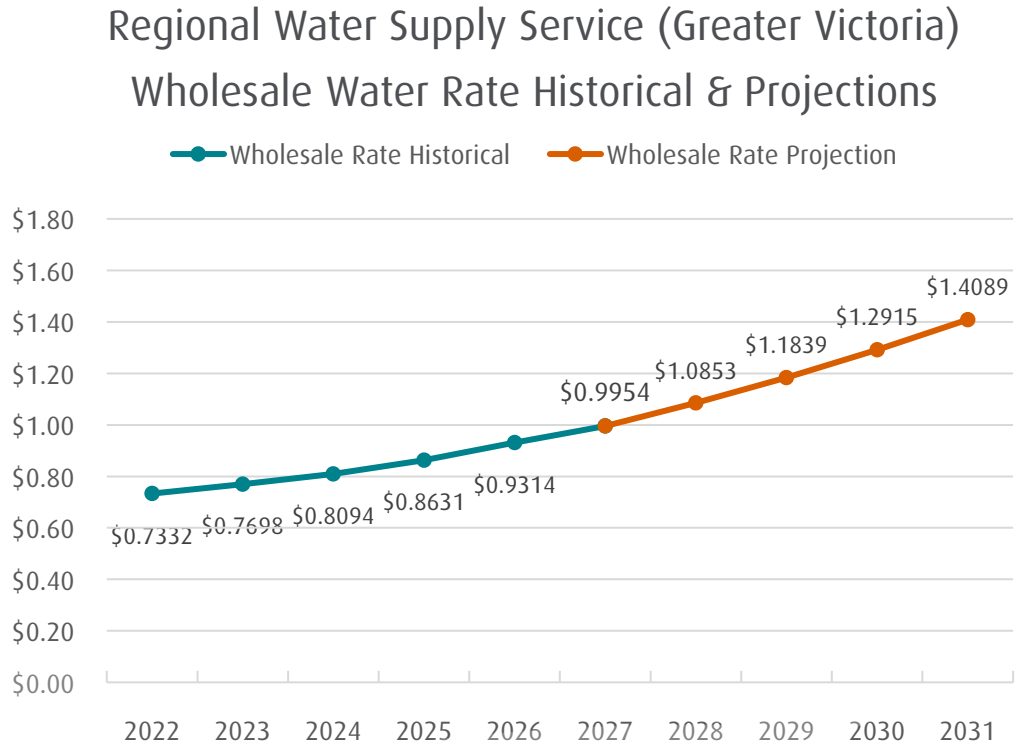
2026 Projected Actual Demand:
51,700,000 m^3

2027 Projected Water Demand:
51,500,000 m^3
(+100,000 m^3)

2026 Wholesale Rate: $0.9314
2027 Wholesale Rate: $0.9954 (+6.88%)

2027 rate is below rate indicated for 2027 in 2026 budget ($1.0130)





2027 Budget Overview

Water Demand and Rates

2027 Total Revenue Budget: $51,854,383

- 2027 Budget Water Demand:
  51,500,000 m^3
  (+100,000 m^3)
- 2027 Regional Water Supply Wholesale Rate:
  $0.9954/$m^3$ (+6.88%)
- 2027 Agricultural Rate:
  $0.2105 / cubic metre (0%)
- Annual cost increase to average residential consumption:
  $14.68



Budget Overview

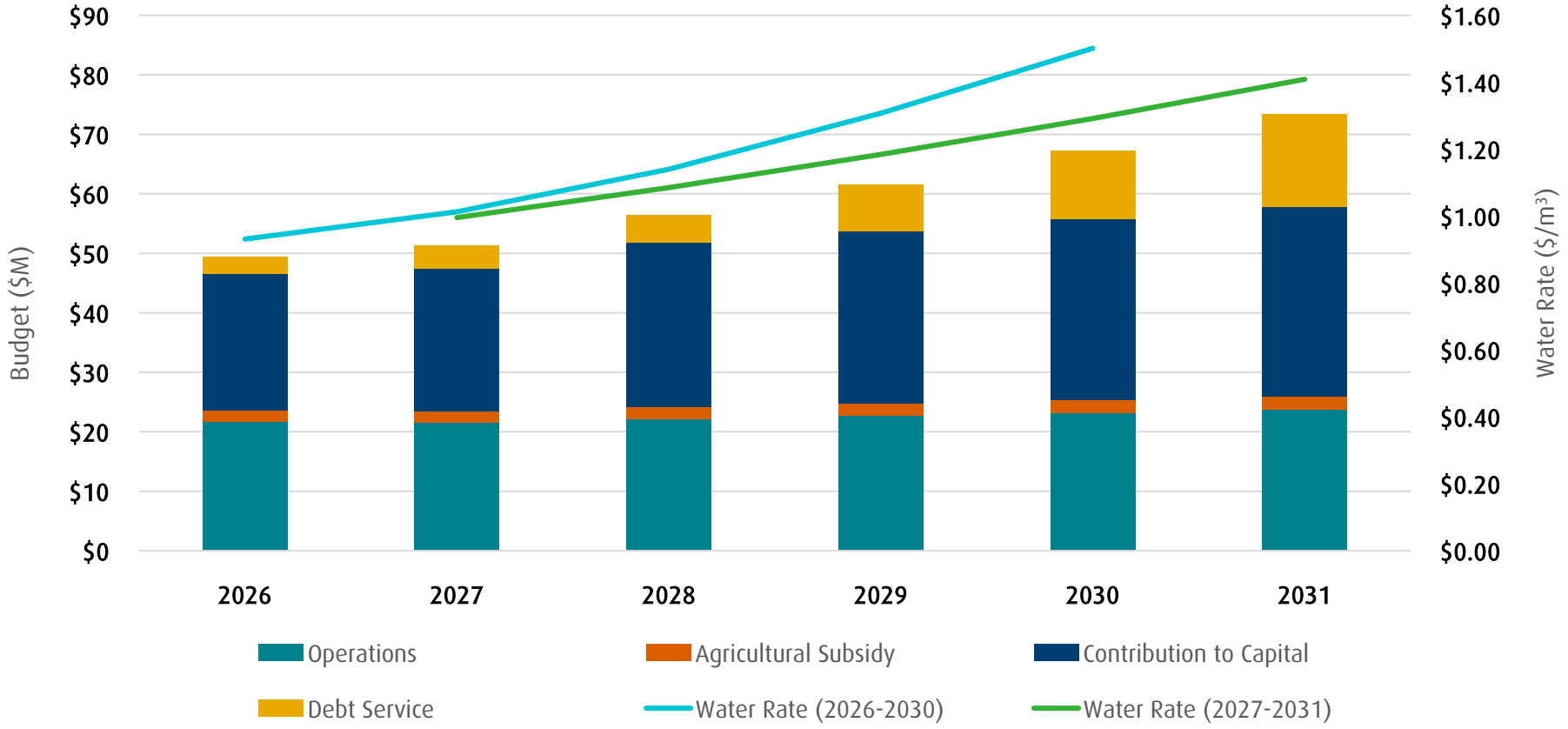
Multi-Year Projection

Overview:

2026 RWS budget: $48,804,152
2027 RWS budget: $51,854,383 (+6.25%)
2027-2031 Average Water Rate Increase: 8.63%

Drivers:

Growing Capital Program linked to development, Master Plan and aging infrastructure*



*Does not account for DCC program or potential future grants

Budget

Recommendations



This budget keeps a large, aging system operating safely today, and funds the work to stay ahead of climate change, water quality and growth pressures.

1. Approve the 2027 Operating & Capital Budget & Five-Year Capital Plan;
2. Approve the 2027 wholesale water rate of $\$0.9954/m^3$;
3. Approve the 2027 agricultural water rate of $\$0.2105/m^3$;
4. Direct staff to balance the 2026 actual revenue and expense on the transfer to the water capital fund;
5. Direct staff to update carry forward balances in the 2027 Capital Budget for changes after year end; and
6. Direct staff to amend the water rates bylaw accordingly.



Thank You

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REPORT TO REGIONAL WATER SUPPLY COMMISSION
MEETING OF WEDNESDAY, SEPTEMBER 16, 2026

SUBJECT **Renewable Energy Generation Proposal at Humpback PCS**

ISSUE SUMMARY

To seek direction on expanding capital works planned at the Humpback Pressure Control Station to include a microturbine to generate renewable electricity from the pressure drop in Supply Main No. 3.

BACKGROUND

In alignment with the Phase 1 Treated Water Transmission Main Projects outlined in the 2022 Regional Water Supply (RWS) Master Plan (Master Plan), the Capital Regional District (CRD) is undertaking a project to increase the hydraulic grade line (HGL) of Supply Main No. 1. The intent of the project is to increase the hydraulic capacity of the water supply system and improve redundancy to Supply Main No. 4. Raising the HGL of Supply Main No. 1 to 169m will match the existing HGL of Supply Main No. 4, providing some further level of redundancy up to the Watkiss PCS location. Operating both Mains 1 & 4 at 169m HGL will also result in a shared hydraulic load between these two mains, minimizing head losses and thus improving capacity during high demands.

This project includes improvements at multiple pressure controls stations (PCS), most notably at the Humpback PCS, where Supply Main No. 5 feeds into Supply Main No. 1 & 3, dropping the HGL from 169m to 116m. Significant upgrades at Humpback PCS are required to accommodate the pressure increase of Supply Main No. 1 and to address operational safety concerns by bringing new pressure control infrastructure for Supply Main No. 3 above grade. Given the extent of capital investments already required, the CRD have engaged Jacobs Consultancy Canada Inc. (Jacobs) to conduct a Microturbine Feasibility Study (Study) to consider the possibility of incorporating a microturbine into the design to recover energy from the pressure drop of Supply Main No. 3. This Study is included in Appendix A and is summarized below.

The Study reviewed siting options, unit sizing, power generation estimates, capital and operational cost estimates, Net Present Value (NPV) and payback period estimates. Sensitivity analysis and considerations for potential future HGL changes to Supply Main No. 3 were also considered. Jacobs solicited market input and incorporated feedback into their analysis.

CRD staff have engaged BC Hydro regarding the proposed microturbine and confirmed that the recently approved Self-Generation Rate allows up to 300kW of net injection for a three-phase customer, with excess generation compensated at $0.10/kWh. Site investigations have confirmed that three-phase power infrastructure is available within approximately 50m of the proposed location. Formal interconnection review and approval will be required during detailed design and will determine whether distribution system upgrades, protection requirements or additional costs will be necessary. If approved to proceed, this coordination will be further advanced as part of the detailed design stage and verified once a microturbine supply vendor is selected.

The Study estimates that incorporating a microturbine would increase project capital costs by approximately $1.3M ($1.18M at NPV) with a –20% to +40% accuracy range given the preliminary stage of the estimate. It is noted that costs are somewhat offset from typical applications, given that the CRD is already planning to expend much of the excavation and piping costs into this overall project, regardless of the decision on microturbine.

The lifecycle of the microturbine was conservatively estimated to be 30 years, and based on the assumptions outlined in the study, an estimated payback period ranges from 20-22 years and an NPV between $620,000 & $760,000, suggesting value for the investment. This information was originally based on the HGL of Main No. 3 remaining at 116m throughout the entire life of the microturbine and is summarized in Table 1 below.

Table 1 – Net Present Value & Payback Period Analysis

Item	Low Range ($M)	Average Range ($M)	High Range ($M)
Capital Expenditure	1.11	1.18	1.25
Operational Expenditure	0.24	0.24	0.24
Total Cash Outflow (1)	**1.34**	**1.41**	**1.48**
Energy Production Cost Savings	0.77	0.77	0.77
Total Cash Inflow	**2.11**	**2.11**	**2.11**
NPV	**0.76**	**0.69**	**0.62**
Discounted RoI	**0.57**	**0.49**	**0.42**
Payback Period	**20**	**21**	**22**

(1) Capital and Operational Expenditures are preliminary estimates. Capital expenditures are largely offset existing capital improvements currently planned and only show forecasted increases to currently planned works.

A separate program is looking at storage optimization on Supply Main No. 3, including the Mount Tolmie Tank and Smith Hill Reservoir assets and have outlined potential future scenarios that involve raising the HGL of Supply Main No. 3. To account for these potential scenarios, alternate payback analyses were explored involving the HGL of Supply Main No. 3 being potentially adjusted to 125m or 136m in the future. These potential scenarios are only in the conceptual development stage but have been considered here as alternate scenarios that could potentially impact the payback period for energy capture at Humpback PCS. These payback period results are summarized below in Table 2.

Table 2 - Estimated Payback Periods(1) Based on various HGL Scenarios

Baseline (Maintaining 116m HGL)	Future HGL Adjustment Scenarios	125m HGL	136m HGL
21 years	@ Year 0	28 years	33 years
	@ Year 10	25 years	29 years
	@ Year 20	21 years	21 years

(1) Payback periods are estimates based on an average capital cost increase of $1.3M, preliminary O&M cost estimates, and preliminary estimates of power production and rate of resale estimated through communications with BC Hydro.

While the assessments completed to date are preliminary, the results indicate that implementing a microturbine on Supply Main No. 3 may be financially viable if incorporated with the overall project improvements required to high pressurize Supply Main No. 1.

The initiative aligns with the CRD Board's Strategic Priorities on Climate Action & Environment, which is expanded upon further in the Implications section of this report. While the Mission Statement of the RWS Strategic Plan (Strategic Plan) may not directly point to facilitating improvements of this nature, it aligns with the Strategic Plan Commitment to "provide efficient, effective and *innovative* operations of our water system infrastructure".

There are still some unknowns that need to be verified through the detailed design and procurement phase, particularly those related to the BC Hydro connection, noted earlier in this report. These unknowns will be addressed through the detailed design and procurement stages, but the work done to date is intended to inform the RWS Commission and support decision making as to whether to proceed further with this initiative. If directed to proceed, Jacobs would be directed to continue advancing the detailed design to include a Microturbine at Humpback PCS. This would allow CRD staff to further advance discussions with BC Hydro and better assess any potential implications to the electrical distribution system, and whether any additional upgrades would be required to accommodate this. CRD would also develop a procurement plan to secure these components in accordance with trade law and incorporate them within the overall project. Staff intend to design the procurement in such a way that the NPV analysis would be reassessed prior to executing a supply contract.

ALTERNATIVES

Alternative 1
The Regional Water Supply Commission recommends that staff:

1. Proceed to incorporate a microturbine at Humpback PCS to capture energy from the pressure reduction on Supply Main No. 3, by incorporating this work with existing capital works planned at this location;
2. Reassess the Net Present Value assumptions as estimates and quotes are updated, to verify a positive payback period remains anticipated, prior to entering a supply contract; and
3. Report back if new information becomes available to impede the viability of this initiative.

Alternative 2
The Regional Water Supply Commission recommends that staff do not proceed with incorporating a microturbine at Humpback PCS and that staff proceed only with improvements necessary to increase the pressure of Main No. 1, as contemplated in the RWS Master Plan.

IMPLICATIONS

Alignment with Board & Corporate Priorities

The CRD Board set a 2023-2026 mandate to focus on regional priorities that fall within five (5) major categories. This initiative aligns with the CRD Board Priority for Climate Action & Environment, which is expanded upon in the next section.

Climate Implications

This project supports implementation of the Capital Regional District's Climate Action Strategy (2021), recently renewed by the Environmental Services Committee in 2026, and approved by the CRD Board earlier this month. The project aligns with the corporate greenhouse gas reduction target of achieving a 45% reduction in corporate emissions by 2030 and supports the critical action of delivering annual improvements to electrical efficiency.

The project also supports Goal 4: Low-Carbon and Resilient Buildings and Infrastructure, which seeks to accelerate energy efficiency, emission reductions and resilience across CRD buildings and infrastructure. More specifically, the project aligns with Action 3.2 of the renewed strategy, to assess and implement energy recovery and renewable energy solutions across CRD infrastructure, including exploring renewable energy opportunities water and wastewater facilities.

The proposed microturbine installation would support climate mitigation objectives by generating renewable electricity from existing water infrastructure and improving the overall energy efficiency of the Regional Water Supply system. The project would contribute toward reducing corporate greenhouse gas emissions while advancing CRD's transition to low-carbon operations.

Financial Implications

Implementing a microturbine to recover energy from Supply Main No. 3 at Humpback PCS shows a favorable NPV and payback period. These favorable results are largely reliant on the significant capital improvements already planned at this site, which will offset the capital expenditure that would otherwise be required if this upgrade were to be completed as a standalone project.

Financial projections for this site are subject to some uncertainty given the wide range of flow variability in our water supply system and the changes to flow patterns that will occur when Supply Main No. 1 & 3 are on separate HGL's. Such analyses rely on hydraulic modelling and assumptions as opposed to direct analysis of historical data. The increased capital expenditure is currently estimated at $1.30M with a further –20% to +40% accuracy range but will need to be further refined as modelling is developed in the design stage. With early estimates of annual energy production at 968,000kWh and export power revenue of $0.10/kWh, the anticipated revenue not exceeding $100,000/year, but this is expected to be sufficient to provide a payback period that is within the anticipated service life.

Neither the capital investment, nor the anticipated revenue are expected to have a significant impact on the overall financial health of the RWS service. With that said, the 2022 Master Plan did indicate the potential for energy recovery on future improvements. This application could serve as a good base case to develop the templates and analyze performance at an easily accessible site in advance of consideration for these future works.

If the recommendations of this staff report are accepted, CRD staff will continue with this initiative through detailed design, followed by a supply contract and implementation into the overarching construction contract noted above. Through this process, staff and Jacobs would reassess that NPV and payback assessments remain positive. Any future revenues would be incorporated into future operating budgets as an additional funding source.

Service Delivery Implications

The CRD does have operational experience with these applications, with a similar installation that has been in operation at the Sooke River Road Disinfection Facility (SRRDF) since 2009. Operational experience with the SRRDF application has shown the system to operate reliably with only minimal operation and maintenance requirements. One key difference between the SRRDF application, and this example proposed for Humpback PCS, is that all power generated from the SRRDF microturbine is utilized at a CRD owned facility. Given the low energy demand requirements at Humpback PCS, this example will require further coordination and agreements with BC Hydro to return captured energy back to the electrical distribution network.

This initiative aligns with the CRD Board's Strategic Priorities on Climate Action & Environment, and while energy recovery may not be a fundamental requirement to achieve the mission statement and commitments outlined in the Strategic Plan, this is an opportunity to support the CRD Board priorities without significant implications on service delivery. The improvements would be designed with fully redundant pressure control valves such that operation of the water system is not impeded by this additional scope and could continue to function even with the microturbine out of service.

CONCLUSION

The Microturbine Feasibility Study indicates that incorporating a microturbine into the planned Humpback Pressure Control Station (PCS) upgrades has the potential to recover energy from an existing pressure reduction within the regional water system while providing a positive lifecycle financial return. Preliminary analysis estimates an incremental capital cost of approximately $1.2M to $1.4M, with a projected payback period of approximately 20 to 22 years under the base operating scenario. The alternative operating scenarios of raising Supply Main No. 3 hydraulic grade line (HGL) to 125m or 136m in the future extends the payback period but are still forecasted to be financially viable.

While the analysis suggests the concept may be financially viable, several factors remain subject to confirmation through detailed design, procurement, and BC Hydro's interconnection review. Future changes to the operating HGL of Supply Main No. 3 could also affect energy generation and project economics.

Given that significant infrastructure upgrades are already required at Humpback PCS as part of the Supply Main No. 1 High Pressurization Project, the microturbine presents an opportunity to integrate energy recovery infrastructure at lower incremental cost than would typically be feasible as a standalone project. Advancing the concept through detailed design would allow the Capital Regional District and Jacobs Consultancy Canada Inc. to further refine cost estimates, confirm interconnection requirements, develop a procurement strategy, and update the financial analysis prior to any commitment to implementation.

RECOMMENDATION

The Regional Water Supply Commission recommends that staff:

1. Proceed to incorporate a microturbine at Humpback PCS to capture energy from the pressure reduction on Supply Main No. 3, by incorporating this work with existing capital works planned at this location;
2. Reassess the Net Present Value assumptions as estimates and quotes are updated, to verify a positive payback period remains anticipated, prior to entering a supply contract; and
3. Report back if new information becomes available to impede the viability of this initiative.

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ATTACHMENT(S)

Appendix A: Microturbine Feasibility Study
Appendix B: Location Plan and Schematics

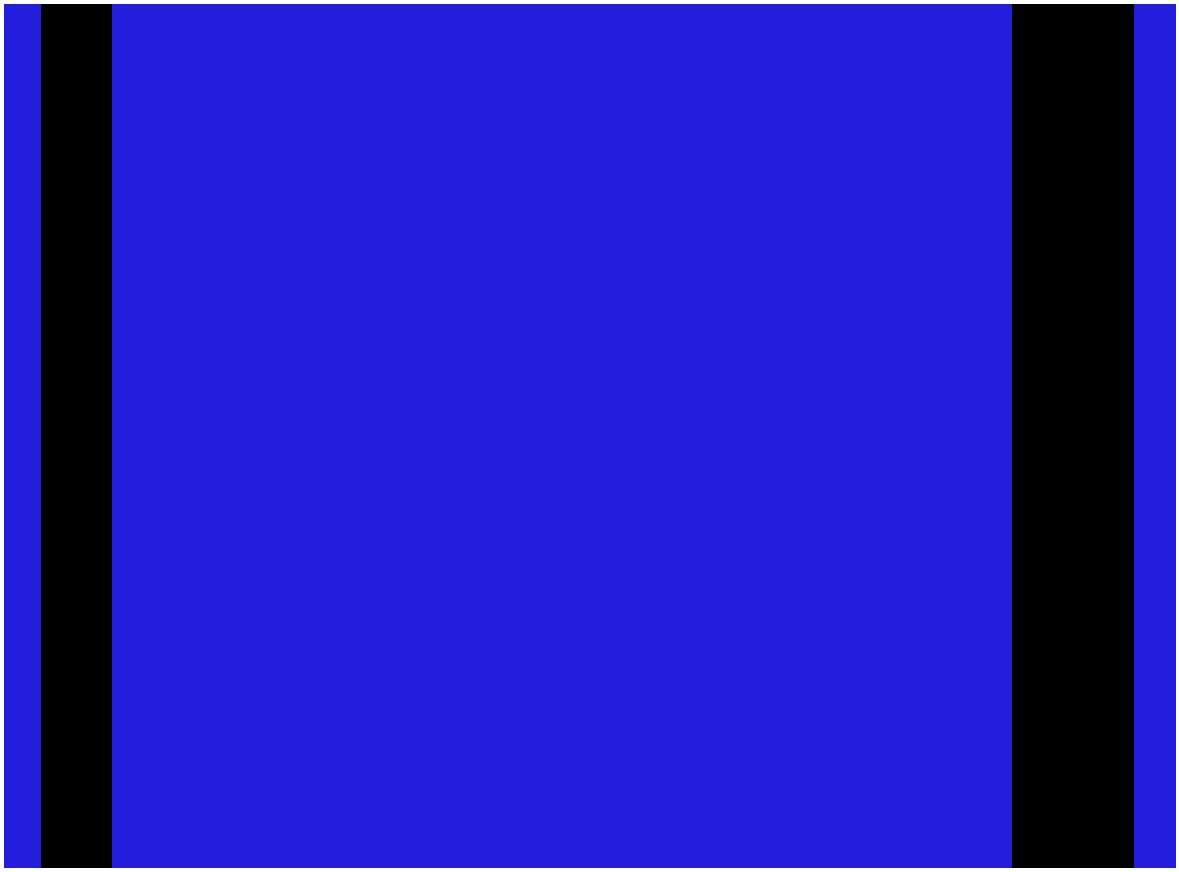
Jacobs

Microturbine Feasibility Study

Revision No: D

Capital Regional District (CRD)
CE881400

RWS/SPW – 2023-2026 Transmission Main Upgrade Program
September 4, 2026



Microturbine Feasibility Study

Client Name:	Capital Regional District (CRD)		
Project Name:	RWS/SPW – 2023-2026 Transmission Main Upgrade Program		
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D	September 04, 2026	Issue for Information	Tania Gill	Paul Luscombe	Patrick Moore	Anita Le

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Corporate Authorization

Jacobs has prepared this Capital Regional District Humpback PCS Microturbine Feasibility Study Technical Memorandum for the Capital Regional District's use. The information and data provided here represent Jacobs' professional judgment at the time of preparation. Jacobs denies any liability whatsoever to any other parties who may obtain this report and use it, or any of its contents.

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Study Lead

Permit to Practice No.: 1003650

Executive Summary

In 2023, the Capital Regional District (CRD) retained Jacobs to undertake a program involving seven individual capital projects on the Regional Water Supply and Saanich Peninsula Water systems. The third project, A2.3: Main No. 1 hydraulic grade line (HGL) Increase, involves upgrading the HGL in Main No. 1 from the current level, 116 metres (m), to a recommended level of 169 m. The scope of this project also includes modifications to the Humpback Pressure Control Station (PCS) to isolate Main No. 1 at this location.

CRD has expressed a desire to decommission the existing Humpback PCS and construct a replacement adjacent the existing station. CRD has also indicated interest in constructing a microturbine at the site of the replacement PCS and has asked Jacobs to complete a feasibility study, including the following deliverables and activities:

- Conceptual design for the installation of the microturbine and associated infrastructure
- Power generation estimate
- Siting analysis
- Cost estimate for detailed engineering design fees
- Net present value (NPV) assessment

From the concept analysis, the new PCS would be located north of the existing site in an above grade kiosk arrangement to address access issues associated with below-grade chambers, particularly at this site adjacent the Humpback Dam, and to minimize costs. This study assumes that the microturbine would need to follow the same design philosophy with an above grade facility in the same location as the PCS. It is assumed that the microturbine would be either housed in the same kiosk as the pressure-reducing valves or a separate adjacent kiosk.

The conceptual design and financial assessment in this memorandum are based on input from InPipe Energy, a leader in small scale energy recapture facilities. Based on the assumed design flow conditions, InPipe Energy has recommended their M12 microturbine, which under the estimated network conditions it is expected to produce a maximum of 220 kilowatt (kW) and operate at an estimated average power of 111 kW.. This would be installed on a 500 millimetre-diameter off-take from Main No. 3 in parallel to the pressure-reducing valve (PRV) configuration. It is assumed that the PCS will operate 24 hours a day, year-round at a varying flow rate between 136 litres per second (L/s) to 678 L/s and respective heads between 560 kPa (81 psi) to 490 kPa (71 psi). This results in the production of 968,000 kilowatt-hours of power per year.

Generally, the most beneficial microturbine arrangement is one where the produced power can be directly used to offset client power demands at co-located or nearby facilities. As the power demands at the proposed PCS (microturbine) location are much less than the capacity of the turbine and with no other adjacent CRD demands it has been assumed that surplus power will be exported to the BC Hydro (BCH) power grid. BCH was engaged by CRD directly and BCH was able to confirm that BCH allows 3-phase power generation systems, up to 300kW capacity to be installed and connected to the grid. However, all connections must go through the formal application process and gain approval and are subject to agreed terms such as connection back to the grid configurations, costs and the associated tariffs. These various details may impact the NPV assessment, however the exact values will not be known until later in the design process and therefore reasonable assumptions based on the initial BCH feedback and in agreement with CRD have been utilized for these parameters and value sensitivity tested in the sensitivity analysis.

Jacobs estimates an average capital cost of $1.13 M ($1.18 M present value) for the microturbine with construction in 2027, with an NPV of approximately $0.69 M and payback period of 21 years from the initial investment over its 30-year design life.

Should the CRD decide to proceed with the microturbine, Jacobs recommends the following:

- Confirm the power connection with BCH for surplus power produced and the microturbine requirements.

- Confirm the microturbine selection, and update capital costs and power production costs accordingly.
- Investigate opportunities for grants and funding if available for this facility.
- Investigate the most cost-effective delivery method for the microturbine.

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Acronyms and Abbreviations

°C	degree(s) Celsius
AACEI	AACE International
CAD	Canadian dollar(s)
CAPEX	capital expenditure
CO_2e	carbon dioxide equivalent
CRD	Capital Regional District
EPA	Electricity Purchase Agreement
FS	feasibility study
g	gram(s)
HGL	hydraulic grade line
IPP	Independent Power Producer
km	kilometre(s)
kPa	kilopascal(s)
kW	kilowatt(s)
kWh	kilowatt-hour(s)
kWh/y	kilowatt-hour(s) per year
L/s	litre(s) per second
m	metre(s)
M	million(s)
mm	millimetre(s)
NPV	net present value
O&M	operations and maintenance
PCS	Pressure Control Station
PRV	pressure-reducing valve
Psi	pound per square inch
RFI	Request for Information
ROI	return on investment
RWS	Regional Water Supply
SCADA	supervisory control and data acquisition
SPW	Saanich Peninsula Water
t	tonne(s)
t/y	tonne(s) per year
USD	U.S. dollar(s)
V	volt(s)

1. Introduction

This section provides information about the project background.

1.1 Project Background

The Capital Regional District (CRD) supplies potable water to approximately 400,000 people across the Greater Victoria area through their Regional Water Supply (RWS) and Saanich Peninsula Water (SPW) systems.

The CRD are undertaking a program of capital projects on the RWS and SPW services from 2023-2026 with the aim of improving system capacity.

1.2 Project Description

Main No. 1 is an approximately 17.5 kilometre (km)-long transmission main consisting of 1,067 millimetres (mm)- and 1,524 mm-diameter welded steel pipe which runs from near the Humpback Reservoir at the Humpback Pressure Control Station (PCS) to the Gorge Road East / Davie Street.

Following the GeoAdvice study (GeoAdvice 2020) of the RWS Hydraulic Capacity Assessment in 2020, it was recommended to increase the hydraulic grade line (HGL) on Main No. 1 between Humpback PCS and Watkiss PCS from 116 metres (m) to 169 m. This improvement is intended to increase the hydraulic capacity of the RWS system, provide redundancy for Main No. 4, and maximize the HGL in Main No. 1, and for Main No. 2, and 3 improve their ability to maintain a consistent HGL at bulk water connections.

Currently, the pressure in Main No. 1 is reduced at Humpback PCS. Project A2.3 involves the isolation of Main No. 1 from this station, followed by valving changes to close connections with the existing 116 m pressure zone (the Juan de Fuca Distribution System and Main No. 3) and the addition of PCSs to allow Main No. 1 to continue providing redundancy to Main No. 3 and the Juan de Fuca.

The original scope of the Humpback PCS (per the Request for Proposal) was to redesign the existing station to account for the flow reduction, due to Main No. 1 bypassing the station following high pressurization, setpoint adjustment, and improving the control philosophy to mitigate impacts of low outlet pressures. These works were expected to all be conducted within the existing station, with the 60% design for this scope of work focusing on the replacement of one of the existing valves with a smaller valve to operate during low flows and updated valve controls to increase the responsiveness of the valves to large spikes in demand.

CRD have identified safety concerns with the existing below grade station, based on these safety concerns associated with retaining equipment in the existing below grade chamber, CRD have provided direction for new/ replacement piping and pressure reducing equipment to be brought above grade in a new station/ kiosk.. Per the Contemplated Changer Order No. 15, the scope of project A2.3 has been extended to include the design for a newly proposed above-ground replacement for the existing Humpback PCS. The replacement PCS is expected to be located north of the existing PCS on Main No. 3 to address access issues associated with below-grade chambers and to minimize costs of the new station.

Figure 1-1 provides an overview of the system and the location of the Humpback PCS.

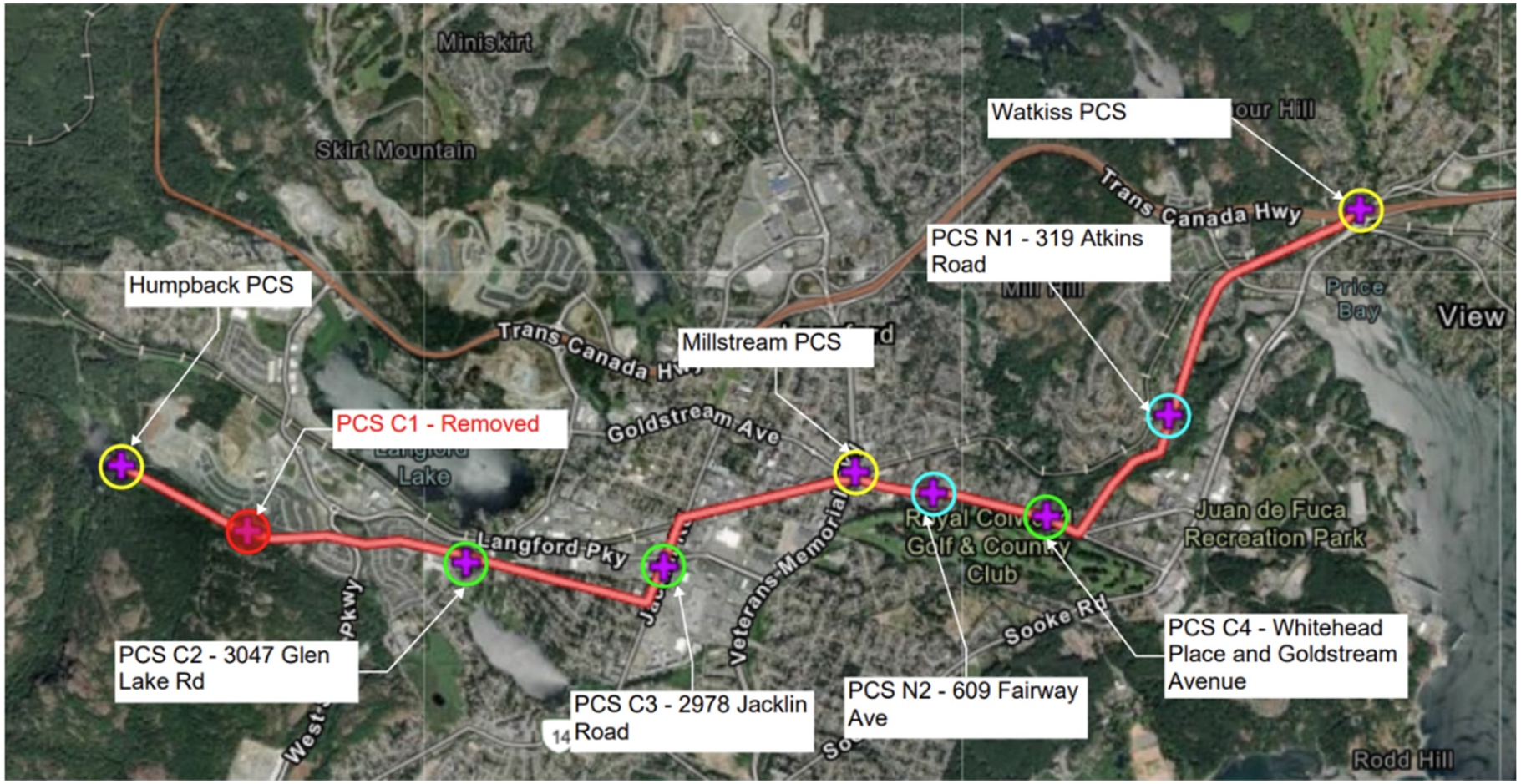


Figure 1-1 System Overview

Sources: Esri, Maxar, Earthstar Geographics, and the GIS User Community

1.3 Humpback PCS Electricity Regeneration Study

On June 5, 2025, Jacobs proposed Contemplated Change Order 15, the scope of which included effort to produce an electricity regeneration study technical memorandum for the Humpback PCS, which would be included as part of the Conceptual Design phase of the RWS/SPW project.

On June 11, 2025, CRD issued Change Order 13– A2.3 – Humpback PCS Electricity Regeneration Study. The key tasks include the following:

- Kick-off meeting to confirm deliverables and approach
- Feasibility study that includes the following:
  - Siting options review and recommendations
  - Unit sizing and specification recommendation in consultation with up to two manufacturers
  - Estimation of amount of power generated
  - Conceptual design for the installation of the microturbine and associated infrastructure (design presented in memorandum with conceptual sketches)
  - Cost estimate and analysis including capital and operating costs, net present value (NPV) and payback period for the microturbine
  - Estimate of the detailed engineering design fees

A draft of this memorandum was issued October 2025 capturing the original planned scope, a revision to the study was undertaken in Q1 of 2026 to incorporate additional sensitivity analysis around potential changes to the planned network pressures with the revised study issued in March 2026.

In March 2026, CRD requested revision of the study to incorporate the latest power usage data provided through consultation with BCH. This memorandum summarizes the findings of the feasibility study (FS) incorporating the original scope and the additional changes raised in 2026.

2. Methodology

This section describes the methodology used during the FS.

2.1 Feasibility Study Objectives

The objectives of this FS included consulting with hydro-microturbine suppliers to complete the following:

- Confirm the feasible amount of power that could be generated by a hydro-microturbine on the transmission main.
- Provide preliminary recommendations on unit sizing and specifications.
- Provide a preliminary site layout and configuration of a hydro-microturbine to facilitate the development of a cost estimate, assess the NPV of the conceptual system.
- Provide a recommendation on whether a hydro-microturbine system should be further pursued.

2.2 Scope of Work

This FS investigated the feasibility of using hydropower in the form of hydro microturbines and included the following:

- Establishment of a basis of design
- Siting review and recommendations
- Unit sizing and specification recommendation in consultation with manufacturer/s
- Estimation of amount of power generated
- Conceptual design for the installation of the microturbine and associated infrastructure (design presented in memorandum with conceptual sketches)
- Cost estimate and analysis including capital and operating costs, NPV and payback period for the microturbine including a sensitivity analysis
- Estimate of the detailed engineering design fees

2.3 Basis of Design

This FS is based on the design for a single turbine located at the newly proposed Humpback PCS replacement on Main No. 3. It is assumed that the new PCS will only have reduction capability for Main No. 3, with Main No. 1 bypassing the station. As such, no consideration for the combined maximum day demand for both Main No. 1 and Main No. 3 will be made.

This study assumes that the microturbine will be located in an above-grade kiosk adjacent to or together with the proposed PCS to the north of the existing below-grade Humpback PCS. Alternative sites were considered as part of the development of the basis of design. The analysis determined that locating the site further down the network, but before any major offtakes, would have negligible impact on the capacity of the energy recapture, but would likely only increase the cost of the facility due to construction in multiple locations rather than together with the PCS. Furthermore, there were no identified larger CRD energy use sites that could utilize the produced power and improve the return on investment (ROI); therefore, the Humpback PCS site was adopted for this FS.

Alternative site locations could be explored in future design phases, if opportunities are identified and if evaluation is desired by CRD. CRD have communicated that the preferred layout of the microturbine would be in a standalone kiosk with the microturbine, pressure-reducing valve (PRV), and all associated infrastructure housed within it per CRD's response to Request for Information (RFI) 26 (CRD 2025). Table 2-1 summarizes the microturbine basis of design.

Table 2-1. Microturbine Basis of Design

Parameter	Values	Scenario	Comments
Design Flows (cubic metres per day [L/s])	11,750 [136][a]	Minimum	Corresponds to the design minimum capacity of the Humpback PCS and is based on a demand multiplier of 0.4. Turbine cannot be operated to produce power at this flow rate: this flow rate is an infrequent operational scenario, so there is minimal impact on the energy production.
	29,289 [339][a]	Average	This corresponds to the nominal and most likely capacity of the Humpback PCS and is based on a derating factor of 0.5. Turbine can be operated at optimal efficiency at this flow rate, as this is the condition that the turbine will operate under for most of its service life.
	58,579 [678][a]	Maximum	This corresponds to the design maximum capacity of the Humpback PCS. Turbine can be operated to produce power at this flow scenario; however, the full flow is not through the turbine. The turbine will operate at its maximum flow with the remainder of flow through the system provided by the parallel PRV. This is a lower-frequency operational scenario expected over the life of the asset, so the flow not passed through the turbine is not expected to significantly impact the energy production.
Upstream Pressures (kPa [psi])	490 [71]	Maximum Flow	This is based on GeoAdvice data from the analysis completed for .
	517 [75]	Average Flow	This was interpolated from GeoAdvice data at minimum and maximum flows using power law relationship.
	558 [81]	Minimum Flow	This is based on GeoAdvice data.
Downstream Pressures at Microturbine (kPa [psi])	21 [3]	Maximum Flow	This is based on SCADA.
	34 [5]	Average Flow	This is assumed based on interpolated SCADA data at minimum and maximum flow using power law relationship.
	76 [11]	Minimum Flow	This is based on SCADA.
Ambient Air Temperature (°C)	6.7	Average Winter	This was based on Historical Data from Esquimalt Harbour Temperature station, located 8 km from proposed Humpback (GoC 2025).
	-9.9	Low Winter	
	15.6	Average Summer	
	27.1	High Summer	
Turbine Elevation (metres above sea level)	109[b]		None
Microturbine Configuration	Duty configuration only is provided, with critical spares maintained onsite due to the robust nature of microturbines. Microturbine must be able to be completely bypassed and the parallel PRV provide 100% duty.		
Energy Usage	Energy produced will be transferred. Through connection to the existing power distribution system for the near municipal infrastructure; modifications to the existing power system are not included in this scope.		

[a] Flow estimates from GeoAdvice 2025

[b] To be confirmed based on final site and layout selection in design. Low pressure risk to be managed during peak flows for both PRVs and turbine.

°C = degree(s) Celsius
kPa = kilopascal(s)
L/s = litre(s) per second
psi = pound(s) per square inch
SCADA = supervisory control and data acquisition

Assumptions

The assumptions made for the FS per CRD's response to RFI-26 (CRD 2025; Attachment 1) are as follows:

- The proposed Humpback PCS station will be above grade.
- The microturbine will be installed at the future Humpback PCS. Alternative site locations may be desired by the CRD in the future but are not within the scope of this FS.
- Confined space entry will be avoided.
- The scope of the FS will cover only the cost comparison between the PRV station with and without the microturbine.
- The assessment period will be based on the design life of the microturbine (30 years), as this will be the major element in the system.
- The assumed energy scenario, as identified in communication from CRD (CRD 2025; Attachment 2), is Self-Generation with import energy costs of $0.13 per kilowatt-hour (kWh) and export energy costs of $0.115/kWh (CRD 2025; Attachment 2). The export energy costs were subsequently reduced to $0.10/ kWh (BC Hydro, 2026; Attachment 7).
- The capital cost breakdown will be 75% equipment fabrication costs and 25% transport and installation fees.
- Annual labour is assumed to be 2% of the capital cost and installation cost of the microturbine. Every 5 years, additional maintenance required is assumed to cost 60% of the annual labour cost. The annual operations and maintenance (O&M) fees will be comparable to similar microturbine models.

3. Technical Feasibility Assessment

This section describes the results of the technical feasibility assessment. Inputs for this assessment have been provided by InPipe Energy (Attachment 3).

3.1 Microturbine Selection

The preliminary selection was completed using the flow and pressure data provided by CRD which was flow data for the month of July 2024. To enable a turbine selection Jacobs has assumed that the diurnal pattern results in minimum flow 20% of the time, nominal flow 65% of the time and maximum flow 15% of the time. It has also been assumed that flows will be decrease over the winter months and assumed a flow reduction of 15 percent. Based on these assumed design flows and system head, InPipe Energy has selected the HydroXS M12-220kW-V-T15 microturbine, shown on Figure 3-1.



Figure 3-1. HydroXS M12-220kW-V-T15 Microturbine

The HydroXS microturbine energy recovery system comes in a variety of different models and covers a range of operating heads and flowrates. It operates as a pressure reducing valve (PRV) and a renewable energy generator. It uses a regenerative variable frequency drive with sensors connected to a programmable logic controller (PLC) based control system to handle the variable daily and seasonal flows. The sizing chart, taken from the HydroXS product catalogue is shown on Figure 3-2 (Inpipe 2023).

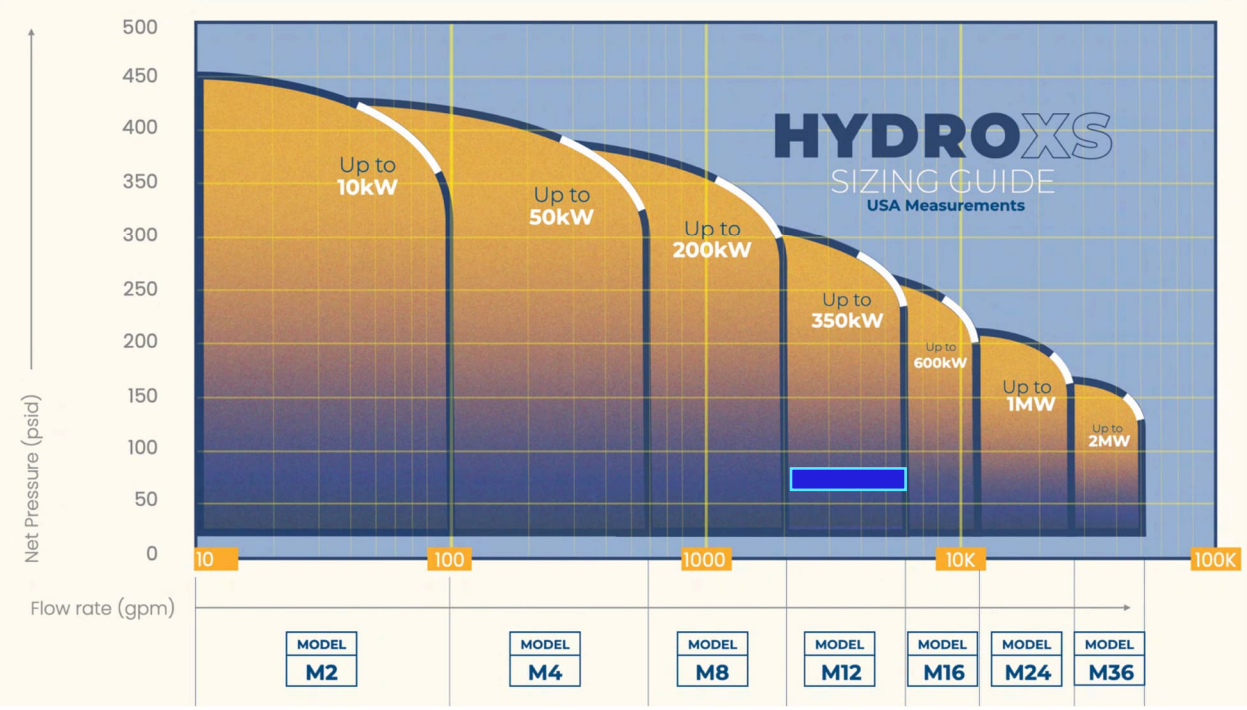


Figure 3-2. HydroXS Sizing Guide (blue box is approx. operating zone)

The quoted model selected by InPipe Energy, according to the operating conditions at the future PCS is the M12 model, which can offer up to 350 kilowatts (kW) of three phase power under higher differential pressure conditions than will be seen at the Humpback site. The M12 system has been tailored to suit the project needs in terms of flows and available pressures, and this results in a maximum possible power generation of 220 kW for the M12 unit under the most favourable network conditions at the Humpback site.

Based on the available flow data and assumptions about system operation, the average annual power generation rate for the preferred microturbine is 111 kW, with an annual power generation of 968,000 kilowatt-hours per year. Table 3-1 summarizes the design conditions and power generated.

Table 3-1. Microturbine Power Production

Design Flow Condition	Estimated Turbine Flow Rate (L/s) [gpm][a]	Inlet Pressure (kPa) [psi]	Outlet Pressure (kPa) [psi]	Net Pressure Difference (kPa) [psi]	Total Turbine Efficiency (%)	Power (kW)	Annual Power Generation (kWh/y)
Minimum	136 [2778]	559 [81]	21 [3]	538 [78]	-	-	-
Nominal	339 [5208]	524 [76]	34 [5]	490 [71]	78	130	1,138,800
Maximum	678 [8000]	490 [71]	76 [11]	414 [60]	80	190	1,664,400

[a] Flow estimates from GeoAdvice, 2025.

- = not applicable
kWh/y = kilowatt-hour(s) per year

3.2 Site Options

A structure is required to house the microturbine and associated equipment. The siting options are dependent on the location of the Humpback PCS at which the turbine will be located. It is assumed that the new PCS will be located directly north of the existing Humpback PCS in an above-grade kiosk

arrangement to allow for the existing PCS to be decommissioned. No allowance has been included at this stage for the assessment of alternate site layouts for the replacement Humpback PCS. The proposed location is shown on Figure **3-3**. This study assumes that the microturbine would either be housed in the same kiosk as the PRVs or a separate kiosk.

The PCS is anticipated to experience a varying flow rate between 136 L/s to 678 L/s and respective heads between 560 kPa (81 psi) to 490 kPa (71 psi). This results in an estimated production of 968,000 kWh of power per year. It should be noted that estimated power generation is subject to change if alternative site locations are considered for the PCS. Increased construction impacts and construction complexity could also be associated with a new location in the form of proximity to residential areas or sensitive ecological zones.

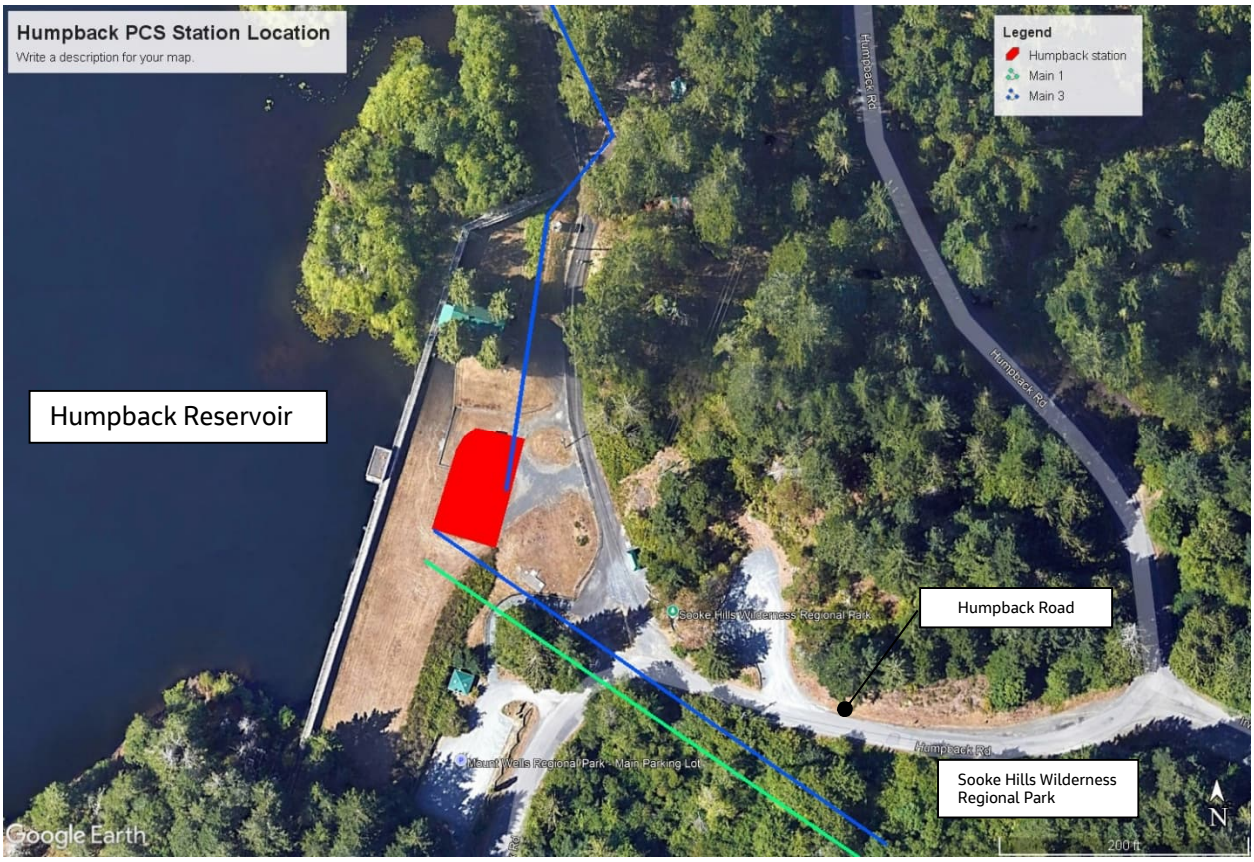


Figure 3-3. **Proposed Site Location**

3.3 Facility and Pipe Layout

The microturbine will be installed on a 500 mm-diameter off-take from Main No. 3 in parallel to the pressure control valves. The microturbine will generate energy and serve as a PRV.

The microturbine system will consist of the following:

- 220 kW Microturbine with induction generator
- Control valves with electronic solenoid control and pressure transmitter
- Self-contained control panel that can be connected to an existing SCADA communication network
- Manual isolation valves
- Flow monitoring
- PLC processors

- Automated alarms for flow interruptions, safety measures and maintenance checks
- Automated safe shutoff and restart

Jacobs recommends that a flow meter be installed on the main pipelines to measure flow that is going to the microturbine or the PRV depending on the scenario the station is operating in to have the capability to assess how the station is operating. This is not a hard requirement, but a recommendation and a recommendation whether the microturbine is installed of not and therefore it is not included in this feasibility analysis.

The general proposed layout is presented on Figure 3-4. The microturbine can be installed in a vertical or horizontal configuration. Jacobs has assumed a horizontal configuration for the following reasons:

- It is more conservative for determining the footprint required for the microturbine.
- It provides ease of access and maintenance with equipment being at working height.
- It makes equipment easier to remove.

The equipment, piping, and valving arrangements can be modified during subsequent design phases if required to improve the cost of the facility or modify system functionality.

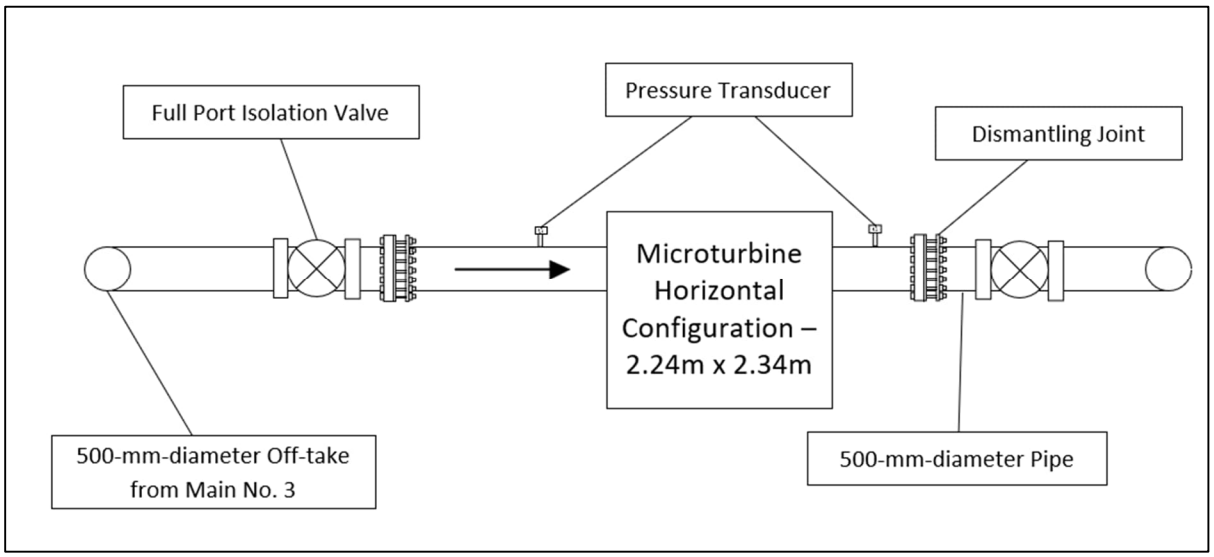


Figure 3-4. Conceptual Microturbine Arrangement

It is assumed that the new PCS will consist of an above-grade kiosk to house the PRV and associated equipment on a concrete slab. It is anticipated that the size of the proposed PCS kiosk will be approximately 3.7 m by 8 m by 3.3 m (WxLxH) internally without the microturbine. Based on the microturbine configuration the feasible options to integrate the microturbine that Jacobs proposes for the site facility arrangement are as follows:

1. Facility Option 1: One large concrete slab and one kiosk to house PRV, microturbine and associated equipment

2. Facility Option 2: Two concrete slabs and two kiosks, one to house PRV and the other for microturbine

Both options are feasible. CRD has indicated a preference for a combined kiosk per response to RFI-26 (CRD 2025; Attachment 1). This option is also more cost-effective. As such, Jacobs has adopted Facility Option 1 for the purposes of this study. Information on both options is provided in the following sections for reference.

3.3.1 Facility Option 1: Joint PRV and Microturbine Kiosk

Option 1 consists of a kiosk large enough to contain both the PRV and microturbine. This results in a larger kiosk and as a result a larger concrete slab. A conceptual assessment approximates the size of the proposed kiosk to be approximately 7m x 8m x 3.3m(WxLxH) internally, with concrete slab dimensions of 7.6m x 8.6m x 0.3m (WxLxH) (Figure 3-5). This will allow for entry into the kiosk for access and maintenance of the equipment.

A joint kiosk results in a larger kiosk footprint to allow for adequate clearance between the equipment; however, the overall site footprint is smaller. Depending on the access design this may make the equipment harder to access compared to separate kiosks.

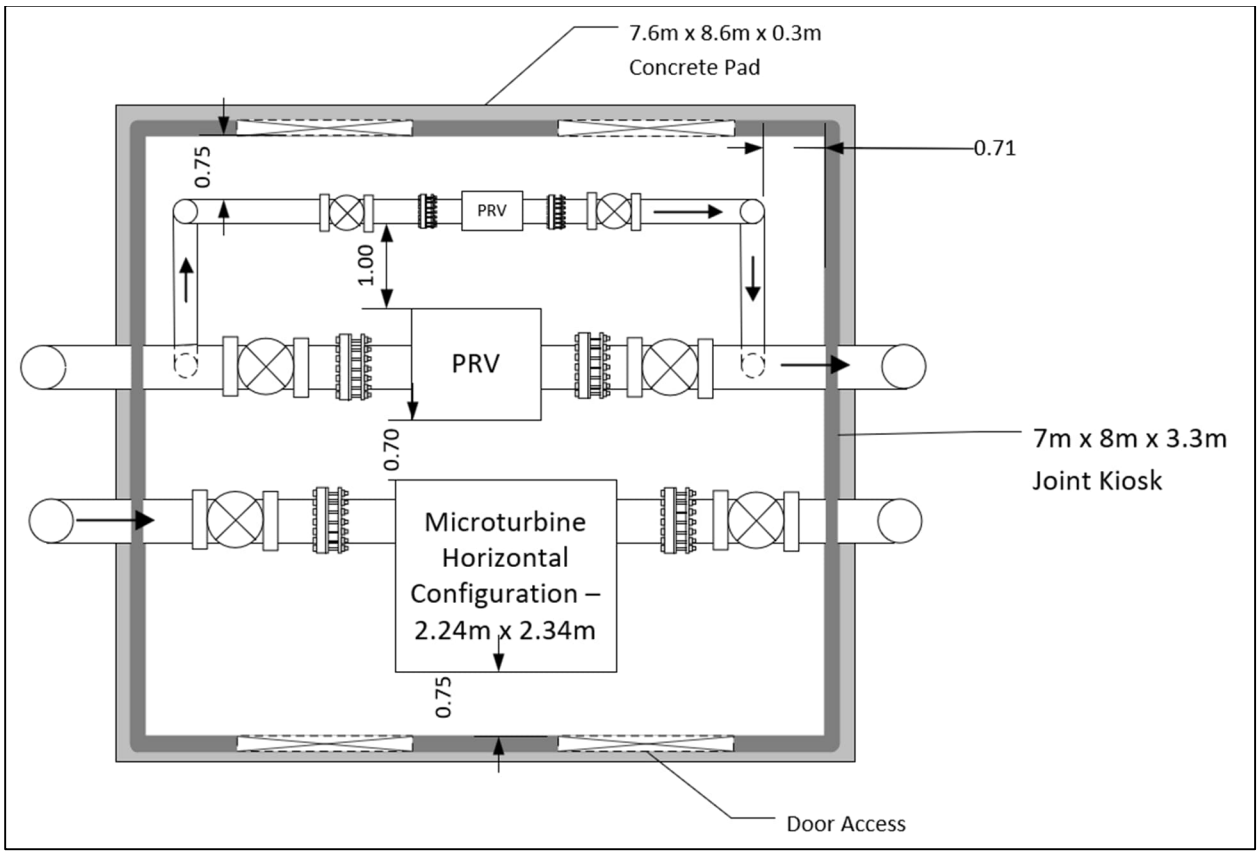


Figure 3-5. Facility Option 1: Joint Kiosk

3.3.2 Facility Option 2: Individual PRV and Microturbine Kiosks

Option 2 consists of two separate kiosks: one for the PRV and one for the microturbine. A conceptual assessment approximates the size of the proposed kiosks to be approximately 3.7m x 8m x 3.3m(WxLxH) internally. The concrete slab dimensions are assumed to be 4.3m x 8.6m x 0.3m (WxLxH) (Figure 3-6).

This option results in an overall smaller kiosk footprint, but a larger site footprint as the kiosks would need to be spaced adequately far apart to allow for access. Depending on the design of the kiosk it may be easier to access the equipment if it is located in separate kiosks.

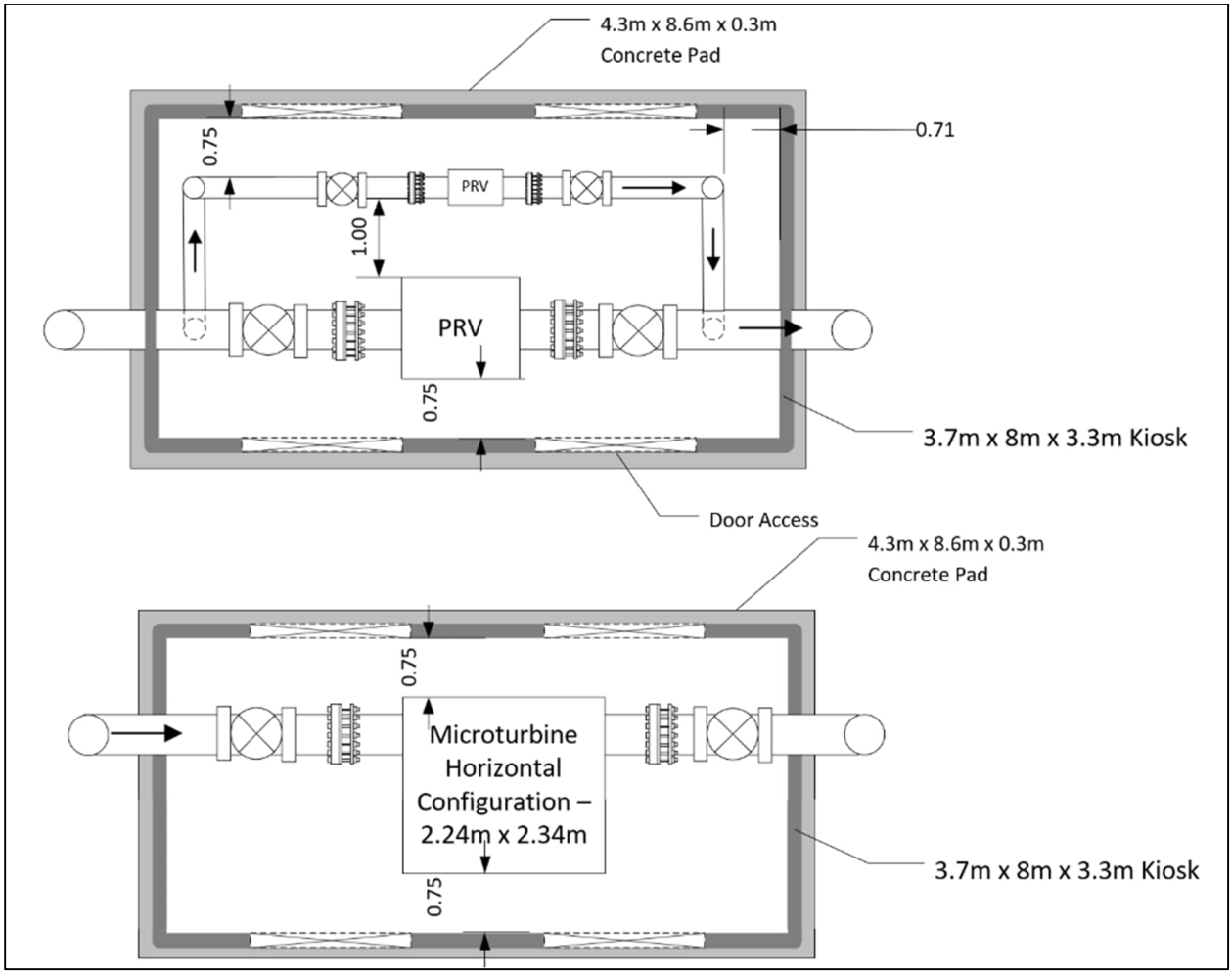


Figure 3-6. Facility Option 2: Separate Kiosks

3.4 Power Connection

The microturbine facility has a small power demand but will produce a considerable amount of power. As the microturbine facility will require a power supply when the turbine is not in operation, and will produce more power than could be used by nearby CRD assets, a connection to the BC Hydro (BCH) grid is required. It is assumed that the microturbine system will connect to the existing power distribution system, similar to the existing PCS. It is assumed that modifications to the existing power system are not required to allow the connection and therefore upgrading a power connection is not included in this scope our costings. This assumption will need to be validated through consultation with BCH at the beginning of concept design.

4. Financial Feasibility

This section describes the results of the financial feasibility analysis, which is based on information provided by InPipe Energy. Canadian Hydro was contacted as well but are yet to provide the required details to be able to develop a solution and complete an analysis/ assessment of their equipment.

4.1 Capital Costs

The financial feasibility assessment is based on the cost of the addition of the microturbine to the PCS. Capital costs for the project include the cost of the following assets and items:

- Microturbine
- Additional infrastructure
- Spare parts
- Net cost to upsize to a larger kiosk to house the microturbine and PRVs
- Cost of additional concrete for the larger kiosk concrete slab
- Installation
- Engineering and Construction Management fees

The cost of the microturbine and installation of a HydroXS M12 microturbine was provided by InPipe Energy (InPipe 2025). Attachment 3 provides correspondence and details. A site visit is required prior to installation to confirm the budgetary quote provided. The remainder of the estimate was completed by Jacobs based on the cost of the kiosk from Valid Manufacturing (Valid Manufacturing 2025; Attachment 5) and allowances for non-infrastructure items, such as engineering fees. The following assumptions were made for the capital cost expenditure:

- CA $942,500 – 1,040,000 (US $725,000 - $800,000 based on an assumed conversion rate of 1 US dollar = 1.3 Canadian Dolars based on long term averages due to uncertainty in the market) provided by InPipe Energy as the total cost for a microturbine with kiosk and the cost of installation. It was confirmed with InPipe Energy that their standard kiosk cost approximately US $75,000 with around 75% of the cost for infrastructure and 25% for installation.
- A combined kiosk for the PRV and microturbine was assumed for the cost assessment, as it is the preferred option identified by CRD and more cost-effective. It is assumed that a redundant 500 mm-diameter PRV is required for the PCS if the microturbine is not installed. An individual kiosk for the PRV is estimated to cost $95,200, and a combined kiosk for the PRV and microturbine is estimated to cost $137,940. It is estimated that a joint kiosk would require 1 m of extra width to allow for the installation of a microturbine where the redundant PRV would have originally been. This is an estimated additional $19,700, which would be associated with the installation of a microturbine (Valid Manufacturing 2025). At this time, it was assumed that roof access would not be provided and electrical panels would not be installed within the kiosk.
- An additional concrete slab was assumed at 2.4 m^3 for $3,000 per m^3.
- Cost for electrical connections to the grid were not included in the capital cost estimate as the requirements are not yet known and it is not clear if the existing connection can be maintained or if a new connection is required and if so who would be responsible for the upfront cost. Further consultation with BCH based on functional design plans is required to confirm these details
- Spare parts cost was assumed to be included in InPipe Energy quote.
- Capital expenditure (CAPEX) for assets was assumed to occur in Year 2 (2026).
- CAPEX for non-asset items was assumed to occur partially in Year 1 (2025) and partially in Year 2 (2026). Construction assumed to occur in Year 3 (2027).

Table 4-1 provides a summary of the additional capital cost estimated for the replacement of the second large PRV in the proposed Humpback PCS with a microturbine in a combined above-grade kiosk.

Table 4-1. Microturbine Capital Cost Estimate

Description	Cost Low ($M)	Cost Average ($M)	Cost High ($M)
Microturbine Cost (Design & Installation)	1.03	1.10	1.17
Facility Cost (Kiosk and Concrete Slab)	0.03	0.03	0.03
Total Direct Construction Cost	**1.06**	**1.13**	**1.20**
Project Management (3% of Capital Cost)	0.03	0.03	0.04
Design Fee (7% of Capital Cost)	0.07	0.08	0.08
Construction Management (5% of Capital Cost)	0.05	0.06	0.06
Total Capital Cost (Excluding Tax [Class 4 AACEI])	**1.22**	**1.30**	**1.37**
High (+40%) Cost Estimate (Excluding Tax [Class 4 AACEI])	1.71	1.82	1.92
Low (-20%) Cost Estimate (Excluding Tax [Class 4 AACEI])	0.98	1.04	1.10

AACEI = AACE International

4.2 Operations and Maintenance Costs

Annual O&M costs for the NPV assessment were based on the maintenance schedule of the HydroXS M24 microtubine model (InPipe 2022a; Attachment 4), escalated to current prices.

The maintenance schedule for the HydroXS series includes annual maintenance and additional maintenance every 5 years (InPipe 2022b; Attachment 4). The conservative cost estimate for annual maintenance labour costs for the M24 model was $14,000 US dollars (USD; 1 USD = 1.3 Canadian dollars [CAD]) in 2022 for remote labour in the Yukon. The conservative cost estimate was escalated to 2027 and reduced by 50% to estimate the cost of labour on Vancouver Island. It was assumed that the labour cost for O&M work every 5 years would be an additional 60% of the annual cost.

4.3 BC Hydro Connection Scenarios

The cost rate for energy exported to the power grid will be highly dependent on the method of connection with BCH. The following sub sections outline the different potential BCH power system connection scenarios.

4.3.1 Self-Generation

In self-generation (formally known as net metering), electricity generated by the microturbine would be used on site first, with the remainder being sold to BCH. The CRD would receive an energy credit for any power sold to the grid, which would be paid out at the end of each year at a “Mid-C Rate”. The Mid-C Rate was $0.115/kWh from 2023 to 2024. However, effective July 1, 2026 BC Hydro will compensate customers at a fixed energy price of $0.100/kWh with an increase in maximum injection limit from 100 kW total to 100 kW per phase (300 kW for 3 phase system) (BC Hydro, 2026; Attachment 7).

4.3.2 Load Displacement

In the Load Displacement scenario, there is no limit on the installed capacity; however, 100% of the electricity must be used on site, with no possibility of injecting energy back into the power distribution network. Since the annual projected site consumption is 27,500 kWh (CRD 2025), this would only result in a $3,575 of yearly savings, which would not be nearly enough to offset the capital costs.

For this scenario, there is the potential BCH would be able to provide an incentive to assist with costs by providing 2 to 5 cents for each kWh generated, up to $1 million or 75% of project cost.

One possibility that could potentially be explored would be using the excess energy generated to offset power at nearby CRD sites, such as the Goldstream Ultraviolet plant. However, it is unknown at this stage if this possibility would still apply under the Load Displacement BCH program. Furthermore, the additional logistics and costs associated with installing the required infrastructure to transfer the energy and tie it into existing CRD facilities are also currently unknown and likely to be significantly costly which would impact the financial feasibility of the system.

4.3.3 Distributed Generator Interconnections

The Distributed Generator scenario would involve the CRD becoming an Independent Power Producer (IPP). This would remove any limitations on power being sold back to the grid and would allow for turbines up to 35 kV. The cost for selling power back to BCH would be determined through a new Electricity Purchase Agreement (EPA) which could range from $0.03/kWh to $0.10/kWh.

No funding incentive would be provided by BCH for this scenario.

This scenario would require additional legal paperwork to register the CRD as an IPP. Furthermore, there is no guarantee that an EPA would be awarded for the microturbine project. The Standing Offer Program and Micro Standing Offer Program for procuring energy programs was suspended indefinitely in February 2019. EPAs are still awarded through other BC programs such as the Request for Expressions of Interest and the yearly Call for Power. However, award of funding is not guaranteed for all applicants.

The 2024 Call for Power issued by BCH was met with 21 applications (BCH 2025). Of the 21 applications, only 10 were accepted. Out of the accepted projects, the smallest size was 94 MW, which is significantly larger than the proposed microturbine project. However, it is not just the size of the system that is considered; rather, it is the location of the system versus demand, the method of power production, and many other items; as such, this option would need to be explored further through consultation with BCH.

4.3.4 Proposed Power Connection Scenario

Self-generation has been identified by Jacobs and CRD as the most likely scenario (CRD 2025) and is the assumption that the NPV calculation was based on. No funding would be provided by BCH in this scenario. CRD and BC Hydro have also confirmed that the rate paid by BCH at the existing Humpback PCS for energy returned to the grid is $0.10/kWh.

CRD has initiated discussion with BCH and has received confirmation that the 100 kW limitation for this type of system, set by BCH is per phase; therefore, as the proposed microturbine is 3-phase, the total system capacity limit is 300 kW (BC Hydro 2026). As such, the proposed maximum 220 kW output microturbine can be pursued and should be the scenario with which the project moves forward.

Further consultation with BCH to confirm the details of the grid connection and the finer details of the energy agreement are needed to fully understand all requirements and costs. This would need to be an early next step in the next design phase if this system design and evaluation is to be developed further.

4.4 Net Present Value Assessment

Jacobs completed an NPV assessment for capital budgeting and investment planning to analyze the profitability of the microturbine project investment. The total expenditure, which includes capital and operational costs, was compared against the cost savings to determine the NPV and ROI.

Table 4-2 summarizes the assumptions made for the assessment, and

Table 4-3 summarizes the calculation. Attachment 6 provides details about the completed NPV calculation at the higher, lower and average end of the capital costs provided by the vendor.

Table 4-2. Net Present Value Calculation Assumptions

Items	Assumption	Comments
Assessment period (years)	30	This was adopted to align with the minimum design life of the major element (the microturbine). As the design life for the other elements, such as the structure, are much greater, an analysis beyond 30 years is not required to capture renewal costs. Additionally, a 25- to 30-year analysis is good practice, as values beyond this are uncertain and have minimal impact on the assessment.
Annual Energy Production (kWh)	968,000	Based on expected output of 220 kW microturbine from InPipe Energy (InPipe 2025; Attachment 3).
Import Power Cost ($/kWh)	0.130	This is provided by CRD (CRD 2025; Attachment 2).
Export Energy Revenue ($/kWh)	0.100	This is provided by BC Hydro, assuming that the self-generation option is pursued (BC Hydro, 2026; Attachment 7).
Discount Rate (%)	5	There is no clear guidance on what should be standard from Statistics Canada (2025). Based on a range of 3% to 8% being referenced in available literature and 5% being a typical value historically used by Jacobs, 5% has been assumed. This is a key input to the assessment and should be validated by CRD to confirm that these values align with their corporate and financial guidelines.
Escalation Rate (%)	3.0	The average annual rate is approximately 3% based on data available for the last 5 years (Statistics Canada 2025). This is a key input to the assessment and should be validated by CRD to confirm that these values align with their corporate and financial guidelines. All costs were escalated at the same rate for each year of the assessment.
Project Start Year	2026	This is the year the microturbine will begin operating. Capital cost investment will occur between 2026 and 2027.
Evaluation Period (years)	30	This is based on the life cycle of the microturbine.
USD to CAD Conversion	1.3	Assumed rate is based on the long-term average.
O&M	$9,100/yr $5,460/5yrs	Annual labour estimated based on cost provided by InPipe Energy for remote labour cost in the Yukon ($14,000 USD/yr). Labour cost in Vancouver Island assumed to be 50% of this. An additional 60% of the annual labour cost is required for additional maintenance every 5 years.
Energy Savings	Cost savings from energy that would be produced by microturbine and not need to be purchased and funds generated from selling energy back to the energy grid.	

Table 4-3. Net Present Value Summary

Present Value ($M)	Low	Average	High
Capital Expenditure	1.11	1.18	1.25
Operational Expenditure	0.24	0.24	0.24
Total Cash Outflow	**1.34**	**1.41**	**1.48**
Energy Production Cost Saving	0.77		
Total Cash Inflow	2.11		
NPV	**0.76**	**0.69**	**0.62**
Discounted Return on Investment	**0.57**	**0.49**	**0.42**
Payback Period	**20**	**21**	**22**

[a] All costs are in Canadian 2025 dollars

Based on the assessment, the project will approximately have a capital cost (present value) ranging between $1.11 and $1.25 million and NPV ranging between $620,000 and $760,000 and a payback period of 20-22 years.

No financial benefits were included for Carbon Cost savings. Effective April 1, 2025, the Government of Canada has ceased application of the federal fuel charge (GoC 2025); thus, there are no additional costs savings due to the reduction in greenhouse gas emissions because of the transfer to clean energy. Applications to receive funding from programs promoting construction of green energy infrastructure could be explored and are further discussed in Section 4.5.2. However, the 30-year carbon saving based on the selected microturbine is approximately 540 tons of CO_2e (based on 18g CO_2e/ kWh for British Columbia network), which provides social benefits that are not captured financially in the NPV analysis but should still be considered when making a triple bottom line assessment on the value of the proposed microturbine installation and in assisting in the ability of CRD to work towards net zero emissions.

4.5 Sensitivity Analysis

4.5.1 Parameter Sensitivity

The assessment is sensitive to the following parameters; as such, CRD should be comfortable with these values prior to making a decision on this investment:

- Discount rate
- Escalation rate
- Capital cost
- Cost of electricity
- Microturbine size – power production

Jacobs has taken a conservative approach where relevant throughout the development of the feasibility assessment and provided a range of costs based on information provided by the vendor to help inform CRD's decision. Additionally, Jacobs has completed a high-level sensitivity analysis to provide CRD with additional information to better understand how changes to the parameters will impact the business case for the microturbine. The sensitivity analysis is summarized in Table 4-4 and on Figure 4-1. Additional details are provided in Attachment 6 for each of the modified NPV calculations.

The analysis indicates the following:

Discount Rate:

Minor changes to the discount rate significantly impact the business case for the microturbine. This is a critical parameter to confirm prior to decision making. There is limited guidance on what the standard discount rate assumed should be. The discount rate used should be reviewed and confirmed to verify the results of the feasibility assessment.

Escalation Rate:

Increased escalation in the long term can potentially improve the business case for the microturbine as the energy production cost savings increase. However, the discount rate would likely decrease as a result and need to be considered in conjunction. The escalation rate over the past 5 years has on average been around 3% and is generally controlled by the government through interest rates to maintain a value around 2.5% to 3.5%, so there is less risk associated with changes to this parameter in the long term.

Energy Cost – Import Cost:

The cost for energy imported is anticipated to be higher than the cost for exported energy. It is also likely to increase more than the value of energy exported. Increases to the cost for energy imported will positively impact the business case. The value used is also based on a rolling average for the CRD's energy cost at this facility, so there is less risk associated with this parameter.

Energy Value – Export Tariff:

The value for energy exported is anticipated to be lower than the cost for energy imported and likely increase less than the cost of energy imported. This value has been provided by BCH, which provides confidence that it is an accurate representation of what the cost will be.

Microturbine Power Production:

Power production significantly impacts the microturbine business case. However, Main No. 3 is a watermain which will maintain flow and pressure more reliably than other applications. The microturbine selection based on what is best suited for the self-generation power connection scenario will impact the power production. Therefore, the microturbine selection and resulting power produced should be confirmed via consultation with BCH.

Capital Cost:

Minor changes to the capital cost don't significantly impact the business case. The budgetary quote provided by the microturbine includes a high and low value for the anticipated cost, both of which result in a favourable business case.

Table 4-4. Sensitivity Analysis Summary

Parameter	Original	Capital Cost Net Present Value ($M)		Discount Rate (%)		Escalation Rate (%)		Energy Cost – Imported ($/kWh)		Energy Revenue – Exported ($/kWh)		Microturbine Power Production (kWh)	
Current	-	1.25[a]		5		3		0.130		0.100		968,000	
Change	-	-10%	10%	-1%	2%	-1%	2%	-0.05 $/kWh	0.1 $/kWh	-0.05 $/kWh	0.03 $/kWh	-30%	8%
New	-	1.12	1.37	4	7	2	5	0.08	0.23	0.05	0.13	670,000	1,050,000
Present Value ($M)													
Capital Expenditure	1.25	1.12	1.37	1.27	1.20	1.23	1.27	1.25	1.25	1.25	1.25	1.25	1.25
Operational Expenditure	0.24	0.24	0.24	0.28	0.18	0.20	0.35	0.24	0.24	0.24	0.24	0.24	0.24
Total Cash Outflow	**1.48**	**1.36**	**1.61**	**1.55**	**1.38**	**1.43**	**1.62**	**1.48**	**1.48**	**1.48**	**1.48**	**1.48**	**1.48**
Energy Production Cost Saving	0.08	0.08	0.08	0.09	0.06	0.07	0.11	0.05	0.14	0.08	0.08	0.08	0.08
Total Cash Inflow	**2.11**	**2.11**	**2.11**	**2.48**	**1.57**	**1.82**	**2.88**	**2.08**	**2.17**	**1.09**	**4.75**	**1.47**	**2.29**
NPV	**0.62**	**0.75**	**0.50**	**0.93**	**0.19**	**0.39**	**1.27**	**0.60**	**0.68**	**-0.39**	**3.27**	**-0.02**	**0.80**
Discounted Return on Investment	**0.42**	**0.55**	**0.31**	**0.60**	**0.14**	**0.27**	**0.78**	**0.40**	**0.46**	**-0.26**	**2.20**	**-0.01**	**0.54**
Percentage Variation from Original NPV	**-**	**20%**	**-20%**	**48%**	**-69%**	**-38%**	**102%**	**-5%**	**10%**	**-163%**	**423%**	**-103%**	**28%**

aMedian capital cost based on price range provided by InPipe Energy (InPipe 2025; Attachment 3).
- = not applicable

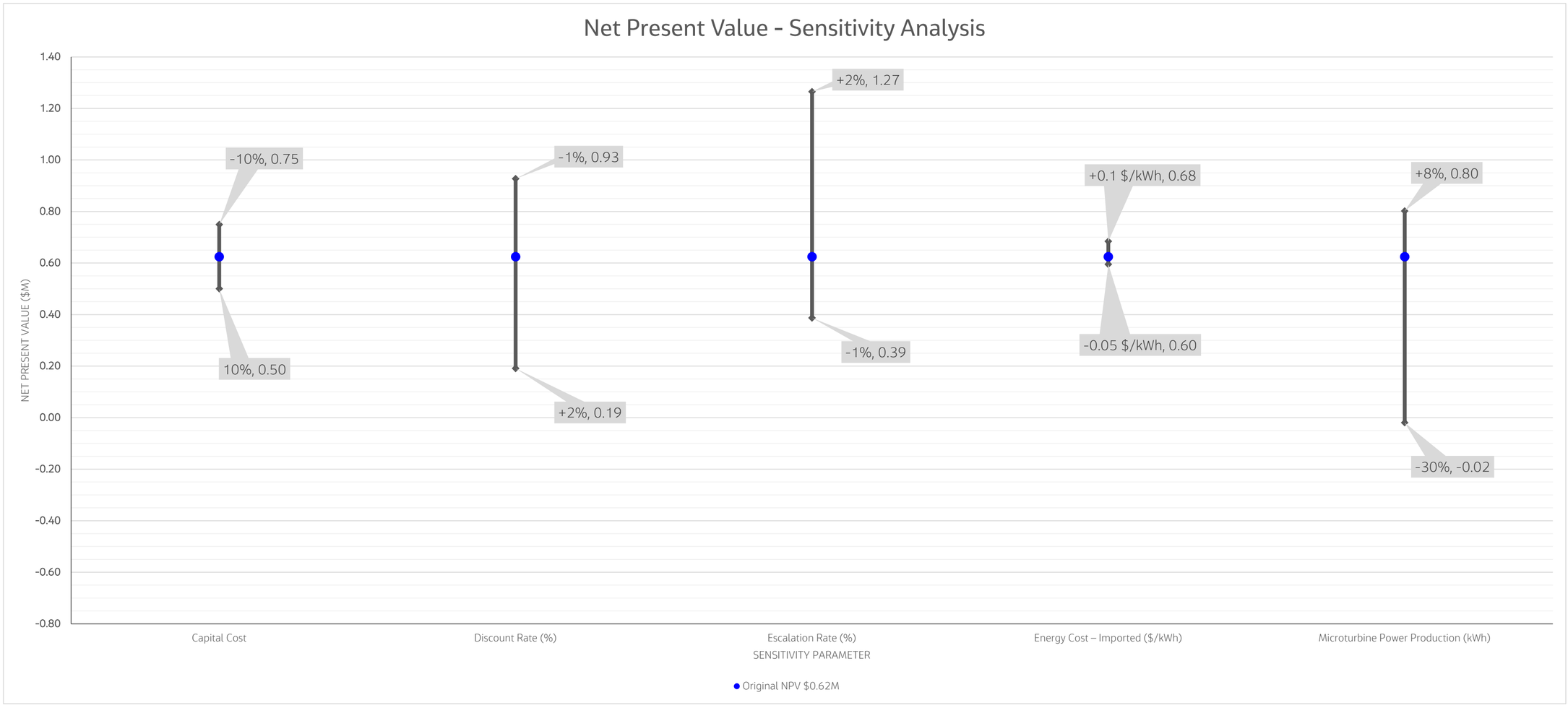


Figure 4-1. Sensitivity Analysis NPV Plot

4.5.2 Reduction in System Hydraulic Grade Line

CRD identified that the HGL in Main No. 3 may be changed to anywhere between 125m to 136m as part of system operational modification some time in the future. The raising of the downstream HGL would result in a lower available pressure differential at the PCS, which would impact the amount of power able to be generated by the microturbine.

InPipe confirmed that the originally proposed M12 Hydro XS microturbine can still be utilized but would have a lower output at average conditions of 150kW and 682,000 kWh/year for the 125m HGL scenario and 112 kW and 511,000 kWh for the 136m HGL scenario. InPipe provided updated cost estimates for the microturbine operating at the lower capacities which ranged from a capital cost of approximately $970,000 to $1,040,000. The reduction in cost from the original microturbine selection is associated with the reduced capacity of the connected electrical systems rather than the turbine itself.

Jacobs completed an NPV analysis for the system assuming the HGL is change from the time of installation of the microturbine, this analysis resulted in a positive business case for both scenarios, see Table 4-5.

Table 4-5 Present Value for Increase in Downstream HGL to 125m and 136m

Present Value ($M)	125m HGL	136m HGL
Capital Expenditure	1.04	0.97
Operational Expenditure	0.24	0.24
Total Cash Outflow	1.28	1.21
Energy Production Cost Saving	0.08	0.08
Total Cash Inflow	1.49	1.12
NPV	0.21	-0.09
Discounted Return on Investment	0.17	-0.07
Payback Period[a]	28	33

[a]The Payback Period is calculated from the year in which the initial financial investment occurs.

As the timing of the system operational modifications is not known, Jacobs completed an NPV analysis to determine the additional benefits of installing a microturbine in the scenario that the downstream HGL in the system is increased in the future. This is a viable option due to the microturbine selection being the same for the original design basis and the increased HGL scenario (Hydro XS M12) but with the electrical system sized for the larger capacity. Based on the range of costs that were received from the supplier, we have used a mid-range cost to reflect a microturbine that could be utilized in a lower or higher HGL scenario. The scenarios presented in Table 4-6 assume that the microturbine operates with a downstream HGL of 116m until it is eventually raised at which point the power generation is reduced accordingly.

Based on the analysis the greater the delay in increasing the downstream HGL, the greater the returns and the lower the payback period. Increasing the downstream HGL in 10 years (2038) after microturbine installation would result in an NPV of approximately $120,000 - $330,000 and a payback period of 25-29 years. Increasing the downstream HGL in 20 years (2048) after installation of the microturbine would result in an NPV of $430,000 - $520,00 with a payback period of 21 years. The implementation of the microturbine would also prevent a significant amount of CO_2 emissions adding to the overall social benefit to the project. Installation of a microturbine will still provide positive financial and social benefits, especially if the modifications to the system HGL are not anticipated until some time in the future.

Table 4-6 Feasibility Assessment for Scenarios with an Increase in the Downstream System HGL

Present Value ($M)	Increase in DS HGL in 2038[a]		Increase in DS HGL in 2048[b]	
	125m	136m	125m	136m
Capital Expenditure	1.19	1.19	1.19	1.19
Operational Expenditure	0.24	0.24	0.24	0.24
Total Cash Outflow	**1.43**	**1.43**	**1.43**	**1.43**
Energy Production Cost Saving	0.08	0.08	0.08	0.08
Total Cash Inflow	**1.75**	**1.54**	**1.95**	**1.85**
NPV	**0.33**	**0.12**	**0.52**	**0.43**
Discounted Return on Investment	**0.23**	**0.08**	**0.37**	**0.30**
Payback Period (Yrs)[c]	**25**	**29**	**21**	**21**

[a]This scenario involves the HGL modification in the system occurring 10 years after the installation of the microturbine.
[b]This scenario involves the HGL modification in the system occurring 20 years after the installation of the microturbine.
[c]The Payback Period is calculated from the year in which the initial financial investment occurs.

5. Conclusions and Recommendation

The objective of this feasibility study was to assess whether a microturbine at the Humpback PRV site presented a positive opportunity or not and if further work should be undertaken to develop the solution. Based on the Feasibility Study findings, Jacobs believes the microturbine will be a beneficial investment from a financial and sustainability perspective and should therefore be approved to move to the next phase of the project development.

The next phase of the microturbine solution development would be to complete detailed network hydraulics and a functional level design, to enable a more detailed and accurate analysis to be completed to confirm the business case.

Current Network Conditions

Based on the assumed design data in the assessment a microturbine is shown to provide long-term economic benefits to the PCS with an initial investment of around CAD $1.13 M (CAD $1.18 M present value), NPV of CAD $0.69M on average, and a payback period of 21 years.. Opportunities to further improve the ROI of the facility can be further explored if the installation proceeds to the next phase of development. The installation of a microturbine is also estimated to prevent 540 tonnes of CO_2e emissions over the next 30 years (InPipe 2025) from the power produced annually.

Increased Downstream System HGL Conditions

If the downstream system HGL is increased, the pressure differential across the proposed microturbine would be lower resulting in lower power generation compared to current network conditions. Based on Jacobs' analysis, the financial benefits are still positive if the downstream system HGL is increased to 125m or 136m.

There is an opportunity to generate power at the higher capacity under current network conditions and reduce the capacity in the future when the downstream system HGL is increased due to the microturbine selection being the same under both scenarios. There are increasing financial returns associated with the modifications to the system HGL being implemented further in the future. If the system HGL modifications occur 20 years after the installation of the microturbine the payback period is 21 years, which is the same as the payback period under current network conditions.

Jacobs recommends the following next steps:

1. CRD is to validate key assessment values:
    a. Complete long-term modelling/ forecasts for flow rates and pressure at inlet and outlet under the proposed network reconfigurations, to confirm the microturbine selection and update the business case. The flow and pressure data and key factors in the energy production capacity and are based on limited data from the existing system which is proposed to be modified as part of the project that would implement the turbine if the solution is adopted.
    b. The sensitivity analysis identified that the discount rate impacts the business case significantly and should be confirmed by CRD before proceeding to confirm the long-term feasibility of a microturbine.
    c. Other parameters also impact the business case; however, these parameters were assumed based on data and input from CRD. As such, the risk for major discrepancies between the assumed parameters and the actual parameters in the future is lower.
2. Confirm network connection arrangement with BCH:
    a. Consult with BCH to determine the power connection and financial benefits from exporting surplus power produced to the power grid.
    b. Continue discussions with BCH around microturbine capacity and get in writing an agreement for a microturbine up to 300kW to be installed.

   c. Update assessment in the next design phase with the details and costs of connection to BCH network.

3. Scope next stage of project implementation to progress alongside current PCS design work:
   a. Confirm what scope is required for the next conceptual/ functional design phase and integrate the details of the microturbine installation project with the larger PCS Design project to enable important design parameters, such as available equipment footprint and site location, to be communicated and accounted for to allow efficient implementation if selected to be adopted.

4. Include scope to assess opportunities and applications for funding and grants:
   a. This assessment does not consider funding from local, provincial, or territorial, or federal clean energy initiatives; however, there are initiatives that this facility may be able to apply for that would further improve the financial assessment completed as part of this FS. Opportunities for grants and funding for clean energy infrastructure can be explored further during detailed design to subsidize the initial capital investment

6. References

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Statistics Canada. 2025. Consumer Price Index, annual average, not seasonally adjusted.

Attachment 1
RFI-26 – Electricity Regeneration Queries

QRequest for Information

Jacobs

Project:	RWS/SPW - 2023-892 - Transmission Upgrade Program		
Jacobs Project No.:	CE881400	**RFI No.:**	26
RFI Title	Electricity Regeneration Queries		
Prepared by:	Tania Gill / Paul Luscombe		
Date Submitted:	02/07/2025	**Response Requested By:**	09/07/2025
Copies to:	Patrick Moore / Oliver South		
Attachments:	N/A		

Query

Jacobs is completing an electricity regeneration study for installing a microturbine at the PRV station that is being replaced with an above grade station as part of the RWS/SPW Transmission Main Upgrade Program.

The following assumptions have been made for the study:

- PRV station will be above grade
- Microturbine will be installed in parallel to the PRV station
- Confined space entry will be avoided
- The study will only consider the cost differential between the PRV station and PRV station with microturbine
- Assessment period will be aligned with the design life of the microturbine (30 years) as this will be the major element in the system.
- Assume on average 2% of capital cost for annual operation and maintenance cost

Can CRD please confirm that the above assumptions are acceptable? If not please provide details of the assumptions to be adopted.

Site Location

It is assumed that the PRV station will be located to the north of the existing below grade station as per the conceptual design, as such this will be used as the design basis for the study. Jacobs understands that CRD may want the PRV station and microturbine facility to potentially be located further downstream in the system should the Humpback site be abandoned. If CRD is interested in this option following the initial microturbine analysis, a sensitivity analysis can be done to see the impacts of moving the station further downstream. Jacobs recommends this approach as the location is not anticipated to be a limit to upfront work as the impacts are not anticipated to be such that the analysis and recommendations are significantly changed.

Can CRD please confirm if an alternative site location downstream of the existing station should be reviewed?

Pipe Configuration

While the previous concept for the aboveground Humpback station was done on the basis of meeting the existing capacity (i.e., being able to reduce both Main No. 1 and 3), and it is expected the size of the PRVs will be smaller than the existing, the proposed station layout involves two parallel large PRVs (and one small PRV) within the new above ground station. Figure 1 below shows the concept of installing the microturbine in the location of one of the large PRVs within the PRV station. This option, assuming operation is in a duty standby arrangement, still provides the

redundancy originally proposed within the system as high flows can go through either the turbine or PRV (and one small PRV for low flows). This option will have a smaller footprint and lower cost.

Figure 2 shows the concept of installing the microturbine in parallel to the two large PRVs within the PRV station. This option provides additional redundancy than originally proposed as high flow can be routed through the microturbine or through one of the two large PRVs. This option will require a larger footprint and additional infrastructure resulting in a higher cost as well as more equipment to operate and maintain.

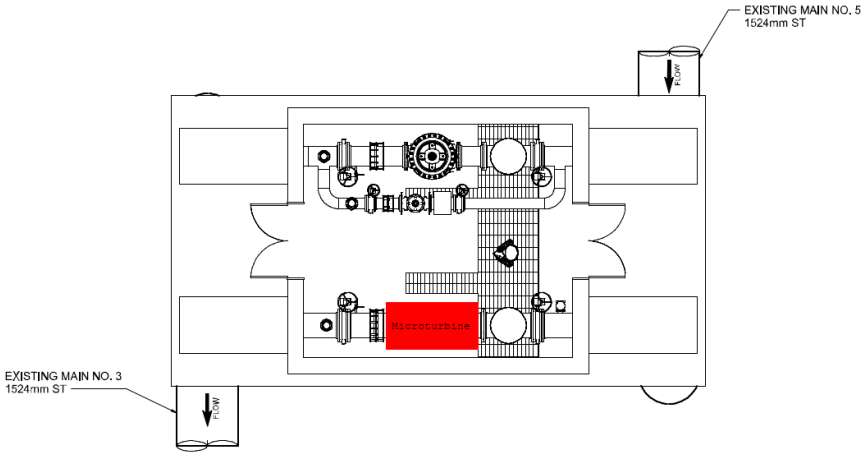


Figure 1: Install microturbine on one of the proposed mains within the PRV station.

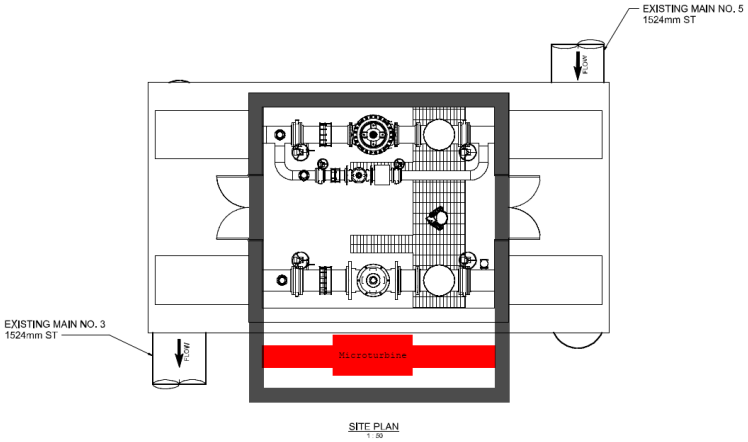


Figure 2: Install microturbine in parallel to the proposed mains within the PRV station.

Can CRD please confirm if one of the large PRVs can be replaced with the microturbine with the other existing one providing redundancy/backup or if the microturbine should be installed in parallel to the proposed two large PRVs?

Station Layout

The current proposed PRV station without the microturbine may potentially be a pre-fabricated kiosk. The microturbine could potentially be installed in a separate standalone kiosk system in conjunction with the PRV station. Alternatively, a small structure can be used to house the PRV station and microturbine in the same building.

A standalone kiosk would be lower cost and provide the required access to equipment. The building would allow operators to provide operation and maintenance indoors and there may be

efficiencies with space but this would a more expensive option. Jacobs recommends proceed with a standalone kiosk for the feasibility study.

Can CRD please confirm the preference for a stand alone kiosk or combined structure?

Net Present Value Assessment

The following information is required to complete the net present value assessment:

- Cost of power imported ($/kWh): Current cost of power supply from the power grid (assume cost increases directly with inflation)
- Cost of power exported ($/kWh): Revenue from power produced by microturbine (assume cost increases directly with inflation)
- Escalation Rate (%)
- Discount Rate (%)
- Carbon Equivalent Emissions (g of CO_2e per kWh): Based on electricity sources for CRD
- Project start year

Response by: Adrian Wardle

Date Responded: July 8, 2025

Copies to: Anita Le, Patrick Moore

Attachments: None

Response

Re: Assumptions:

The assumptions listed are correct. For the 2% of capital cost for annual O&M costs, the CRD looks to Jacobs to advise and support this.

Re: Site Location:

Focus on the Humpback location at this time. If alternative site locations are desired down the road, this can be addressed at that time.

Re: Pipe Location:

Given that the station will only be reducing flow from Main No. 3, and given that high flows can still go through the microturbine and a PRV, the option outlined in Figure 1 is preferred. From Jacobs's experience, what frequency of downtime (maintenance) should be expected on the turbine?

Station Layout:

By going with the configuration noted above, a standalone kiosk housing all items is the preferred option.

Attachment 2
BC Hydro Power Connections Correspondence

Outlook

FW: CRD TUP: RFI #26 - Humpback Electricity Regeneration Queries

From Moore, Patrick <Patrick.Moore@jacobs.com>
Date Tue 8/19/2025 12:04 PM
To Luscombe, Paul <Paul.Luscombe1@jacobs.com>; Gill, Tania <Tania.Gill@jacobs.com>; Shi, Rose <Rose.Shi@jacobs.com>

Hi Paul, Tania, and Rose,

Please see below for some background work the CRD did on this one. I tried to quickly digest the below stuff from the CRD but not sure how exactly it factors in or if any of their working is correct, are you able to please have a look at the below and factor this into the report or reject if it's not relevant? Hopefully there should at least be some more accurate rates on things that they've given us there but I'm not entirely sure.

Regards,

Patrick Moore, BEng (Hons) (he/him) | Jacobs | Civil Engineer & Project Manager
M:+1.236.971.6565 | patrick.moore@jacobs.com
Level 21 4720 Kingsway | Burnaby, BC V5H 4N2 | Canada

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From: Adrian Wardle <AWardle@crd.bc.ca>
Sent: Tuesday, August 19, 2025 10:58 AM
To: Moore, Patrick <Patrick.Moore@jacobs.com>
Cc: Keegan Hardy <kjhardy@crd.bc.ca>; Le, Anita <Anita.Le@jacobs.com>
Subject: [EXTERNAL] RE: CRD TUP: RFI #26 - Humpback Electricity Regeneration Queries

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I should have worded that differently – it is actually a net credit rate after removing any of our electrical "costs". Scenario 1 describes this in greater detail.

Adrian Wardle, P.Eng. (He/Him/His)
Project Engineer | Corporate Capital Project Delivery Services
T: 250.474.9521| C: 250.508.6729 | E: awardle@crd.bc.ca
Facebook | Instagram | LinkedIn | www.crd.ca

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Capital Regional District
479 Island Hwy
Victoria, BC V9B 1H7

From: Adrian Wardle
Sent: Tuesday, August 19, 2025 10:55 AM
To: patrick.moore@jacobs.com
Cc: Keegan Hardy <kjhardy@crd.bc.ca>; anita.le@jacobs.com
Subject: FW: CRD TUP: RFI #26 - Humpback Electricity Regeneration Queries

Thanks Keegan, this is great information. Appreciate all the effort and help with this.

Patrick – please see below for recommendations in the feasibility study regarding rates that we pay for electricity consumption at Humpback PCS, and the rates we can expect to receive when selling power back to BC Hydro.

Adrian Wardle, P.Eng. (He/Him/His)
Project Engineer | Corporate Capital Project Delivery Services
T: 250.474.9521| C: 250.508.6729 | E: awardle@crd.bc.ca
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Making a difference...together

Capital Regional District
479 Island Hwy
Victoria, BC V9B 1H7

From: Keegan Hardy <kjhardy@crd.bc.ca>
Sent: Tuesday, August 19, 2025 10:44 AM
To: Adrian Wardle <AWardle@crd.bc.ca>
Subject: RE: CRD TUP: RFI #26 - Humpback Electricity Regeneration Queries

Thanks Adrian, that makes sense.

I've confirmed that the rolling electricity rate we pay at the Humpback PCS is **$0.13/kWh**. This is based on a 12-month average and is a blended rate – capturing both consumption and demand charges. This is the most accurate rate we can get and is generally acceptable to BC Hydro when submitting energy studies.

The cost rate we are paid to generate clean energy can differ significantly based on how we would connect to the BC Hydro. There are 3 different scenarios, but I believe the first is the most likely, as both the second and third have a few tricky hurdles.
I've used the data from the Stantec report to run each scenario.
Here's a quick breakdown of each scenario, and the links to BC Hydro for more information:

1. Self Generation (formerly Net Metering):
    a. Nameplate installed capacity is limited to 100 kW
        i. This is about ¼ of the size of capacity that could be installed, based on the Stantec report which states up to 475 kW of capacity could be installed.
    b. The electricity generated is used on site first, and then the remainder is sold back to the grid.
        i. The invoice only bills for the net amount of power exchanged and carries a kWh credit until the end of year. At the end of the year, if a credit exists, it is paid out at what is called the "Mid-C Rate" (a long calculation BC Hydro does annually).
    c. The 2023-24 Mid-C Rate was USD $0.08341/kWh, or **CAD $0.115/kWh**
    d. I have done a very basic calculation, based on the estimated power consumption and using the Stantec report – which yields an **annual revenue of $87,000** from this scenario, plus we would pay essentially $0 for electricity (we still have basic admin fees)

i. Total energy generated (included that used on-site) is **788,000 kWh.**

e. We would get no funding from BC Hydro for this scenario.

2. Load Displacement Scenario:
   a. No limit on installed capacity, however – we must use 100% of electricity within the facility.
   b. BC Hydro incentives of up to $1 Million (or 75% of cost)
   c. Annual projected site consumption is **27,500 kWh** – so we would only be permitted to generate this much energy, yielding a measly **$3,500 in savings.**
   d. I've inquired about allowing us to offset the power used by nearby CRD sites (ie – Goldstream UV Plant) – big unknown/hurdle
      i. If BC Hydro would allow this, we could generate up **1,327,500 kWh** – yielding **$143,500 in savings**, between both sites

-

3. Distributed Generator Interconnections Scenario:
   a. Very unlikely scenario – lots of legal hurdles.
   b. This scenario would have the CRD becoming an Independent Power Producer (IPP), removing any limitation of power sold back to grid, and this would allow us to look at turbines up to 35 kV.
   c. The cost we would sell power back to BCH would be determined through an Electricity Purchase Agreement (EPAs), and range anywhere from $0.03 - $.10 / kWh.
      i. Using an average of **$0.06 / kWh** and using Stantec's maximum energy generation (2,926 MWh), this would yield **$175,000 in electricity revenue**.
   d. We would get no funding from BC Hydro for this scenario.

Boiled down – my recommendation at this time would be to advise Jacobs to base the analysis off the first "Self Generation" scenario – sizing a turbine with a name plate capacity of 100 kW, and only the remainder of electricity is sold back to the grid, at $0.115/kWh.

Sorry for the wordy email, feel free to give me a call if you want to chat about it.
Happy to provide my basic calculations if there is interest.

Chat soon,
Keegan.

-

-

Keegan Hardy
Corporate Energy Specialist | Climate Action Program
T: 250.360.3099 | C: 672.922.1352 – New!
Facebook | Instagram | LinkedIn | www.crd.bc.ca

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Attachment 3
InPipe Energy Budgetary Quote

Shi, Rose

From: Gregg Semler <gregg@inpipeenergy.com>
Sent: Thursday, September 18, 2025 3:00 PM
To: Luscombe, Paul
Cc: Gill, Tania; Shi, Rose
Subject: Re: [EXTERNAL] Re: Hydro-microturbine Opportunity in Langford, BC - Jacobs

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Paul,
Budgetary cost estimate for the M12-90kW-V system with enclosure: $700,700

Budgetary cost estimate for the M12-90kW-V system without enclosure: $625,000

Quote is for Product only, USD FOB Houston, Texas USA

Let me know if you need anything more.
Best,
Gregg

On Thu, Sep 18, 2025 at 2:11 PM Luscombe, Paul <Paul.Luscombe1@jacobs.com> wrote:

> Hi Gregg,
>
> Thanks for the suggested options.
>
> Would you please be able to give us a budgetary cost estimate for the M12-90kW-V system, then we can run the options in parallel and be ready to proceed with a solution once we have an answer on what will be allowed. It would be great if you could indicate the cost difference for the system in or without the enclosure as the system may be installed in a kiosk with other PRVs to minimise the overall project cost and make it as attractive as possible.

Regards,

Paul Luscombe,

MIEAust CPEng NER, RPEQ, BEng.(Hons), **P. Eng.**(BC, YK)

(he/him) | Jacobs | Senior Civil Engineer

C:+61.456.594.358 | Paul.Luscombe1@jacobs.com
32 Cordelia Street | South Brisbane QLD 4101 | Australia

Upcoming Leave: Oct 9-10, Nov 6-7.

From: Gregg Semler <gregg@inpipeenergy.com>
Sent: Friday, 19 September 2025 12:09 AM
To: Luscombe, Paul <Paul.Luscombe1@jacobs.com>
Cc: Gill, Tania <Tania.Gill@jacobs.com>; Shi, Rose <Rose.Shi@jacobs.com>
Subject: Re: [EXTERNAL] Re: Hydro-microturbine Opportunity in Langford, BC - Jacobs

Hi Paul,
Let me know what you need from me.

I would suggest considering the M12-90kW-V. This would get you <100 kW nameplate and energy generation would be 788,000 kWh/year (down from 968,000 kWh/year)·. Still makes solid economic sense.

You may also consider using 2 HydroXS systems and treat them as separate projects from an interconnection point of view.

Best,

Gregg

On Wed, Sep 17, 2025 at 2:35 PM Luscombe, Paul <Paul.Luscombe1@jacobs.com> wrote:

> Hi Gregg,

Thanks for following up on this one.

We are in the process of working out the possible details for connection back to the grid for the power as the local utility has some tough rules based on the size of the power plant.

There is a 100kW name plate threshold where the requirements change.

Options are to

- reduce the size of the turbine to a 100kW name plate model
- reduce the turbine to have a max output of 100kW and get this accepted by the power utility
- Stick with our larger design and go through the process of getting approved as a small power plant/ supplier

I'm hoping we can do the last option to get the most out of the system. We'll let you know where this ends up landing.

Cheers,

Paul Luscombe,

MIEAust CPEng NER, RPEQ, BEng.(Hons), **P. Eng.**(BC, YK)

(he/him) | Jacobs | Senior Civil Engineer

C:+61.456.594.358 | Paul.Luscombe1@jacobs.com
32 Cordelia Street | South Brisbane QLD 4101 | Australia

Upcoming Leave: Oct 9-10, Nov 6-7.

From: Gregg Semler <gregg@inpipeenergy.com>
Sent: Thursday, 18 September 2025 6:33 AM
To: Shi, Rose <Rose.Shi@jacobs.com>
Cc: Gill, Tania <Tania.Gill@jacobs.com>; Luscombe, Paul <Paul.Luscombe1@jacobs.com>
Subject: Re: [EXTERNAL] Re: Hydro-microturbine Opportunity in Langford, BC - Jacobs

Shi, Rose

From: Gregg Semler <gregg@inpipeenergy.com>
Sent: Friday, August 1, 2025 2:49 PM
To: Shi, Rose
Cc: Gill, Tania; Luscombe, Paul
Subject: Re: [EXTERNAL] Re: Hydro-microturbine Opportunity in Langford, BC - Jacobs

This Message Is From an External Sender
This message came from outside your organization.

Hi Rose,
I will get you a data table and a performance plot that shows the duty points that were assumed based on the data provided. Shipping costs will be determined once we know the final size and configuration. There is no cost difference between vertical and horizontal configurations. I sent them to you so that as you design the facility, you have some options.

Best,
Gregg

On Fri, Aug 1, 2025 at 1:04 PM Shi, Rose <Rose.Shi@jacobs.com> wrote:

> Hi Gregg,
>
> Thanks for sending that over, the information for the HydroXS looks great! Would it be possible to include the following information in the formal proposal as well?
>
> - Cost for shipping to the site in Langford, BC
> - A data table and a performance plot that shows the duty points that were assumed based on the data we've provided
>
> Also, regarding the difference between the vertical and horizontal configuration models, would you be able to provide the cost difference, if any, between the two different configurations?
>
> Regards,

Rose

From: Gregg Semler <gregg@inpipeenergy.com>
Sent: Thursday, July 31, 2025 11:27 AM
To: Shi, Rose <Rose.Shi@jacobs.com>
Cc: Gill, Tania <Tania.Gill@jacobs.com>; Luscombe, Paul <Paul.Luscombe1@jacobs.com>
Subject: Re: [EXTERNAL] Re: Hydro-microturbine Opportunity in Langford, BC - Jacobs

Rose,

Here is a draft proposal and spare parts list.

Let me know if this is complete or if you need anything else before finalizing for you.

Thanks,

Gregg

On Thu, Jul 31, 2025 at 11:12 AM Gregg Semler <gregg@inpipeenergy.com> wrote:

> Thanks Rose. Do you know the electricity costs at the facility?
>
> On Thu, Jul 31, 2025 at 11:06 AM Shi, Rose <Rose.Shi@jacobs.com> wrote:
>
> > Hi Gregg,
> >
> > The required voltage for BC is 600V 3 phase power.
> >
> > Thanks!

Rose

From: Gregg Semler <gregg@inpipeenergy.com>
Sent: Thursday, July 31, 2025 10:39 AM
To: Shi, Rose <Rose.Shi@jacobs.com>
Cc: Gill, Tania <Tania.Gill@jacobs.com>; Luscombe, Paul <Paul.Luscombe1@jacobs.com>
Subject: Re: [EXTERNAL] Re: Hydro-microturbine Opportunity in Langford, BC - Jacobs

Hi Rose,

Im working on the proposal for the HydroXS. We typically provide 480V 3 phase power. What is the required voltage at the site location in BC?

Gregg

On Mon, Jul 28, 2025 at 9:50 AM Shi, Rose <Rose.Shi@jacobs.com> wrote:

> Hi Gregg,
>
> We are aiming to submit our feasibility study to our client in August and would greatly appreciate it if you could respond with a formal proposal this week. Apologies for the tight schedule, please let us know if this timing is not possible, or if there's any other information you need us to provide to put together the formal proposal.
>
> Thanks,
>
> Rose
>
> ---
>
> **From:** Gregg Semler <gregg@inpipeenergy.com>
> **Sent:** Monday, July 28, 2025 9:43 AM
> **To:** Shi, Rose <Rose.Shi@jacobs.com>

Cc: Gill, Tania <Tania.Gill@jacobs.com>; Luscombe, Paul <Paul.Luscombe1@jacobs.com>
Subject: Re: [EXTERNAL] Re: Hydro-microturbine Opportunity in Langford, BC - Jacobs

Cool, what's your timing need for the proposal?

> On Jul 28, 2025, at 10:41 AM, Shi, Rose <Rose.Shi@jacobs.com> wrote:
>
> Hi Gregg,
>
> We are putting together a business case for a client that is interested in adopting energy recovery systems in their network. This is part of a PRV station replacement project, but if we can show a good business case, the client may allocate the additional funds needed to adapt the project into a microturbine installation rather than a typical PRV station.
>
> Thanks,
>
> Rose
>
> ---
>
> **From:** Gregg Semler <gregg@inpipeenergy.com>
> **Sent:** Monday, July 28, 2025 9:22 AM
> **To:** Shi, Rose <Rose.Shi@jacobs.com>
> **Cc:** Gill, Tania <Tania.Gill@jacobs.com>; Luscombe, Paul <Paul.Luscombe1@jacobs.com>
> **Subject:** Re: [EXTERNAL] Re: Hydro-microturbine Opportunity in Langford, BC - Jacobs
>
> Yes, will do. Do you have a budget?
>
> > On Jul 28, 2025, at 9:33 AM, Shi, Rose <Rose.Shi@jacobs.com> wrote:

Hi Gregg,

Thanks so much for sending the information over, this looks excellent! Could you please provide a formal proposal for a 600V system instead of a 480V system?

Best Regards,

Rose

From: Gregg Semler <gregg@inpipeenergy.com>
Sent: Friday, July 25, 2025 1:29 PM
To: Shi, Rose <Rose.Shi@jacobs.com>
Cc: Gill, Tania <Tania.Gill@jacobs.com>; Luscombe, Paul <Paul.Luscombe1@jacobs.com>
Subject: [EXTERNAL] Re: Hydro-microturbine Opportunity in Langford, BC - Jacobs

Hi Rose,
Here is our Assessment for the Capital Regional District in Langford, BC. It looks like we can recover about a million kilowatt hours of electricity annually using the HydroXS at this site. If this looks like it would work for your report, I can gather the rest of the information you requested and provide a more formal proposal.

Let me know what you think.

Gregg

On Thu, Jul 10, 2025 at 12:25 PM Shi, Rose <Rose.Shi@jacobs.com> wrote:

> Hi Gregg,

Jacobs is working on a watermain project for the Capital Regional District in Langford, BC with an opportunity for the installation of a hydro-microturbine.

The microturbine would be installed at the site of a new above-ground Pressure Control Valve station, and flows will range from 11,750 m3/d to 58,580 m3/d, with a nominal flow of 29,290 m3/d.

We are looking to install microturbines at the site of an above-ground Pressure Reduction Valve (PRV) station and will have an assumed elevation of 110 masl. The existing watermain is a 1524mm steel pipe which, during maximum flow, will have an upstream pressure of 71 psi (max flow) to 81 psi (min flow) and a downstream pressure at the microturbine of 3 psi (max flow) to 11 psi (min flow). The microturbine would be installed on a 500mm off-take from the watermain within the PRV station. See proposed pipe that the microturbine would be installed on in the PRV station drawings attached. The map showing the approximate geographic location of the station has also been included.

We would like to get input from you as to whether you see a good opportunity for hydro-microturbines at this location and, if so, what hydro-microturbine would you recommend for installation?

The client prefers that the microturbine and PRV be housed together in a standalone kiosk. Is this feasible and a complete package that you could provide?

Could you please provide information on the following for the recommended hydro-microturbines for our consideration:

1. Capital costs for the microturbine including cost to be delivered to Langford, BC
2. List of replacement parts, costs for parts, and frequency of replacement
3. Examples of similar installations and layout drawings if available
4. Flow/head/Power/Efficiency curves
5. NPV or NPC calculations if available to calculate the Return on investment and demonstrate the viability of installing them.
6. Confirmation on that you offer complete installation packages with electrical equipment

7. Capital cost for complete kiosk installation package with electrical equipment
8. Downtime required for maintenance of the microturbine

This information is needed within the next couple of weeks so that it can be evaluated and incorporated into the Preliminary design of the project so a prompt response even if it is a partial response would be greatly appreciated.

We can connect for a discussion if needed following your review of this information.

Thank you,

Rose Shi
Engineering Intern
Jacobs | Vancouver, BC | Cell: 778.929.5298

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--

Gregg Semler

CEO and Founder

503-341-0004

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--

Gregg Semler

CEO and Founder

503-341-0004



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--

Gregg Semler

CEO and Founder

503-341-0004



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Gregg Semler

CEO and Founder

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--

Gregg Semler
CEO and Founder
503-341-0004

Humpback Station

Potential Energy Assessment and Scope Information

July 31, 2025

Prepared for: **Rose Shi**
Engineering Intern
Jacobs | Vancouver, BC | Cell: 778.929.5298

Project Location: Capital Regional District (CRD) in Langford, BC

Prepared by: InPipe Energy, Inc.
830 NE Holladay St.
Portland, Oregon 97232

Primary contact: Gregg Semler
CEO and Founder
InPipe Energy



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1. INTRODUCTION

InPipe Energy specializes in energy recovery solutions in water infrastructure to support water managers concerned with operating efficient, productive, and sustainable water systems. The Company has combined its expertise, technology, and experience to create its HydroXS® energy recovery system. The HydroXS is a patented modular energy recovery system designed in collaboration with Grundfos to cost-effectively optimize energy production, reliably manage pressure, and control flow.

The HydroXS is delivered as a turnkey, end to end energy recovery solution. It comes standard in 7 sizes that integrates state-of-the-art control valve technology from Cla-val with a micro-turbine from Grundfos, and a regenerative variable frequency drive (VFD) with sensors connected to a PLC based control system. The result is both increased efficiency and energy generation by as much as 60% compared to typical in-conduit hydroelectricity systems.

Here's how it's unique:

Water flows are variable, but all in-conduit hydro turbines are single fix speed. While the prospect of energy savings from single speed turbines is appealing, single-speed turbines do not handle in the daily and seasonal flow variables many cities experience. These turbines work on an efficiency curve based on a single flow and pressure design point. Maintaining efficiency results in a very narrow operating range greatly limits the potential energy that can be generated.

InPipe Energy's variable speed HydroXS was specifically designed to address multiple efficiency curves. Here's how it works. Flow and pressure sensors provide continuous feedback to the control system which then responds by adjusting the speed of the turbine - generating more energy more efficiently. It's designed to achieve the perfect balance between pressure regulation and maximizing energy recovery.

In this document, InPipe will summarize its preliminary assessment of the energy generation and carbon emissions reduction potential using the HydroXS to support the goals and objectives of Capital Regional District (CRD) for energy savings at this location.

2. PRODUCT DESCRIPTION

InPipe Energy is proposing to provide the HydroXS M12-220kW-V-T15, a patented, modular digitally enabled energy recovery system that serves as both a pressure reducing valve and a renewable energy generator. The HydroXS accurately replicates the functionality of a control valve while tapping wasted energy (vented pressure) to produce carbon-free, renewable energy.

InPipe Energy's HydroXS product offers several key benefits to CRD, including:

1. Reliable water pressure-power generation management - the HydroXS accurately controls downstream delivery pressure and optimizes energy production without having to change the current infrastructure.
2. Low cost, easy installation – the HydroXS is delivered with key components prefabricated.
3. Standard grid interconnection capability – System is designed to comply with electric utility safety and reliability requirements.
4. Improved data-driven water management – the HydroXS collects real-time hydraulic data which is integrated into supervisory control and data acquisition (SCADA).
5. Low cost operation & maintenance.
6. Real time data – The HydroXS includes our Flow, Pressure Management, and Energy Recovery dashboard so that operators and managers can track operational, NRW, and sustainability metrics.

The HydroXS combines proven integrated hardware, a control system with sensors, and a 600 Volt 3 phase power distribution cabinet with industry-standard lifecycle expectations. Product features, capabilities and sub-systems include:

- A micro-hydro turbine with UL-tested induction generator
- Control valves with electronic solenoid control and pressure transmitter
- A self-contained custom control panel (controllers, relays, ancillary PFCCs and a PCL system) that can be connected to an existing SCADA communication network.
- Manual isolation valves, visual position indicators
- Constant flow monitoring (+/- 2% accuracy, NIST traceable)
- Automated alarms for flow interruptions, safety measures, and maintenance checks
- Programmable logic controller (PLC) processors.
- Automated safe shutoff and restart adhering to IEEE 1574

The HydroXS complies with all rules governing electric utility parallel interconnection, including power outage protection, and auto shut off and restart. The system has a single microprocessor multifunction relay; and the main trip functions are backed up with an alternative backup trip function.

3. BASIS OF DESIGN AND PERFORMANCE

InPipe Energy has analyzed the hydraulic data provided by Jacobs and is proposing the use of the HydroXS M12-220kW-V-T15 at the Humpback PRV Station location.



Figure 1: CRD's Humpback PRV Station

The HydroXS would be installed at the site of a new above-ground Pressure Control Station

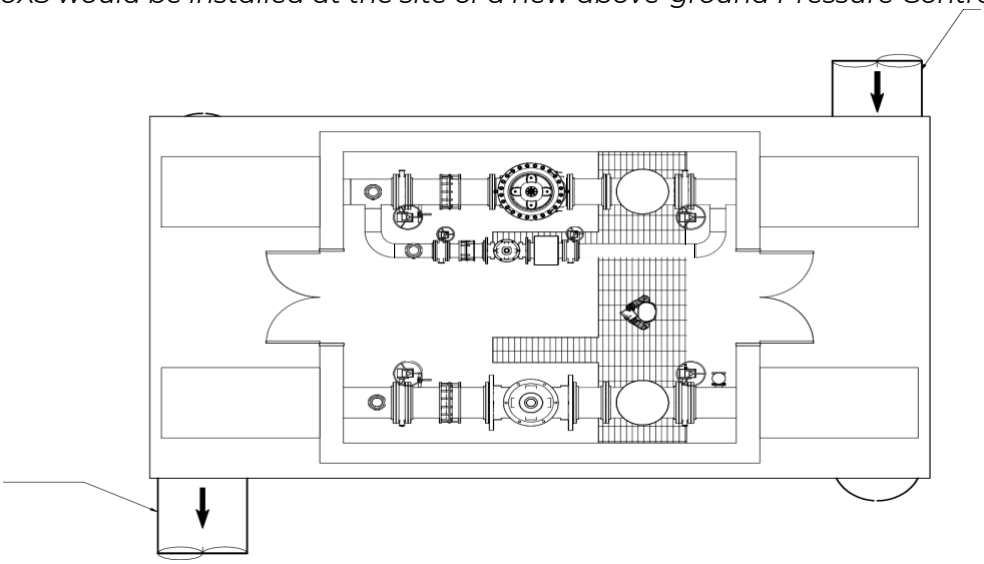
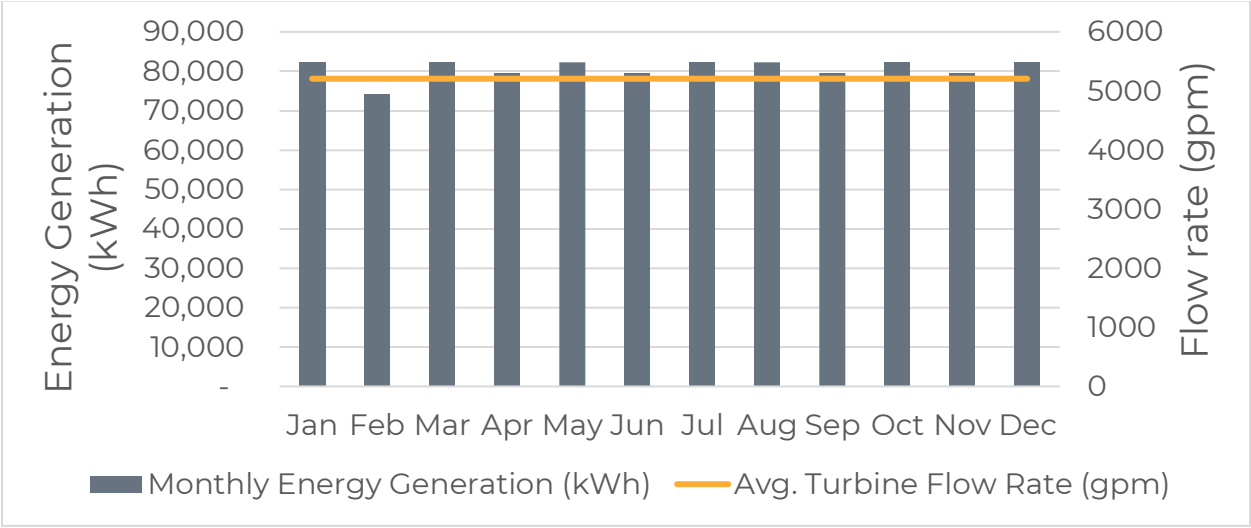


Figure 2: New_Pressure Control Valve Station

4. HYDRAULICS & ENERGY PRODUCTION

Based on data provided here is the projected energy production:



The table below shows the estimated performance for the HydroXS system for this new facility:

Month	Avg. Turbine Flow Rate [gpm]	Avg. Net Pressure [psid]	Avg. Power [kW]	% Time Running	Est. Monthly Energy [kWh]
Jan	5208	**70**	111	100%	**82,222**
Feb	5208	**70**	111	100%	**74,265**
Mar	5208	**70**	111	100%	**82,222**
Apr	5208	**70**	111	100%	**79,570**
May	5208	**70**	111	100%	**82,222**
Jun	5208	**70**	111	100%	**79,570**
Jul	5208	**70**	111	100%	**82,222**
Aug	5208	**70**	111	100%	**82,222**
Sep	5208	**70**	111	100%	**79,570**
Oct	5208	**70**	111	100%	**82,222**
Nov	5208	**70**	111	100%	**79,570**
Dec	5208	**70**	111	100%	**82,222**
				TOTAL	**968,000 kWh/year**

METRICS	HydroXS M12-220kW-V-T15
Capacity	220 kW (Est. avg. power: 111kW)
Site Flow Rate (min/avg/max)	MGD: 4/8/13 (gpm: 2,778/5,556/9,027)
Est. Turbine Flow Rate (min/avg/max)	MGD: 4/7.5/11.5 (gpm: 2,778/5,208/8,000)
Net Pressure	70 psid - (75psig inlet, 5psig outlet)
Percentage of time on	100%
Est. Annual Energy Generation	968,000 kWh
30-Year Net Revenue (at $0.073/kWh)*	$4,694,834
30-Year Carbon Savings	15,200 tons CO_2 reduced

The figures on the next page show the front and isometric view of the HydroXS M12 as well as a representative picture of the system controls and power panels.

HYDROXS

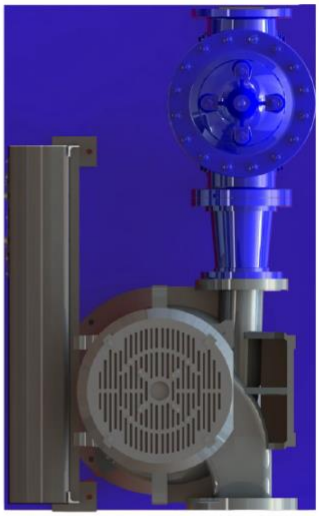
MALL VERTICAL CONFIGURATIONS WITHOUT ENCLOSURE

7

ISOMETRIC VIEW



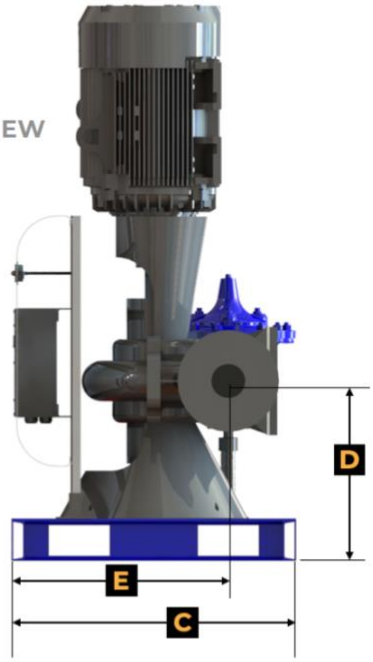
TOP VIEW



FRONT VIEW



SIDE VIEW



FLOW DIRECTION

Dimensions

	A		B		C		D		E		Weight	
System Size	mm	in	mm	in	mm	in	mm	in	mm	in	kg	lb
M2	940	37	1,372	54	762	30	457	18	622	25	488	1,075
M4	1,143	45	1,372	54	876	35	460	18	470	19	726	1,600
M8	1,721	68	2,083	82	1,080	43	673	27	819	32	2,155	4,750
M12	2,235	88	2,972	117	1,334	53	762	30	914	36	4,967	10,950

This table shows the dimensions and weights of the small vertical orientation skids

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HYDROXS

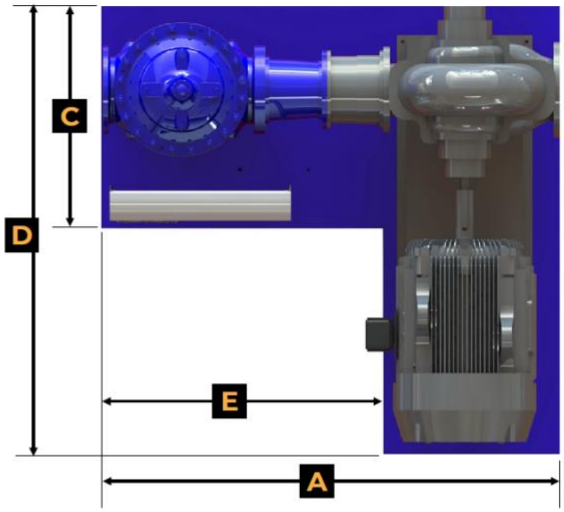
LARGE HORIZONTAL CONFIGURATIONS WITHOUT ENCLOSURE

9

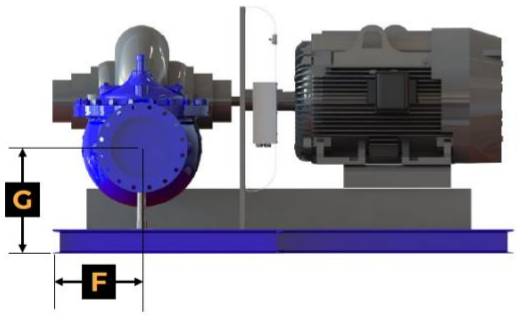
ISOMETRIC VIEW



TOP VIEW



SIDE VIEW



FRONT VIEW



FLOW DIRECTION

Dimensions

	A		B		C		D		E		F		G		Weight	
System Size	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	kg	lb
M16	3,124	123	1,651	65	1,524	60	3,048	120	1,905	75	591	23	699	28	8,505	18,750
M24	4,268	168	2,413	95	1,930	76	4,064	160	2,597	102	813	32	851	34	11,408	25,150
M36	5,690	224	2,845	112	2,210	87	4,674	184	3,150	124	1,118	44	1,003	40	17,428	38,422

This table shows the dimensions and weights of the large horizontal orientation skids

HYDROXS

CONFIGURATIONS & SPECIFICATIONS

6

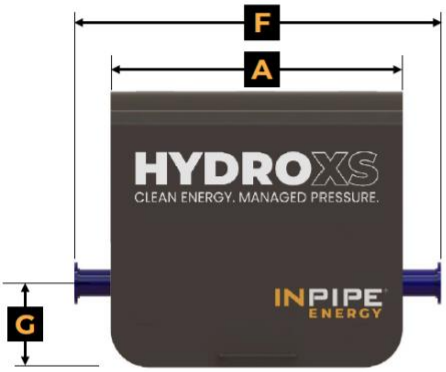
TOP VIEW



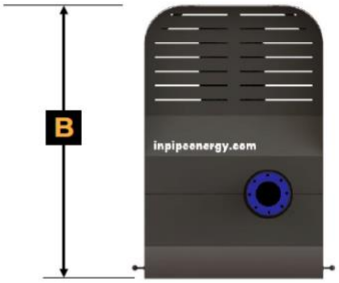
ISOMETRIC VIEW



FRONT VIEW



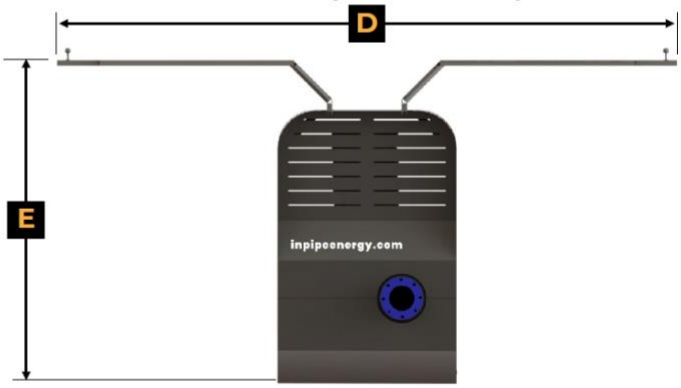
SIDE VIEW



FRONT VIEW (DOORS OPEN)



SIDE VIEW (DOORS OPEN)



Dimensions

System Size	A		B		C		D		E		F		G		H		Total Weight (Enclosure + Skid)	
	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	kg	lb
M2-V	1,524	60	2,235	88	1,321	52	4,907	193	2,680	106	1,549	61	457	18	267	11	673	1,483
M4-V	1,727	68	2,235	88	1,372	54	4,958	195	2,680	106	1,956	77	460	18	533	21	951	2,096
M8-V	2,305	91	2,235	88	1,448	57	5,034	198	2,680	106	2,940	116	673	27	457	18	2,488	5,484
M12-V	2,819	111	3,175	125	1,626	64	7,092	279	3,620	143	4,064	160	762	30	546	22	5,603	12,353
M2-H	1,524	60	2,235	88	1,321	52	4,907	193	2,680	106	1,549	61	343	14	305	12	797	1,758
M4-H	1,702	67	2,235	88	1,473	58	5,060	199	2,680	106	1,930	76	356	14	356	14	1,071	2,361
M8-H	2,337	92	2,235	88	2,032	80	5,618	221	2,680	106	2,972	117	495	20	508	20	2,773	6,114
M12-H	2,819	111	2,235	88	2,591	102	6,177	243	2,680	106	4,064	160	597	24	600	24	5,812	12,813
M16-H	3,708	146	2,235	88	3,302	130	6,888	271	2,680	106	5,258	207	699	28	686	27	9,464	20,732
M24-H	4,851	191	2,667	105	4,318	170	8,768	345	3,112	123	7,010	276	851	34	950	37	13,017	28,698
M36-H	6,274	247	3,099	122	4,928	194	10,241	403	3,543	140	9,347	368	1,003	40	1,245	49	20,545	45,294

This table shows the dimensions and weights of the enclosure

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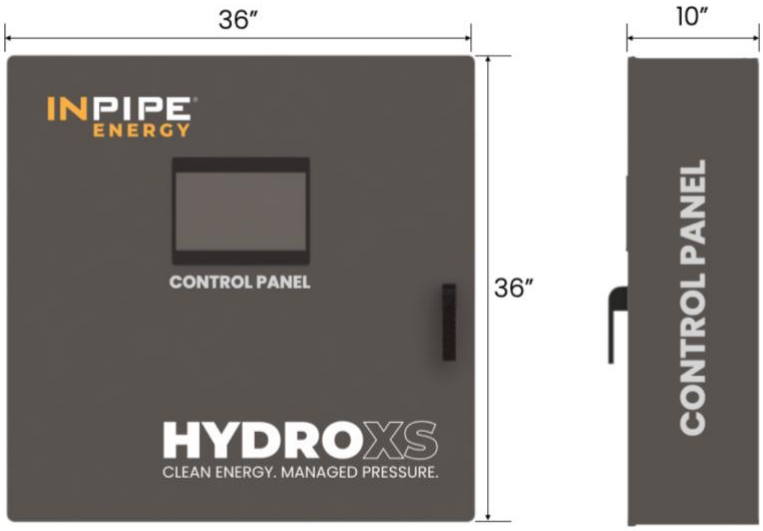
System parameters are summarized in the tables below:



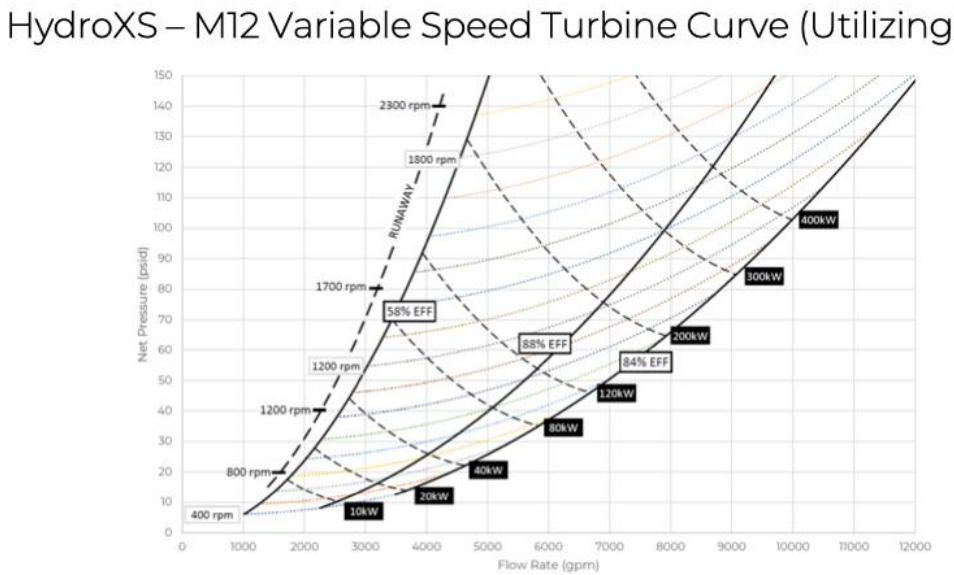
Example Controls Panel and Power Panel – (could be side by side)

This project utilizes 1 power panel & 1 controls panel per HydroXS System with the below specifications

Electrical Parameters	
Power Panel Voltage Rating	480VAC, 3PH
Generator Full Load Amps	TBD
Power Panel Rating	NEMA4
Power Panel Weight	250 lbs
Controls Panel Voltage Rating	120VAC, 1PH
Controls Panel Rating	NEMA4
Controls Panel Weight	250 lbs
Instrumentation and Controls	
Flowmeter	McCrometer
Pressure Transducers (3)	Wika or similar
Turbine Tachometer	Electro-Sensor
Generator Protection Relay	Schweitzer
PLC	AB Compact Logix



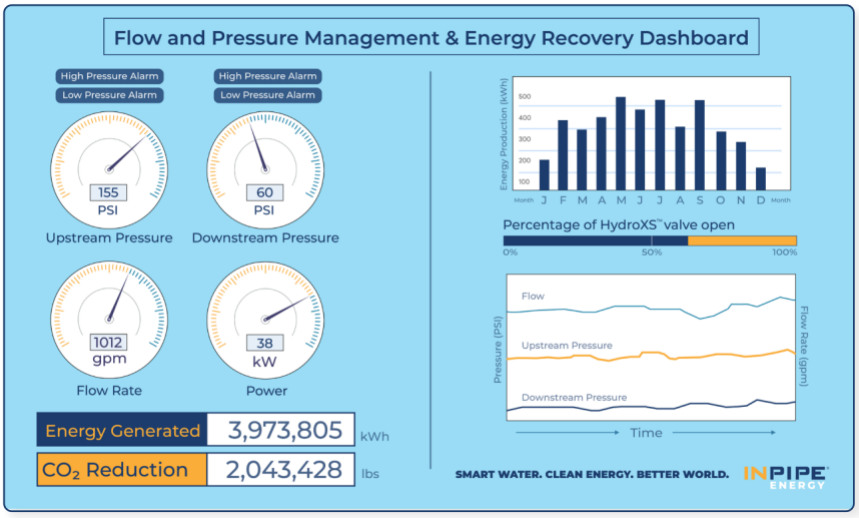
Instrumentation and Controls	
Flowmeter	McCrometer
Pressure Tranducers (3)	Wika or Similar
Turbine Tachometer	Electro-Sensor
Generator Protection Relay	Schweitzer
PLC	Allen-Bradley CompactLogix
HMI	Maple Systems 10″
Controls Panel Rating	NEMA 4



5. REMOTE MONITORING DASHBOARD

In addition to the hardware, the HydroXS also has a remote dashboard that provides real-time hydraulics, energy, and carbon reduction data.

See figure below for an example of InPipe energy's Energy Recovery and Pressure Management Dashboard.



Sample Flow & Pressure Management & Energy Recovery Dashboard

6. BUDGET & PAYBACK

The following provides a budgetary range for the design, supply, and services of the HydroXS equipment. InPipe Energy has not included an estimate for installation

services at this time. As the project continues forward and additional relevant site information is shared, InPipe Energy can prepare pricing for a complete design-build turnkey offering including design, supply, installation, and support services.

6.1. Budgetary Pricing for InPipe Energy's HydroXS M12

$USD 725,000 - $800,000 FOB Houston, Texas USA

7. OPTIONAL ADDITIONAL SCOPE OF SERVICES

In addition to supplying the HydroXS, InPipe can also provide the following services on a project or hourly fee basis:

- **Design**, mechanical and electrical layout stamped by a PE.
- **Regulatory**, including the required FERC filing for conduits.
- **Grant writing support** (utility incentives, State and Federal).
- **Project Management/Development**, including utility tariff assessments and interconnection agreement drafting and filings.
- **Turnkey Capabilities**: Turn-key equipment installation and project management.

8. NEXT STEPS

At this stage, InPipe Energy is prepared to move forward with a 30% Design & Economics report.

Jacobs to provide the following information:

1. Flow rate data (3+ years of hourly time series data if possible)
2. Pressure data at inlet and outlet (3+ years of hourly time series data is best if possible)
3. Updated As-Builts of site (and photos if applicable)
4. $Cost/kWh or copy of energy bill

Attachment 4
InPipe Energy O&M Details

Gregg

On Fri, Aug 5, 2022 at 8:25 AM Gregg Semler <gregg@inpipeenergy.com> wrote:

> Hi Tania,
>
> This looks like an excellent opportunity for the HydroXS.
>
> Here is our Preliminary Energy and Carbon Recovery estimate:

Jacobs - Yukon-Faro	
Power:	542 kW @ maximum flow 464 kW @ nominal flow 258 kW @ minimum flow
Flowrate (Design):	870 L/s maximum flow 705 L/s nominal flow 355 L/s minimum flow
Net Pressure (Design):	95m @ maximum flow 100m @ nominal flow 110m @ minimum flow
Percentage of Time On:	60%
Annual Energy Generation:	2,847,000 kWh/year @ maximum flow 2,436,000 kWh/year @ nominal flow 1,357,000 kWh/year @ minimum flow
Power Value (Assumed):	$0.25 / kWh
Annual Energy Cost Savings:	$674,000
Annual O&M:	$14,000
Annual Net Savings:	$660,000
30-Year Carbon Savings	19,000 tons CO2 reduced
Project Cost (budgetary):	$2,922,000

System Design Summary	
Project Location (Lat, Lng):	62°21'17.93"N, 133°27'10.05"W

Application:	Federal Mine Closure Dewatering
Water Source:	Treated Ground Water
Site power:	480VAC, 3ph, 60 Hz
Ambient temperatures:	-50C to 25C (-58F to 77F)
System Area Classification:	Non-hazardous, non-seismic
Panel Certification:	CSA
Design Operating Basis:	Run 100% from April to October (therefore 60% of the year)
Nominal Dimensions:	TBD
Nominal Weight:	TBD
Inlet Connection:	24" 150# FF Flange
Outlet Connection:	24" 150# FF Flange
Solids Filtration:	Water is to be free of solids

Let me know if you have more questions. What do you see as next steps?

Gregg

From: "Gill, Tania" <Tania.Gill@jacobs.com>
Date: July 21, 2022 at 1:28:25 PM PDT
To: gregg@inpipeenergy.com
Cc: "Luscombe, Paul/VBC" <Paul.Luscombe1@jacobs.com>, "Draper, Mark/CGY" <Mark.Draper@jacobs.com>
Subject: Hydro-microturbine Opportunity in Faro, Yukon - Jacobs Engineering

Hi Gregg,

Jacobs Engineering is working on a water treatment project for a mine in Faro, Yukon with an opportunity for the installation of hydro-microturbines.

The treated mine water will go through full treatment at the plant including filtration and flows will range from 15,000 m^3/d to 75,000 m^3/d, with the normal flow estimated at 60,000 m^3/d.

We are looking to install microturbines on the effluent pipeline which has an elevation of 1,129 masl at the treatment plant and 1014.3 masl at the outfall where it discharges into a creek.

The pipeline will be about 3.3 km long and have a continual gradual slope from the plant to the outfall. The pipeline is currently designed to be a 750-mm-diameter HDPE DR17 gravity pipeline with pipe part full flow but the size can be adjusted based on microturbine design requirements. See key plan & profile attached.

We would like to get input from you as to whether you see a good opportunity for hydro-microturbines in this pipeline and if so what hydro-microturbine or turbines would you recommend for installation?

Could you please provide information on the following for the recommended and any alternative hydro-microturbines for our consideration:

1. Capital costs for the microturbines to be delivered to Faro, Yukon
2. List of replacement parts, costs for parts, and frequency of replacement
3. Examples of similar installations and layout drawings if available
4. Flow/head/Power curves
5. NPV or NPC calculations if available to calculate the Return on

investment and demonstrate the viability of installing them.

6. Confirmation on whether you offer complete installation packages with electrical equipment or only supply the turbine element.

This information is needed within the next couple of weeks so that it can be evaluated and incorporated into the 90% design of the project so a prompt response even if it is a partial response would be greatly appreciated.

We can connect for a discussion if needed following the your review of this information.

Thank you,

Tania Gill (she/her) | Jacobs | Civil Design Specialist

M:+1.416.276.2742
| Tania.Gill@jacobs.com

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Attachment 5
Valid Manufacturing Quote

Advanced Technology. Simple Solutions.

BUDGET QUOTATION

QUOTE: Q251748

To:	**Tania Gill**	**Date:**	**9/22/2025 6:58 AM**		
Company:	Jacobs	**From:**	Andrew van Berkel		
Email:	tania.gill@jacobs.com	**Email:**	AndrewV@validmfg.com		
Project:	Capital Regional District - Humpback Reservoir	**Addendum:**	N/A	**Pages:**	1

Quotation is valid for 30 days. Please include quote number on all correspondence and purchase orders.

We are pleased to quote as requested for a quantity of **one** KXXA series kiosk. It is certified to CSA standards for the enclosure.

Part #: KXXA136321106-251748

- Marine grade aluminum construction
- Dimensions of 136"H x 321"W x 106"D
- Powder coated PC 101 Grey (Ansi 61) / CSA Type 3R rated
- Double-sided, multi-door *(Seven per side)*
- Pad-mount, open-bottom design
- Hinged doors with pour-in-place gaskets & gas shock stay
- Padlockable, 3-point latch mechanism on doors
- Interior insulated w/ 1" foil back insulation
- Removable lifting apparatus
- Peaked roof with rain gutter
-

- **Price: $125,402 ea.**
- **Price for 2 kiosks: $86,570 ea. (total: $173,140.00)**

Pricing is subject to change without prior notice due to fluctuations in tariffs, import duties, or other government-imposed regulations.

DELIVERY:	**10-12 weeks after approval, pending material availability and plant loading**		
FREIGHT:	**TBD**		
TAXES:	**Extra**	**TERMS:**	**TBD**

This quote is based on preliminary information and not drawings designed for construction

Pricing is based on quantities shown – changes will be subject to a revised quotation • Customer is responsible for providing equipment to unload at delivery site • Due to the volatility of transportation costs, VML reserves the right to re-price freight at time of shipping if required • Standard terms and conditions of sale apply unless stated otherwise • Due to ongoing global supply issues, quoted lead times may be affected by material procurement delays. Valid Manufacturing is making every effort to mitigate the effect that this will have on our customers

THANK YOU FOR YOUR BUSINESS!

Outlook

[EXTERNAL] RE: Capital Regional District - Humpback Reservoir - Due ASAP

From Andrew van Berkel <AndrewV@validmfg.com>
Date Mon 9/22/2025 6:59 AM
To Gill, Tania <Tania.Gill@jacobs.com>
Cc Chris Slade <ChrisS@validmfg.com>; Jay Barot <JayB@validmfg.com>

1 attachment (195 KB)
Q251748 - BUDGET - Capital Regional District - Humpback Reservoir.pdf;

This Message Is From an External Sender
This message came from outside your organization.

Hi Tania,

Sorry I made a Mistake on the quote number in the BOM Please see attached corrected.

Thank you,
Andrew van Berkel
Quoting and Estimating

AndrewV@validmfg.com
Office: 250-832-6477 ext #426 **Fax:** 250-832-7746
Toll Free: 1-888-632-6477
www.validmfg.com

From: Andrew van Berkel <AndrewV@validmfg.com>
Sent: September 22, 2025 6:55 AM
To: Gill, Tania <Tania.Gill@jacobs.com>
Cc: Chris Slade <ChrisS@validmfg.com>; Jay Barot <JayB@validmfg.com>
Subject: RE: Capital Regional District - Humpback Reservoir - Due ASAP

Hi Tania,

Please see attached budget quotation for the Capital Regional District - Humpback Reservoir Kiosk. - **Q251748**

Note that I only provided a quote for kiosk option one in quantities of 1 and 2 for option 3. We will be unable to provide a quote for option 2 due to the requested size we would not be able to get it in and out of our shop.

If you have any questions, don't hesitate to contact me.

Regards,
Andrew van Berkel
Quoting and Estimating

AndrewV@validmfg.com
Office: 250-832-6477 ext #426 **Fax:** 250-832-7746
Toll Free: 1-888-632-6477
www.validmfg.com

From: Valid Manufacturing <noreply@validmfg.com>
Sent: September 15, 2025 10:06 PM
To: sales <sales@validmfg.com>
Subject: New Form Entry: Contact/Product Inquiry Form

SECURITY WARNING: This is an external email. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Valid Manufacturing Ltd.

Name
Tania Gill

Email
tania.gill@jacobs.com

Phone

+14162762742

Company

Jacobs

Address

4720 Kingsway
Burnaby, BC
CA

Product you're interested in

Pressure Relief Valve Kiosks Quote

Questions/Comments

Hello,
Jacobs is working on a project for the Capital Regional District which consists of installing a new above grade PRV station within a kiosk near the Humpback Reservoir.

We are currently completing a conceptual assessment to determine if it would be financially and technically feasible to install a microturbine at the station to generate power.

We are looking at a couple of options for the facility:

Option 1: Kiosk with PRV (no microturbine) - 2.5m x 8m x 3.3m (WxLxH internally)ï¿½
Option 2: Combined kiosk for PRV and microturbine - 5.8m x 8m x 3.3m(WxLxH internally)
Option 3: Two separate kiosks - one for PRV and one for microturbine - Two 2.5m x 8m x 3.3m (WxLxH internally)ï¿½kiosks

At this time we are trying to determine a high level cost differential between the different options.
Could you please provide an estimate for how much the kiosk(s) would cost for the options listed above?

It would be appreciated if you could get back to me as soon as possible as the client is trying to make a decision as soon as possible so that the microturbine can be integrated into the design schedule for the project.

Thank you,
Tania Gill

Sent from Valid Manufacturing Ltd.

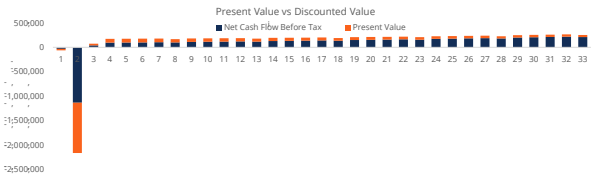
Attachment 6
Net Present Value Estimate

Net Present Value of Humpback Microturbine Self Gen With Kiosk High

Assumed Parameters	
Discount Rate	5%
Escalation Rate	3%
Evaluation Period (Years)	30.00
Current Financial Year	2025
Design Year	2026
Start of Construction	2027
USD to CAD Conversion	1.30
Cost of Electricity Import ($/kWh)	0.13
Cost of Electricity export ($/kWh)	0.100
Assumed Scenario	Self Generation

Project Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Financial Year Ending	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057
Discount Factor	0.95	0.91	0.86	0.82	0.78	0.75	0.71	0.68	0.64	0.61	0.58	0.56	0.53	0.51	0.48	0.46	0.44	0.42	0.40	0.38	0.36	0.34	0.33	0.31	0.30	0.28	0.27	0.26	0.24	0.23	0.22	0.21	0.20
Outflows																																	
Capital Expenditure																																	
Microturbine		1,165,617																															
Kiosk		22,326																															
Concrete Slab		7,416																															
Project Management (3% of capital cost)	11,954	23,907																															
Design Fee (7% of total capital cost)	23,907	59,768																															
Construction Management (5% of total capital cost)			59,768																														
Total Captial Expenditure	35,861	1,279,034	59,768	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Present Value	34,153	1,160,121	51,630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total Capital Expenditure Net Present Value	**1,245,904**																																
Operational Expenditure																																	
Labour (Annual)			10,549	10,866	11,192	11,528	11,873	12,230	12,597	12,974	13,364	13,765	14,178	14,603	15,041	15,492	15,957	16,436	16,929	17,437	17,960	18,498	19,053	19,625	20,214	20,820	21,445	22,088	22,751	23,433	24,136	24,860	25,606
Labour (Required every 5 years)								7,338					8,507					9,861					11,432					13,253					15,364
Total Operational Expenditure	0	0	10,549	10,866	11,192	11,528	11,873	19,567	12,597	12,974	13,364	13,765	22,684	14,603	15,041	15,492	15,957	26,297	16,929	17,437	17,960	18,498	30,485	19,625	20,214	20,820	21,445	35,341	22,751	23,433	24,136	24,860	40,970
Present Value	0	0	9,113	8,939	8,769	8,602	8,438	13,244	8,120	7,965	7,813	7,665	12,030	7,375	7,235	7,097	6,962	10,927	6,699	6,572	6,446	6,324	9,925	6,085	5,969	5,855	5,744	9,015	5,527	5,422	5,319	5,217	8,189
Total Operational Net Present Value	**238,604**																																
Total Outflows	35,861	1,279,034	70,317	10,866	11,192	11,528	11,873	19,567	12,597	12,974	13,364	13,765	22,684	14,603	15,041	15,492	15,957	26,297	16,929	17,437	17,960	18,498	30,485	19,625	20,214	20,820	21,445	35,341	22,751	23,433	24,136	24,860	40,970
Present Value	34,153	1,160,121	60,743	8,939	8,769	8,602	8,438	13,244	8,120	7,965	7,813	7,665	12,030	7,375	7,235	7,097	6,962	10,927	6,699	6,572	6,446	6,324	9,925	6,085	5,969	5,855	5,744	9,015	5,527	5,422	5,319	5,217	8,189
Net Present Value (Total Outflows)	**1,484,508**																																
Inflows																																	
Reference: estimated energy production (kWh)			968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000
Reference: estimated energy consumption (kWh)			27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500
Assumed: Energy sold to BC Hydro (kWh)			940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500
Cost Savings																																	
Energy use on site	0	0	3,793	3,906	4,024	4,144	4,269	4,397	4,529	4,665	4,805	4,949	5,097	5,250	5,408	5,570	5,737	5,909	6,086	6,269	6,457	6,651	6,850	7,056	7,267	7,485	7,710	7,941	8,179	8,425	8,677	8,938	9,206
Energy Credit sold to BC Hydro	0	0	99,778	102,771	105,854	109,030	112,301	115,670	119,140	122,714	126,395	130,187	134,093	138,116	142,259	146,527	150,923	155,450	160,114	164,917	169,865	174,961	180,210	185,616	191,184	196,920	202,827	208,912	215,180	221,635	228,284	235,133	242,187
Energy Use on Site Present Value	77,245																																
Total Inflows	0	0	103,570	106,677	109,878	113,174	116,569	120,066	123,668	127,378	131,200	135,136	139,190	143,366	147,667	152,097	156,659	161,359	166,200	171,186	176,322	181,611	187,060	192,671	198,452	204,405	210,537	216,853	223,359	230,060	236,961	244,070	251,392
Present Value	0	0	89,468	87,764	86,092	84,452	82,844	81,266	79,718	78,199	76,710	75,249	73,815	72,409	71,030	69,677	68,350	67,048	65,771	64,518	63,289	62,084	60,901	59,741	58,603	57,487	56,392	55,318	54,264	53,231	52,217	51,222	50,246
Net Present Value (Total Inflows)	**2,109,377**																																
Net Cash Flow Before Tax	-35,861	-1,279,034	33,253	95,812	98,686	101,647	104,696	100,499	111,072	114,404	117,836	121,371	116,506	128,763	132,626	136,604	140,703	135,062	149,271	153,749	158,362	163,113	156,574	173,046	178,238	183,585	189,092	181,512	200,608	206,626	212,825	219,210	210,423
Present Value	-34,153	-1,160,121	28,725	78,824	77,323	75,850	74,405	68,022	71,598	70,234	68,896	67,584	61,786	65,034	63,795	62,580	61,388	56,121	59,072	57,947	56,843	55,760	50,976	53,656	52,634	51,632	50,648	46,303	48,737	47,809	46,898	46,005	42,058
Discounted Value	-1,708	-118,912	4,528	16,987	21,363	25,796	30,290	32,477	39,474	44,170	48,940	53,787	54,720	63,729	68,830	74,024	79,314	78,941	90,200	95,803	101,519	107,353	105,598	119,390	125,604	131,953	138,444	135,210	151,871	158,818	165,927	173,205	168,365

Net Present Value	**624,868**
Discounted Return on Investment (DROI)	**0.42**
Payback Period	**22**



Assumptions:

Outflows

Microturbine Facility, Includes:

Direct turbine assets - $-725,000- $800,000- (USD) provided by InPipe Energy as total cost for microturbine infrastructure and installation. Assumed 75% of cost for infrastructure and 25% for installation. Escalated cost provided by supplier in 2025 to determine cost in 2026 (1 year worth of escalation). Multiplied by 1.3 to convert from USD to CAD (assumed 1USD=1.3 CAD). $75,000 subtracted from cost of InPipe kiosk and $125,000 subtracted for cost of redundant PRV that would be installed in microturbine wasn:t

Micorturbine capital expenditure cost from InPipe energy includes a kiosk. It was assumed that the cost is 75,000 USD. CRD will be procuring a separate kiosk so this was removed from their quote. With the installation of a microturbine a redundant PRV is not required. This cost was subtracted from the microturbine cost estimated at CA$125,000.

Spare Parts - Assumed this cost was included in budgetary quote from InPipe Energy

Kiosk Costs Include:

An individual kiosk for the PRV is estimated to cost$95.227 ($86,570+10% for 1.2m wider kiosk required than quoted) and a combined kiosk for the PRV and microturbine is estimated to cost $137,940 ($125,400+10% for 1.2m wider kiosk required than quoted) . It is assumed that a redundant 500mm PRV is required if a microturbine is not installed. This allows an approximate reduction of 1m in width to the combined kiosk. The kiosk cost for the additional 1m is estimated to be $19,705.

At this time it was assumed that roof access would not be provided and electrical panels would not be installed within the kiosk.

Assume $3000/m3 for additional concrete slab required. 2.4m^3 (1m additional width, 8m length and 0.3m height based on Option 1 combined kiosk which is the more conservative option)

Project Management - Assume 3% of subtotal construction cost. 1% of which is spent in Year 1 and 2% in Year 2.

Design Fee - Assume 7% of subtotal construction cost. 2% of which is spent in Year 1 and 5% in Year 2.

Construction Management - Assume 5% of subtotal construction cost. 2% of which is spent in Year 1 and 3% in Year 2.

Labour Annual - Cost provided by supplier for $14,000 in 2022 for remote labour cost in the Yukon. Assumed cost would be 50% of this for Vancouver Island and escalated and converted to USD (Assume 1 USD = 1.3 CAD)

Labour (every 5 years) - Assumed labour cost every 5 years will be 60% of the cost of annual labour, escalated cost to respective year and converted to USD.

Inflows

Energy Production - Cost savings from not having to pay for energy. Assumed microturbine will produce 968,000 kWh annually based on flows expected at Humpback PCS and assumed average cost of electricity at PCS Site to be $0.115/kWh (CAD). Escalated cost of every item to determine cost in 2027 and onwards.

Estimated annual energy consumption at the PCS is 27,500 kWh as provided by CRD and the rolling electricity rate based on a 12-month average is $0.13/kWh.

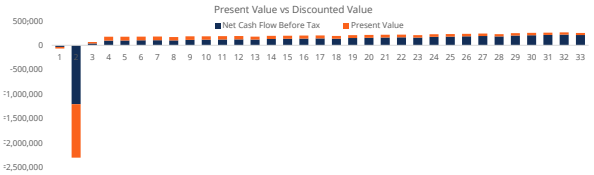
Carbon Cost Savings - Starting from April 2025, the carbon tax in British Columbia is being abolished. Direct cost savings from reduced GHG emissions will not contribute to the inflows. However, environmental impacts from producing renewable energy have been considered using the typical levels of GHG in the surrounding area.

Net Present Value of Humpback Microturbine Self Gen With Kiosk Avg

Assumed Parameters	
Discount Rate	5%
Escalation Rate	3%
Evaluation Period (Years)	30.00
Current Financial Year	2025
Design Year	2026
Start of Construction	2027
USD to CAD Conversion	1.30
Cost of Electricity Import ($/kWh)	0.13
Cost of Electricity export ($/kWh)	0.100
Assumed Scenario	Self Generation

Project Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**
Financial Year Ending	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057
Discount Factor	0.95	0.91	0.86	0.82	0.78	0.75	0.71	0.68	0.64	0.61	0.58	0.56	0.53	0.51	0.48	0.46	0.44	0.42	0.40	0.38	0.36	0.34	0.33	0.31	0.30	0.28	0.27	0.26	0.24	0.23	0.22	0.21	0.20
Outflows																																	
Capital Expenditure																																	
Microturbine		1,098,667																															
Kiosk		22,326																															
Concrete Slab		7,416																															
Project Management (3% of capital cost)	11,284	22,568																															
Design Fee (7% of total capital cost)	22,568	56,420																															
Construction Management (5% of total capital cost)			56,420																														
Total Captial Expenditure	33,852	1,207,397	56,420	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Present Value	32,240	1,095,145	48,738	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total Capital Net Present Value	**1,176,123**																																
Operational Expenditure																																	
Labour (Annual)			10,549	10,866	11,192	11,528	11,873	12,230	12,597	12,974	13,364	13,765	14,178	14,603	15,041	15,492	15,957	16,436	16,929	17,437	17,960	18,498	19,053	19,625	20,214	20,820	21,445	22,088	22,751	23,433	24,136	24,860	25,606
Labour (Required every 5 years)								7,338					8,507					9,861					11,432					13,253					15,364
Total Operational Expenditure	0	0	10,549	10,866	11,192	11,528	11,873	19,567	12,597	12,974	13,364	13,765	22,684	14,603	15,041	15,492	15,957	26,297	16,929	17,437	17,960	18,498	30,485	19,625	20,214	20,820	21,445	35,341	22,751	23,433	24,136	24,860	40,970
Present Value	0	0	9,113	8,939	8,769	8,602	8,438	13,244	8,120	7,965	7,813	7,665	12,030	7,375	7,235	7,097	6,962	10,927	6,699	6,572	6,446	6,324	9,925	6,085	5,969	5,855	5,744	9,015	5,527	5,422	5,319	5,217	8,189
Total Operational Net Present Value	**238,604**																																
Total Outflows	33,852	1,207,397	66,970	10,866	11,192	11,528	11,873	19,567	12,597	12,974	13,364	13,765	22,684	14,603	15,041	15,492	15,957	26,297	16,929	17,437	17,960	18,498	30,485	19,625	20,214	20,820	21,445	35,341	22,751	23,433	24,136	24,860	40,970
Present Value	32,240	1,095,145	57,851	8,939	8,769	8,602	8,438	13,244	8,120	7,965	7,813	7,665	12,030	7,375	7,235	7,097	6,962	10,927	6,699	6,572	6,446	6,324	9,925	6,085	5,969	5,855	5,744	9,015	5,527	5,422	5,319	5,217	8,189
Net Present Value (Total Outflows)	**1,414,727**																																
Inflows																																	
Reference: estimated energy production (kWh)			968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000
Reference: estimated energy consumption (kWh)			27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500
Assumed: Energy sold to BC Hydro (kWh)			940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500
Cost Savings:																																	
Energy use on site	0	0	3,793	3,906	4,024	4,144	4,269	4,397	4,529	4,665	4,805	4,949	5,097	5,250	5,408	5,570	5,737	5,909	6,086	6,269	6,457	6,651	6,850	7,056	7,267	7,485	7,710	7,941	8,179	8,425	8,677	8,938	9,206
Energy Credit sold to BC Hydro	0	0	99,778	102,771	105,854	109,030	112,301	115,670	119,140	122,714	126,395	130,187	134,093	138,116	142,259	146,527	150,923	155,450	160,114	164,917	169,865	174,961	180,210	185,616	191,184	196,920	202,827	208,912	215,180	221,635	228,284	235,133	242,187
Energy Use on Site Present Value	**77,245**																																
Total Inflows	0	0	103,570	106,677	109,878	113,174	116,569	120,066	123,668	127,378	131,200	135,136	139,190	143,366	147,667	152,097	156,659	161,359	166,200	171,186	176,322	181,611	187,060	192,671	198,452	204,405	210,537	216,853	223,359	230,060	236,961	244,070	251,392
Present Value	0	0	89,468	87,764	86,092	84,452	82,844	81,266	79,718	78,199	76,710	75,249	73,815	72,409	71,030	69,677	68,350	67,048	65,771	64,518	63,289	62,084	60,901	59,741	58,603	57,487	56,392	55,318	54,264	53,231	52,217	51,222	50,246
Net Present Value (Total Inflows)	**2,109,377**																																
Net Cash Flow Before Tax	-33,852	-1,207,397	36,601	95,812	98,686	101,647	104,696	100,499	111,072	114,404	117,836	121,371	116,506	128,763	132,626	136,604	140,703	135,062	149,271	153,749	158,362	163,113	156,574	173,046	178,238	183,585	189,092	181,512	200,608	206,626	212,825	219,210	210,423
Present Value	-32,240	-1,095,145	31,617	78,824	77,323	75,850	74,405	68,022	71,598	70,234	68,896	67,584	61,786	65,034	63,795	62,580	61,388	56,121	59,072	57,947	56,843	55,760	50,976	53,656	52,634	51,632	50,648	46,303	48,737	47,809	46,898	46,005	42,058
Discounted Value	-1,612	-112,252	4,984	16,987	21,363	25,796	30,290	32,477	39,474	44,170	48,940	53,787	54,720	63,729	68,830	74,024	79,314	78,941	90,200	95,803	101,519	107,353	105,598	119,390	125,604	131,953	138,444	135,210	151,871	158,818	165,927	173,205	168,365

Net Present Value	**694,649**
Discounted Return on Investment (DROI)	**0.49**
Payback Period	21



Assumptions:

Outflows

Microturbine Facility, Includes:

Direct turbine assets - $-725,000- $800,000- (USD) provided by InPipe Energy as total cost for microturbine infrastructure and installation. Assumed 75% of cost for infrastructure and 25% for installation. Escalated cost provided by supplier in 2025 to determine cost in 2026 (1 year worth of escalation). Multiplied by 1.3 to convert from USD to CAD (assumed 1USD=1.3 CAD). $75,000 subtracted from cost of InPipe kiosk and $125,000 subtracted for cost of redundant PRV that would be installed in microturbine wasn;t

Microturbine capital expenditure cost from InPipe energy includes a kiosk. It was assumed that the cost is 75,000 USD. CRD will be procuring a separate kiosk so this was removed from their quote. With the installation of a microturbine a redundant PRV is not required. This cost was subtracted from the microturbine cost estimated at CA$125,000.

Spare Parts - Assumed this cost was included in budgetary quote from InPipe Energy

Kiosk Costs Include:

An individual kiosk for the PRV is estimated to cost$95,227 ($86,570+10% for 1.2m wider kiosk required than quoted) and a combined kiosk for the PRV and microturbine is estimated to cost $137,940 ($125,400+10% for 1.2m wider kiosk required than quoted) . It is assumed that a redundant 500mm PRV is required if a microturbine is not installed. This allows an approximate reduction of 1m in width to the combined kiosk. The kiosk cost for the additional 1m is estimated to be $19,705.

At this time it was assumed that roof access would not be provided and electrical panels would not be installed within the kiosk.

Assume $3000/m3 for additional concrete slab required. 2.4m^2 (1m additional width, 8m length and 0.3m height based on Option 1 combined kiosk which is the more conservative option)

Project Management - Assume 3% of subtotal construction cost. 1% of which is spent in Year 1 and 2% in Year 2.

Design Fee - Assume 7% of subtotal construction cost. 2% of which is spent in Year 1 and 5% in Year 2.

Construction Management - Assume 5% of subtotal construction cost. 2% of which is spent in Year 1 and 3% in Year 2.

Labour Annual - Cost provided by supplier ($14,000 in 2022) escalated and converted to USD (Assume 1 USD = 1.3 CAD)

Labour (every 5 years) - Assumed labour cost every 5 years will be 60% of the cost of annual labour, escalated cost to respective year and converted to USD.

Inflows

Energy Production - Cost savings from not having to pay for energy. Assumed microturbine will produce 968,000 kWh annually based on flows expected at Humpback PCS and assumed average cost of electricity at PCS Site to be $0.115/kWh (CAD). Escalated cost of every item to determine cost in 2027 and onwards.

Estimated annual energy consumption at the PCS is 27,500 kWh as provided by CRD and the rolling electricity rate based on a 12-month average is $0.13/kWh.

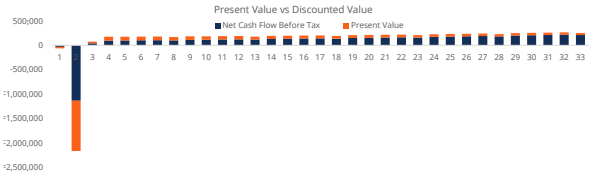
Carbon Cost Savings - Starting from April 2025, the carbon tax in British Columbia is being abolished. Direct cost savings from reduced GHG emissions will not contribute to the inflows. However, environmental impacts from producing renewable energy have been considered using the typical levels of GHG in the surrounding area.

Net Present Value of Humpback Microturbine Self Gen With Kiosk Low

Assumed Parameters	
Discount Rate	5%
Escalation Rate	3%
Evaluation Period (Years)	30.00
Current Financial Year	2025
Design Year	2026
Start of Construction	2027
USD to CAD Conversion	1.30
Cost of Electricity Import ($/kWh)	0.13
Cost of Electricity export ($/kWh)	0.100
Assumed Scenario	Self Generation

Project Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Financial Year Ending	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057
Discount Factor	0.95	0.91	0.86	0.82	0.78	0.75	0.71	0.68	0.64	0.61	0.58	0.56	0.53	0.51	0.48	0.46	0.44	0.42	0.40	0.38	0.36	0.34	0.33	0.31	0.30	0.28	0.27	0.26	0.24	0.23	0.22	0.21	0.20
Outflows																																	
Capital Expenditure																																	
Microturbine		1,031,717																															
Kiosk		22,326																															
Concrete Slab		7,416																															
Project Management (3% of capital cost)	10,615	21,229																															
Design Fee (7% of total capital cost)	21,229	53,073																															
Construction Management (5% of total capital cost)			53,073																														
Total Captial Expenditure	31,844	1,135,761	53,073	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Present Value	30,327	1,030,168	45,846	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total Capital Net Present Value	**1,106,342**																																
Operational Expenditure																																	
Labour (Annual)			10,549	10,866	11,192	11,528	11,873	12,230	12,597	12,974	13,364	13,765	14,178	14,603	15,041	15,492	15,957	16,436	16,929	17,437	17,960	18,498	19,053	19,625	20,214	20,820	21,445	22,088	22,751	23,433	24,136	24,860	25,606
Labour (Required every 5 years)								7,338					8,507					9,861					11,432					13,253					15,364
Total Operational Expenditure	0	0	10,549	10,866	11,192	11,528	11,873	19,567	12,597	12,974	13,364	13,765	22,684	14,603	15,041	15,492	15,957	26,297	16,929	17,437	17,960	18,498	30,485	19,625	20,214	20,820	21,445	35,341	22,751	23,433	24,136	24,860	40,970
Present Value	0	0	9,113	8,939	8,769	8,602	8,438	13,244	8,120	7,965	7,813	7,665	12,030	7,375	7,235	7,097	6,962	10,927	6,699	6,572	6,446	6,324	9,925	6,085	5,969	5,855	5,744	9,015	5,527	5,422	5,319	5,217	8,189
Total Operational Net Present Value	**238,604**																																
Total Outflows	31,844	1,135,761	63,622	10,866	11,192	11,528	11,873	19,567	12,597	12,974	13,364	13,765	22,684	14,603	15,041	15,492	15,957	26,297	16,929	17,437	17,960	18,498	30,485	19,625	20,214	20,820	21,445	35,341	22,751	23,433	24,136	24,860	40,970
Present Value	30,327	1,030,168	54,959	8,939	8,769	8,602	8,438	13,244	8,120	7,965	7,813	7,665	12,030	7,375	7,235	7,097	6,962	10,927	6,699	6,572	6,446	6,324	9,925	6,085	5,969	5,855	5,744	9,015	5,527	5,422	5,319	5,217	8,189
Net Present Value (Total Outflows)	**1,344,946**																																
Inflows																																	
Reference: estimated energy production (kWh)			968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000
Reference: estimated energy consumption (kWh)			27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500
Assumed: Energy sold to BC Hydro (kWh)			940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500
Cost Savings:																																	
Energy use on site	0	0	3,793	3,906	4,024	4,144	4,269	4,397	4,529	4,665	4,805	4,949	5,097	5,250	5,408	5,570	5,737	5,909	6,086	6,269	6,457	6,651	6,850	7,056	7,267	7,485	7,710	7,941	8,179	8,425	8,677	8,938	9,206
Energy Credit sold to BC Hydro	0	0	99,778	102,771	105,854	109,030	112,301	115,670	119,140	122,714	126,395	130,187	134,093	138,116	142,259	146,527	150,923	155,450	160,114	164,917	169,865	174,961	180,210	185,616	191,184	196,920	202,827	208,912	215,180	221,635	228,284	235,133	242,187
Energy Use on Site Present Value	**77,245**																																
Total Inflows	0	0	103,570	106,677	109,878	113,174	116,569	120,066	123,668	127,378	131,200	135,136	139,190	143,366	147,667	152,097	156,659	161,359	166,200	171,186	176,322	181,611	187,060	192,671	198,452	204,405	210,537	216,853	223,359	230,060	236,961	244,070	251,392
Present Value	0	0	89,468	87,764	86,092	84,452	82,844	81,266	79,718	78,199	76,710	75,249	73,815	72,409	71,030	69,677	68,350	67,048	65,771	64,518	63,289	62,084	60,901	59,741	58,603	57,487	56,392	55,318	54,264	53,231	52,217	51,222	50,246
Net Present Value (Total Inflows)	**2,109,377**																																
Net Cash Flow Before Tax	-31,844	-1,135,761	39,948	95,812	98,686	101,647	104,696	100,499	111,072	114,404	117,836	121,371	116,506	128,763	132,626	136,604	140,703	135,062	149,271	153,749	158,362	163,113	156,574	173,046	178,238	183,585	189,092	181,512	200,608	206,626	212,825	219,210	210,423
Present Value	-30,327	-1,030,168	34,509	78,824	77,323	75,850	74,405	68,022	71,598	70,234	68,896	67,584	61,786	65,034	63,795	62,580	61,388	56,121	59,072	57,947	56,843	55,760	50,976	53,656	52,634	51,632	50,648	46,303	48,737	47,809	46,898	46,005	42,058
Discounted Value	-1,516	-105,592	5,439	16,987	21,363	25,796	30,290	32,477	39,474	44,170	48,940	53,787	54,720	63,729	68,830	74,024	79,314	78,941	90,200	95,803	101,519	107,353	105,598	119,390	125,604	131,953	138,444	135,210	151,871	158,818	165,927	173,205	168,365

Net Present Value	**764,430**
Discounted Return on Investment (DROI)	**0.57**
Payback Period	20



Assumptions:

Outflows

Microturbine Facility, Includes:

Direct turbine assets - $-725,000- $800,000- (USD) provided by InPipe Energy as total cost for microturbine infrastructure and installation. Assumed 75% of cost for infrastructure and 25% for installation. Escalated cost provided by supplier in 2025 to determine cost in 2026 (1 year worth of escalation). Multiplied by 1.3 to convert from USD to CAD (assumed 1USD=1.3 CAD). $75,000 subtracted from cost of InPipe kiosk and $125,000 subtracted for cost of redundant PRV that would be installed in microturbine wasn;t

Microturbine capital expenditure cost from InPipe energy includes a kiosk. It was assumed that the cost is 75,000 USD. CRD will be procuring a separate kiosk so this was removed from their quote. With the installation of a microturbine a redundant PRV is not required. This cost was subtracted from the microturbine cost estimated at CA$125,000.

Spare Parts - Assumed this cost was included in budgetary quote from InPipe Energy

Kiosk Costs Include:

An individual kiosk for the PRV is estimated to cost$95,227 ($86,570+10% for 1.2m wider kiosk required than quoted) and a combined kiosk for the PRV and microturbine is estimated to cost $137,940 ($125,400+10% for 1.2m wider kiosk required than quoted) . It is assumed that a redundant 500mm PRV is required if a microturbine is not installed. This allows an approximate reduction of 1m in width to the combined kiosk. The kiosk cost for the additional 1m is estimated to be $19,705.

At this time it was assumed that roof access would not be provided and electrical panels would not be installed within the kiosk.

Assume $3000/m3 for additional concrete slab required. 2.4m^2 / (1m additional width, 8m length and 0.3m height based on Option 1 combined kiosk which is the more conservative option)

Project Management - Assume 3% of subtotal construction cost. 1% of which is spent in Year 1 and 2% in Year 2.

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Construction Management - Assume 5% of subtotal construction cost. 2% of which is spent in Year 1 and 3% in Year 2.

Labour Annual - Cost provided by supplier ($14,000 in 2022) escalated and converted to USD (Assume 1 USD = 1.3 CAD)

Labour (every 5 years) - Assumed labour cost every 5 years will be 60% of the cost of annual labour, escalated cost to respective year and converted to USD.

Inflows

Energy Production - Cost savings from not having to pay for energy. Assumed microturbine will produce 968,000 kWh annually based on flows expected at Humpback PCS and assumed average cost of electricity at PCS Site to be $0.115/kWh (CAD). Escalated cost of every item to determine cost in 2027 and onwards.

Estimated annual energy consumption at the PCS is 27,500 kWh as provided by CRD and the rolling electricity rate based on a 12-month average is $0.13/kWh.

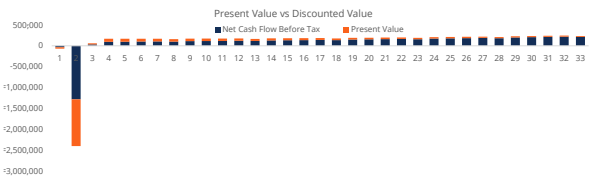
Carbon Cost Savings - Starting from April 2025, the carbon tax in British Columbia is being abolished. Direct cost savings from reduced GHG emissions will not contribute to the inflows. However, environmental impacts from producing renewable energy have been considered using the typical levels of GHG in the surrounding area.

Net Present Value of Humpback Microturbine Sensitivity Discount Rate High

Assumed Parameters	
Discount Rate	7%
Escalation Rate	3%
Evaluation Period (Years)	30.00
Current Financial Year	2025
Design Year	2026
Start of Construction	2027
USD to CAD Conversion	1.30
Cost of Electricity Import ($/kWh)	0.13
Cost of Electricity export ($/kWh)	0.100
Assumed Scenario	Self Generation

Project Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**
Financial Year Ending	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057
Discount Factor	0.93	0.87	0.82	0.76	0.71	0.67	0.62	0.58	0.54	0.51	0.48	0.44	0.41	0.39	0.36	0.34	0.32	0.30	0.28	0.26	0.24	0.23	0.21	0.20	0.18	0.17	0.16	0.15	0.14	0.13	0.12	0.11	0.11
Outflows																																	
Capital Expenditure																																	
Microturbine		1,165,617																															
Kiosk		22,326																															
Concrete Slab		7,416																															
Project Management (3% of capital cost)	11,954	23,907																															
Design Fee (7% of total capital cost)	23,907	59,768																															
Construction Management (5% of total capital cost)			59,768																														
Total Captial Expenditure	35,861	1,279,034	59,768	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Present Value	33,515	1,117,157	48,788	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total Capital Net Present Value	**1,199,461**																																
Operational Expenditure																																	
Labour (Annual)			10,549	10,866	11,192	11,528	11,873	12,230	12,597	12,974	13,364	13,765	14,178	14,603	15,041	15,492	15,957	16,436	16,929	17,437	17,960	18,498	19,053	19,625	20,214	20,820	21,445	22,088	22,751	23,433	24,136	24,860	25,606
Labour (Required every 5 years)								7,338					8,507					9,861					11,432					13,253					15,364
Total Operational Expenditure	0	0	10,549	10,866	11,192	11,528	11,873	19,567	12,597	12,974	13,364	13,765	22,684	14,603	15,041	15,492	15,957	26,297	16,929	17,437	17,960	18,498	30,485	19,625	20,214	20,820	21,445	35,341	22,751	23,433	24,136	24,860	40,970
Present Value	0	0	8,611	8,290	7,980	7,681	7,394	11,388	6,852	6,596	6,349	6,112	9,413	5,663	5,452	5,248	5,052	7,780	4,681	4,506	4,337	4,175	6,431	3,869	3,724	3,585	3,451	5,315	3,198	3,078	2,963	2,853	4,393
Total Operational Net Present Value	**176,421**																																
Total Outflows	35,861	1,279,034	70,317	10,866	11,192	11,528	11,873	19,567	12,597	12,974	13,364	13,765	22,684	14,603	15,041	15,492	15,957	26,297	16,929	17,437	17,960	18,498	30,485	19,625	20,214	20,820	21,445	35,341	22,751	23,433	24,136	24,860	40,970
Present Value	33,515	1,117,157	57,400	8,290	7,980	7,681	7,394	11,388	6,852	6,596	6,349	6,112	9,413	5,663	5,452	5,248	5,052	7,780	4,681	4,506	4,337	4,175	6,431	3,869	3,724	3,585	3,451	5,315	3,198	3,078	2,963	2,853	4,393
Net Present Value (Total Outflows)	**1,375,881**																																
Inflows																																	
Reference: estimated energy production (kWh)			968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000
Reference: estimated energy consumption (kWh)			27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500
Assumed: Energy sold to BC Hydro (kWh)			940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500
Cost Savings:																																	
Energy use on site	0	0	3,793	3,906	4,024	4,144	4,269	4,397	4,529	4,665	4,805	4,949	5,097	5,250	5,408	5,570	5,737	5,909	6,086	6,269	6,457	6,651	6,850	7,056	7,267	7,485	7,710	7,941	8,179	8,425	8,677	8,938	9,206
Energy Credit sold to BC Hydro	0	0	99,778	102,771	105,854	109,030	112,301	115,670	119,140	122,714	126,395	130,187	134,093	138,116	142,259	146,527	150,923	155,450	160,114	164,917	169,865	174,961	180,210	185,616	191,184	196,920	202,827	208,912	215,180	221,635	228,284	235,133	242,187
Energy Use on Site Present Value	**57,397**																																
Total Inflows	0	0	103,570	106,677	109,878	113,174	116,569	120,066	123,668	127,378	131,200	135,136	139,190	143,366	147,667	152,097	156,659	161,359	166,200	171,186	176,322	181,611	187,060	192,671	198,452	204,405	210,537	216,853	223,359	230,060	236,961	244,070	251,392
Present Value	0	0	84,544	81,384	78,341	75,413	72,594	69,880	67,267	64,753	62,332	60,002	57,759	55,600	53,521	51,520	49,594	47,740	45,956	44,238	42,584	40,992	39,460	37,985	36,565	35,198	33,882	32,615	31,396	30,222	29,092	28,005	26,958
Net Present Value (Total Inflows)	**1,567,391**																																
Net Cash Flow Before Tax	-35,861	-1,279,034	33,253	95,812	98,686	101,647	104,696	100,499	111,072	114,404	117,836	121,371	116,506	128,763	132,626	136,604	140,703	135,062	149,271	153,749	158,362	163,113	156,574	173,046	178,238	183,585	189,092	181,512	200,608	206,626	212,825	219,210	210,423
Present Value	-33,515	-1,117,157	27,144	73,094	70,362	67,731	65,199	58,491	60,416	58,157	55,983	53,890	48,346	49,936	48,070	46,273	44,543	39,960	41,275	39,732	38,246	36,817	33,029	34,116	32,840	31,612	30,431	27,300	28,198	27,144	26,129	25,152	22,565
Discounted Value	-2,346	-161,876	6,109	22,717	28,324	33,915	39,497	42,008	50,656	56,247	61,853	67,481	68,160	78,826	84,556	90,332	96,160	95,102	107,997	114,018	120,115	126,296	123,545	138,931	145,398	151,972	158,662	154,213	172,410	179,483	186,696	194,058	187,858

Net Present Value	**191,510**
Discounted Return on Investment (DROI)	**0.14**
Payback Period	



Assumptions:

Outflows

Microturbine Facility, Includes:

Direct turbine assets - $-725,000- $800,000- (USD) provided by InPipe Energy as total cost for microturbine infrastructure and installation. Assumed 75% of cost for infrastructure and 25% for installation. Escalated cost provided by supplier in 2025 to determine cost in 2026 (1 year worth of escalation). Multiplied by 1.3 to convert from USD to CAD (assumed 1USD=1.3 CAD). $75,000 subtracted from cost of InPipe kiosk and $125,000 subtracted for cost of redundant PRV that would be installed in microturbine wasn;t

Microturbine capital expenditure cost from InPipe energy includes a kiosk. It was assumed that the cost is 75,000 USD. CRD will be procuring a separate kiosk so this was removed from their quote. With the installation of a microturbine a redundant PRV is not required. This cost was subtracted from the microturbine cost estimated at CA$125,000.

Spare Parts - Assumed this cost was included in budgetary quote from InPipe Energy

Kiosk Costs Include:

An individual kiosk for the PRV is estimated to cost$95,227 ($86,570+10% for 1.2m wider kiosk required than quoted) and a combined kiosk for the PRV and microturbine is estimated to cost $137,940 ($125,400+10% for 1.2m wider kiosk required than quoted) . It is assumed that a redundant 500mm PRV is required if a microturbine is not installed. This allows an approximate reduction of 1m in width to the combined kiosk. The kiosk cost for the additional 1m is estimated to be $19,705.

At this time it was assumed that roof access would not be provided and electrical panels would not be installed within the kiosk.

Assume $3000/m3 for additional concrete slab required. 2.4m^2 (1m additional width, 8m length and 0.3m height based on Option 1 combined kiosk which is the more conservative option)

Project Management - Assume 3% of subtotal construction cost. 1% of which is spent in Year 1 and 2% in Year 2.

Design Fee - Assume 7% of subtotal construction cost. 2% of which is spent in Year 1 and 5% in Year 2.

Construction Management - Assume 5% of subtotal construction cost. 2% of which is spent in Year 1 and 3% in Year 2.

Labour Annual - Cost provided by supplier ($14,000 in 2022) escalated and converted to USD (Assume 1 USD = 1.3 CAD)

Labour (every 5 years) - Assumed labour cost every 5 years will be 60% of the cost of annual labour, escalated cost to respective year and converted to USD.

Inflows

Energy Production - Cost savings from not having to pay for energy. Assumed microturbine will produce 968,000 kWh annually based on flows expected at Humpback PCS and assumed average cost of electricity at PCS Site to be $0.115/kWh (CAD). Escalated cost of every item to determine cost in 2027 and onwards.

Estimated annual energy consumption at the PCS is 27,500 kWh as provided by CRD and the rolling electricity rate based on a 12-month average is $0.13/kWh.

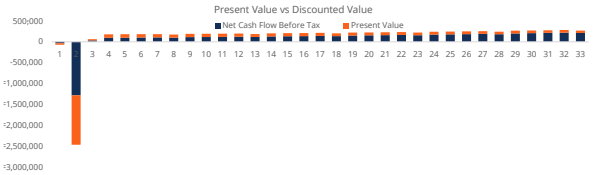
Carbon Cost Savings - Starting from April 2025, the carbon tax in British Columbia is being abolished. Direct cost savings from reduced GHG emissions will not contribute to the inflows. However, environmental impacts from producing renewable energy have been considered using the typical levels of GHG in the surrounding area.

Net Present Value of Humpback Microturbine Sensitivity Discount Rate Low

Assumed Parameters	
Discount Rate	**4%**
Escalation Rate	**3%**
Evaluation Period (Years)	**30.00**
Current Financial Year	**2025**
Design Year	**2026**
Start of Construction	**2027**
USD to CAD Conversion	**1.30**
Cost of Electricity Import ($/kWh)	**0.13**
Cost of Electricity export ($/kWh)	**0.100**
Assumed Scenario	**Self Generation**

Project Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**
Financial Year Ending	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057
Discount Factor	0.96	0.92	0.89	0.85	0.82	0.79	0.76	0.73	0.70	0.68	0.65	0.62	0.60	0.58	0.56	0.53	0.51	0.49	0.47	0.46	0.44	0.42	0.41	0.39	0.38	0.36	0.35	0.33	0.32	0.31	0.30	0.29	0.27
Outflows																																	
Capital Expenditure																																	
Microturbine		1,165,617																															
Kiosk		22,326																															
Concrete Slab		7,416																															
Project Management (3% of capital cost)	11,954	23,907																															
Design Fee (7% of total capital cost)	23,907	59,768																															
Construction Management (5% of total capital cost)			59,768																														
Total Captial Expenditure	35,861	1,279,034	59,768	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Present Value	34,481	1,182,538	53,133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total Capital Net Present Value	**1,270,153**																																
Operational Expenditure																																	
Labour (Annual)			10,549	10,866	11,192	11,528	11,873	12,230	12,597	12,974	13,364	13,765	14,178	14,603	15,041	15,492	15,957	16,436	16,929	17,437	17,960	18,498	19,053	19,625	20,214	20,820	21,445	22,088	22,751	23,433	24,136	24,860	25,606
Labour (Required every 5 years)								7,338					8,507					9,861					11,432					13,253				15,364
Total Operational Expenditure	0	0	10,549	10,866	11,192	11,528	11,873	19,567	12,597	12,974	13,364	13,765	22,684	14,603	15,041	15,492	15,957	26,297	16,929	17,437	17,960	18,498	30,485	19,625	20,214	20,820	21,445	35,341	22,751	23,433	24,136	24,860	40,970
Present Value	0	0	9,378	9,288	9,199	9,110	9,023	14,298	8,850	8,765	8,681	8,597	13,623	8,433	8,352	8,271	8,192	12,981	8,035	7,958	7,881	7,806	12,369	7,656	7,583	7,510	7,437	11,785	7,295	7,225	7,155	7,087	11,230
Total Operational Net Present Value	**281,053**																																
Total Outflows	35,861	1,279,034	70,317	10,866	11,192	11,528	11,873	19,567	12,597	12,974	13,364	13,765	22,684	14,603	15,041	15,492	15,957	26,297	16,929	17,437	17,960	18,498	30,485	19,625	20,214	20,820	21,445	35,341	22,751	23,433	24,136	24,860	40,970
Present Value	34,481	1,182,538	62,512	9,288	9,199	9,110	9,023	14,298	8,850	8,765	8,681	8,597	13,623	8,433	8,352	8,271	8,192	12,981	8,035	7,958	7,881	7,806	12,369	7,656	7,583	7,510	7,437	11,785	7,295	7,225	7,155	7,087	11,230
Net Present Value (Total Outflows)	**1,551,206**																																
Inflows																																	
Reference: estimated energy production (kWh)			968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000
Reference: estimated energy consumption (kWh)			27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500
Assumed: Energy sold to BC Hydro (kWh)			940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500
Cost Savings:																																	
Energy use on site	0	0	3,793	3,906	4,024	4,144	4,269	4,397	4,529	4,665	4,805	4,949	5,097	5,250	5,408	5,570	5,737	5,909	6,086	6,269	6,457	6,651	6,850	7,056	7,267	7,485	7,710	7,941	8,179	8,425	8,677	8,938	9,206
Energy Credit sold to BC Hydro	0	0	99,778	102,771	105,854	109,030	112,301	115,670	119,140	122,714	126,395	130,187	134,093	138,116	142,259	146,527	150,923	155,450	160,114	164,917	169,865	174,961	180,210	185,616	191,184	196,920	202,827	208,912	215,180	221,635	228,284	235,133	242,187
Energy Use on Site Present Value	**90,759**																																
Total Inflows	0	0	103,570	106,677	109,878	113,174	116,569	120,066	123,668	127,378	131,200	135,136	139,190	143,366	147,667	152,097	156,659	161,359	166,200	171,186	176,322	181,611	187,060	192,671	198,452	204,405	210,537	216,853	223,359	230,060	236,961	244,070	251,392
Present Value	0	0	92,074	91,188	90,312	89,443	88,583	87,731	86,888	86,052	85,225	84,405	83,594	82,790	81,994	81,206	80,425	79,651	78,886	78,127	77,376	76,632	75,895	75,165	74,443	73,727	73,018	72,316	71,620	70,932	70,250	69,574	68,905
Net Present Value (Total Inflows)	**2,478,426**																																
Net Cash Flow Before Tax	-35,861	-1,279,034	33,253	95,812	98,686	101,647	104,696	100,499	111,072	114,404	117,836	121,371	116,506	128,763	132,626	136,604	140,703	135,062	149,271	153,749	158,362	163,113	156,574	173,046	178,238	183,585	189,092	181,512	200,608	206,626	212,825	219,210	210,423
Present Value	-34,481	-1,182,538	29,562	81,900	81,113	80,333	79,560	73,434	78,038	77,287	76,544	75,808	69,970	74,357	73,642	72,934	72,233	66,671	70,851	70,169	69,495	68,826	63,526	67,509	66,860	66,217	65,580	60,530	64,325	63,707	63,094	62,488	57,676
Discounted Value	-1,379	-96,495	3,691	13,911	17,573	21,314	25,136	27,065	33,034	37,117	41,292	45,563	46,535	54,405	58,983	63,670	68,470	68,392	78,421	83,580	88,867	94,286	93,048	105,537	111,378	117,368	123,512	120,982	136,283	142,920	149,731	156,722	152,747

Net Present Value	**927,220**
Discounted Return on Investment (DROI)	**0.60**
Payback Period	



Assumptions:

Outflows

Microturbine Facility, Includes:

Direct turbine assets - $-725,000- $800,000- (USD) provided by InPipe Energy as total cost for microturbine infrastructure and installation. Assumed 75% of cost for infrastructure and 25% for installation. Escalated cost provided by supplier in 2025 to determine cost in 2026 (1 year worth of escalation). Multiplied by 1.3 to convert from USD to CAD (assumed 1USD=1.3 CAD). $75,000 subtracted from cost of InPipe kiosk and $125,000 subtracted for cost of redundant PRV that would be installed in microturbine wasn;t

Microturbine capital expenditure cost from InPipe energy includes a kiosk. It was assumed that the cost is 75,000 USD. CRD will be procuring a separate kiosk so this was removed from their quote. With the installation of a microturbine a redundant PRV is not required. This cost was subtracted from the microturbine cost estimated at CA$125,000.

Spare Parts - Assumed this cost was included in budgetary quote from InPipe Energy

Kiosk Costs Include:

An individual kiosk for the PRV is estimated to cost$95,227 ($86,570+10% for 1.2m wider kiosk required than quoted) and a combined kiosk for the PRV and microturbine is estimated to cost $137,940 ($125,400+10% for 1.2m wider kiosk required than quoted) . It is assumed that a redundant 500mm PRV is required if a microturbine is not installed. This allows an approximate reduction of 1m in width to the combined kiosk. The kiosk cost for the additional 1m is estimated to be $19,705.

At this time it was assumed that roof access would not be provided and electrical panels would not be installed within the kiosk.

Assume $3000/m3 for additional concrete slab required. 2.4m^2 / (1m additional width, 8m length and 0.3m height based on Option 1 combined kiosk which is the more conservative option)

Project Management - Assume 3% of subtotal construction cost. 1% of which is spent in Year 1 and 2% in Year 2.

Design Fee - Assume 7% of subtotal construction cost. 2% of which is spent in Year 1 and 5% in Year 2.

Construction Management - Assume 5% of subtotal construction cost. 2% of which is spent in Year 1 and 3% in Year 2.

Labour Annual - Cost provided by supplier ($14,000 in 2022) escalated and converted to USD (Assume 1 USD = 1.3 CAD)

Labour (every 5 years) - Assumed labour cost every 5 years will be 60% of the cost of annual labour, escalated cost to respective year and converted to USD.

Inflows

Energy Production - Cost savings from not having to pay for energy. Assumed microturbine will produce 968,000 kWh annually based on flows expected at Humpback PCS and assumed average cost of electricity at PCS Site to be $0.115/kWh (CAD). Escalated cost of every item to determine cost in 2027 and onwards.

Estimated annual energy consumption at the PCS is 27,500 kWh as provided by CRD and the rolling electricity rate based on a 12-month average is $0.13/kWh.

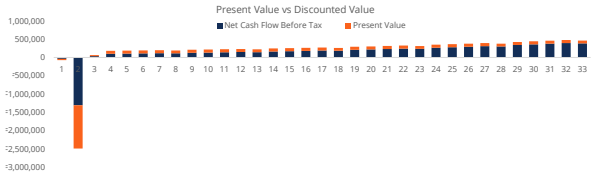
Carbon Cost Savings - Starting from April 2025, the carbon tax in British Columbia is being abolished. Direct cost savings from reduced GHG emissions will not contribute to the inflows. However, environmental impacts from producing renewable energy have been considered using the typical levels of GHG in the surrounding area.

Net Present Value of Humpback Microturbine Sensitivity Escalation High

Assumed Parameters	
Discount Rate	5%
Escalation Rate	5%
Evaluation Period (Years)	30.00
Current Financial Year	2025
Design Year	2026
Start of Construction	2027
USD to CAD Conversion	1.30
Cost of Electricity Import ($/kWh)	0.13
Cost of Electricity export ($/kWh)	0.100
Assumed Scenario	Self Generation

Project Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**
Financial Year Ending	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057
Discount Factor	0.95	0.91	0.86	0.82	0.78	0.75	0.71	0.68	0.64	0.61	0.58	0.56	0.53	0.51	0.48	0.46	0.44	0.42	0.40	0.38	0.36	0.34	0.33	0.31	0.30	0.28	0.27	0.26	0.24	0.23	0.22	0.21	0.20
Outflows																																	
Capital Expenditure																																	
Microturbine		1,188,250																															
Kiosk		22,759																															
Concrete Slab		7,560																															
Project Management (3% of capital cost)	12,186	24,371																															
Design Fee (7% of total capital cost)	24,371	60,928																															
Construction Management (5% of total capital cost)			60,928																														
Total Captial Expenditure	36,557	1,303,869	60,928	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Present Value	34,816	1,182,648	52,632	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total Capital Net Present Value	**1,270,096**																																
Operational Expenditure																																	
Labour (Annual)			11,614	12,195	12,805	13,445	14,117	14,823	15,564	16,342	17,159	18,017	18,918	19,864	20,857	21,900	22,995	24,145	25,352	26,620	27,951	29,348	30,816	32,357	33,974	35,673	37,457	39,330	41,296	43,361	45,529	47,805	50,196
Labour (Required every 5 years)								8,894					11,351					14,487					18,489					23,598					30,117
Total Operational Expenditure	0	0	11,614	12,195	12,805	13,445	14,117	23,717	15,564	16,342	17,159	18,017	30,269	19,864	20,857	21,900	22,995	38,632	25,352	26,620	27,951	29,348	49,305	32,357	33,974	35,673	37,457	62,927	41,296	43,361	45,529	47,805	80,313
Present Value	0	0	10,033	10,033	10,033	10,033	10,033	16,052	10,033	10,033	10,033	10,033	16,052	10,033	10,033	10,033	10,033	16,052	10,033	10,033	10,033	10,033	16,052	10,033	10,033	10,033	10,033	16,052	10,033	10,033	10,033	10,033	16,052
Total Operational Net Present Value	**347,133**																																
Total Outflows	36,557	1,303,869	72,543	12,195	12,805	13,445	14,117	23,717	15,564	16,342	17,159	18,017	30,269	19,864	20,857	21,900	22,995	38,632	25,352	26,620	27,951	29,348	49,305	32,357	33,974	35,673	37,457	62,927	41,296	43,361	45,529	47,805	80,313
Present Value	34,816	1,182,648	62,665	10,033	10,033	10,033	10,033	16,052	10,033	10,033	10,033	10,033	16,052	10,033	10,033	10,033	10,033	16,052	10,033	10,033	10,033	10,033	16,052	10,033	10,033	10,033	10,033	16,052	10,033	10,033	10,033	10,033	16,052
Net Present Value (Total Outflows)	**1,617,229**																																
Inflows																																	
Reference: estimated energy production (kWh)			968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000
Reference: estimated energy consumption (kWh)			27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500
Assumed: Energy sold to BC Hydro (kWh)			940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500
Cost Savings:																																	
Energy use on site	0	0	3,941	4,139	4,345	4,563	4,791	5,030	5,282	5,546	5,823	6,114	6,420	6,741	7,078	7,432	7,804	8,194	8,604	9,034	9,486	9,960	10,458	10,981	11,530	12,106	12,712	13,347	14,014	14,715	15,451	16,223	17,035
Energy Credit sold to BC Hydro	0	0	103,690	108,875	114,318	120,034	126,036	132,338	138,955	145,902	153,198	160,857	168,900	177,345	186,213	195,523	205,299	215,564	226,343	237,660	249,543	262,020	275,121	288,877	303,321	318,487	334,411	351,132	368,688	387,123	406,479	426,803	448,143
Energy Use on Site Present Value	**105,548**																																
Total Inflows	0	0	107,632	113,013	118,664	124,597	130,827	137,368	144,237	151,448	159,021	166,972	175,320	184,086	193,291	202,955	213,103	223,758	234,946	246,694	259,028	271,980	285,579	299,858	314,850	330,593	347,123	364,479	382,703	401,838	421,930	443,026	465,177
Present Value	0	0	92,976	92,976	92,976	92,976	92,976	92,976	92,976	92,976	92,976	92,976	92,976	92,976	92,976	92,976	92,976	92,976	92,976	92,976	92,976	92,976	92,976	92,976	92,976	92,976	92,976	92,976	92,976	92,976	92,976	92,976	92,976
Net Present Value (Total Inflows)	**2,882,262**																																
Net Cash Flow Before Tax	-36,557	-1,303,869	35,089	100,818	105,859	111,152	116,710	113,651	128,672	135,106	141,861	148,955	145,051	164,222	172,433	181,055	190,108	185,126	209,594	220,074	231,077	242,631	236,273	267,501	280,876	294,920	309,666	301,551	341,406	358,477	376,401	395,221	384,864
Present Value	-34,816	-1,182,648	30,311	82,943	82,943	82,943	82,943	76,924	82,943	82,943	82,943	82,943	76,924	82,943	82,943	82,943	82,943	76,924	82,943	82,943	82,943	82,943	76,924	82,943	82,943	82,943	82,943	76,924	82,943	82,943	82,943	82,943	76,924
Discounted Value	-1,741	-121,221	4,778	17,875	22,916	28,209	33,766	36,728	45,729	52,163	58,918	66,011	68,127	81,279	89,490	98,112	107,164	108,202	126,651	137,130	148,134	159,688	159,349	184,557	197,932	211,976	226,722	224,627	258,463	275,533	293,457	312,277	307,940

Net Present Value	**1,265,032**
Discounted Return on Investment (DROI)	**0.78**
Payback Period	



Assumptions:

Outflows

Microturbine Facility, Includes:

- Direct turbine assets - $-725,000- $800,000- (USD) provided by InPipe Energy as total cost for microturbine infrastructure and installation. Assumed 75% of cost for infrastructure and 25% for installation. Escalated cost provided by supplier in 2025 to determine cost in 2026 (1 year worth of escalation). Multiplied by 1.3 to convert from USD to CAD (assumed 1USD=1.3 CAD). $75,000 subtracted from cost of InPipe kiosk and $125,000 subtracted for cost of redundant PRV that would be installed in microturbine wasn;t
- Microturbine capital expenditure cost from InPipe energy includes a kiosk. It was assumed that the cost is 75,000 USD. CRD will be procuring a separate kiosk so this was removed from their quote. With the installation of a microturbine a redundant PRV is not required. This cost was subtracted from the microturbine cost estimated at CA$125,000.
- Spare Parts - Assumed this cost was included in budgetary quote from InPipe Energy

Kiosk Costs Include:

- An individual kiosk for the PRV is estimated to cost$95,227 ($86,570+10% for 1.2m wider kiosk required than quoted) and a combined kiosk for the PRV and microturbine is estimated to cost $137,940 ($125,400+10% for 1.2m wider kiosk required than quoted) . It is assumed that a redundant 500mm PRV is required if a microturbine is not installed. This allows an approximate reduction of 1m in width to the combined kiosk. The kiosk cost for the additional 1m is estimated to be $19,705.
- At this time it was assumed that roof access would not be provided and electrical panels would not be installed within the kiosk.
- Assume $3000/m3 for additional concrete slab required. 2.4m^2 (1m additional width, 8m length and 0.3m height based on Option 1 combined kiosk which is the more conservative option)

Project Management - Assume 3% of subtotal construction cost. 1% of which is spent in Year 1 and 2% in Year 2.

Design Fee - Assume 7% of subtotal construction cost. 2% of which is spent in Year 1 and 5% in Year 2.

Construction Management - Assume 5% of subtotal construction cost. 2% of which is spent in Year 1 and 3% in Year 2.

Labour Annual - Cost provided by supplier ($14,000 in 2022) escalated and converted to USD (Assume 1 USD = 1.3 CAD)

Labour (every 5 years) - Assumed labour cost every 5 years will be 60% of the cost of annual labour, escalated cost to respective year and converted to USD.

Inflows

Energy Production - Cost savings from not having to pay for energy. Assumed microturbine will produce 968,000 kWh annually based on flows expected at Humpback PCS and assumed average cost of electricity at PCS Site to be $0.115/kWh (CAD). Escalated cost of every item to determine cost in 2027 and onwards.

Estimated annual energy consumption at the PCS is 27,500 kWh as provided by CRD and the rolling electricity rate based on a 12-month average is $0.13/kWh.

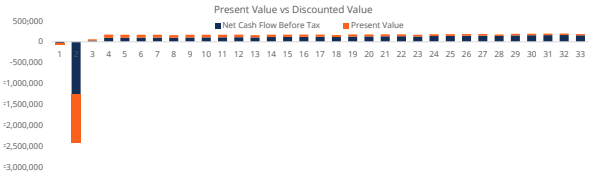
Carbon Cost Savings - Starting from April 2025, the carbon tax in British Columbia is being abolished. Direct cost savings from reduced GHG emissions will not contribute to the inflows. However, environmental impacts from producing renewable energy have been considered using the typical levels of GHG in the surrounding area.

Net Present Value of Humpback Microturbine Sensitivity Escalation Low

Assumed Parameters	
Discount Rate	5%
Escalation Rate	2%
Evaluation Period (Years)	30.00
Current Financial Year	2025
Design Year	2026
Start of Construction	2027
USD to CAD Conversion	1.30
Cost of Electricity Import ($/kWh)	0.13
Cost of Electricity export ($/kWh)	0.100
Assumed Scenario	Self Generation

Project Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Financial Year Ending	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057
Discount Factor	0.95	0.91	0.86	0.82	0.78	0.75	0.71	0.68	0.64	0.61	0.58	0.56	0.53	0.51	0.48	0.46	0.44	0.42	0.40	0.38	0.36	0.34	0.33	0.31	0.30	0.28	0.27	0.26	0.24	0.23	0.22	0.21	0.20
Outflows																																	
Capital Expenditure																																	
Microturbine		1,154,300																															
Kiosk		22,109																															
Concrete Slab		7,344																															
Project Management (3% of capital cost)	11,838	23,675																															
Design Fee (7% of total capital cost)	23,675	59,188																															
Construction Management (5% of total capital cost)			59,188																														
Total Captial Expenditure	35,513	1,266,616	59,188	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Present Value	33,822	1,148,858	51,129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total Capital Net Present Value	**1,233,808**																																
Operational Expenditure																																	
Labour (Annual)			10,047	10,248	10,453	10,662	10,875	11,093	11,315	11,541	11,772	12,007	12,247	12,492	12,742	12,997	13,257	13,522	13,793	14,068	14,350	14,637	14,930	15,228	15,533	15,843	16,160	16,483	16,813	17,149	17,492	17,842	18,199
Labour (Required every 5 years)								6,656					7,348					8,113					8,958					9,890				10,919
Total Operational Expenditure	0	0	10,047	10,248	10,453	10,662	10,875	17,749	11,315	11,541	11,772	12,007	19,596	12,492	12,742	12,997	13,257	21,635	13,793	14,068	14,350	14,637	23,887	15,228	15,533	15,843	16,160	26,373	16,813	17,149	17,492	17,842	29,118
Present Value	0	0	8,679	8,431	8,190	7,956	7,729	12,013	7,294	7,085	6,883	6,686	10,392	6,309	6,129	5,954	5,784	8,990	5,458	5,302	5,151	5,004	7,777	4,722	4,587	4,456	4,328	6,728	4,085	3,968	3,855	3,744	5,820
Total Operational Net Present Value	**199,489**																																
Total Outflows	35,513	1,266,616	69,235	10,248	10,453	10,662	10,875	17,749	11,315	11,541	11,772	12,007	19,596	12,492	12,742	12,997	13,257	21,635	13,793	14,068	14,350	14,637	23,887	15,228	15,533	15,843	16,160	26,373	16,813	17,149	17,492	17,842	29,118
Present Value	33,822	1,148,858	59,808	8,431	8,190	7,956	7,729	12,013	7,294	7,085	6,883	6,686	10,392	6,309	6,129	5,954	5,784	8,990	5,458	5,302	5,151	5,004	7,777	4,722	4,587	4,456	4,328	6,728	4,085	3,968	3,855	3,744	5,820
Net Present Value (Total Outflows)	**1,433,297**																																
Inflows																																	
Reference: estimated energy production (kWh)			968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000
Reference: estimated energy consumption (kWh)			27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500
Assumed: Energy sold to BC Hydro (kWh)			940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500
Cost Savings:																																	
Energy use on site	0	0	3,719	3,794	3,870	3,947	4,026	4,107	4,189	4,272	4,358	4,445	4,534	4,625	4,717	4,811	4,908	5,006	5,106	5,208	5,312	5,419	5,527	5,637	5,750	5,865	5,982	6,102	6,224	6,349	6,476	6,605	6,737
Energy Credit sold to BC Hydro	0	0	97,850	99,807	101,803	103,839	105,916	108,034	110,195	112,398	114,646	116,939	119,278	121,664	124,097	126,579	129,110	131,693	134,327	137,013	139,753	142,548	145,399	148,307	151,274	154,299	157,385	160,533	163,743	167,018	170,359	173,766	177,241
Energy Use on Site Present Value	**66,670**																																
Total Inflows	0	0	101,569	103,600	105,672	107,786	109,942	112,140	114,383	116,671	119,004	121,384	123,812	126,288	128,814	131,390	134,018	136,699	139,433	142,221	145,066	147,967	150,926	153,945	157,024	160,164	163,367	166,635	169,967	173,367	176,834	180,371	183,978
Present Value	0	0	87,739	85,232	82,797	80,431	78,133	75,901	73,732	71,626	69,579	67,591	65,660	63,784	61,962	60,191	58,472	56,801	55,178	53,602	52,070	50,582	49,137	47,733	46,370	45,045	43,758	42,507	41,293	40,113	38,967	37,854	36,772
Net Present Value (Total Inflows)	**1,820,616**																																
Net Cash Flow Before Tax	-35,513	-1,266,616	32,334	93,352	95,219	97,124	99,066	94,392	103,069	105,130	107,233	109,377	104,216	113,796	116,072	118,393	120,761	115,063	125,640	128,153	130,716	133,330	127,039	138,717	141,491	144,321	147,207	140,261	153,154	156,218	159,342	162,529	154,860
Present Value	-33,822	-1,148,858	27,932	76,801	74,607	72,475	70,405	63,888	66,439	64,541	62,697	60,905	55,268	57,475	55,833	54,237	52,688	47,811	49,720	48,299	46,919	45,579	41,360	43,012	41,783	40,589	39,429	35,780	37,208	36,145	35,112	34,109	30,952
Discounted Value	-1,691	-117,758	4,403	16,551	20,613	24,649	28,662	30,504	36,630	40,589	44,536	48,472	48,948	56,321	60,239	64,156	68,074	67,252	75,920	79,853	83,796	87,751	85,679	95,705	99,708	103,732	107,778	104,482	115,946	120,072	124,229	128,419	123,908

Net Present Value	**387,319**
Discounted Return on Investment (DROI)	**0.27**
Payback Period	



Assumptions:

Outflows

Microturbine Facility, Includes:

Direct turbine assets - $-725,000- $800,000- (USD) provided by InPipe Energy as total cost for microturbine infrastructure and installation. Assumed 75% of cost for infrastructure and 25% for installation. Escalated cost provided by supplier in 2025 to determine cost in 2026 (1 year worth of escalation). Multiplied by 1.3 to convert from USD to CAD (assumed 1USD=1.3 CAD). $75,000 subtracted from cost of InPipe kiosk and $125,000 subtracted for cost of redundant PRV that would be installed in microturbine wasn;t

Microturbine capital expenditure cost from InPipe energy includes a kiosk. It was assumed that the cost is 75,000 USD. CRD will be procuring a separate kiosk so this was removed from their quote. With the installation of a microturbine a redundant PRV is not required. This cost was subtracted from the microturbine cost estimated at CA$125,000.

Spare Parts - Assumed this cost was included in budgetary quote from InPipe Energy

Kiosk Costs Include:

An individual kiosk for the PRV is estimated to cost$95,227 ($86,570+10% for 1.2m wider kiosk required than quoted) and a combined kiosk for the PRV and microturbine is estimated to cost $137,940 ($125,400+10% for 1.2m wider kiosk required than quoted) . It is assumed that a redundant 500mm PRV is required if a microturbine is not installed. This allows an approximate reduction of 1m in width to the combined kiosk. The kiosk cost for the additional 1m is estimated to be $19,705.

At this time it was assumed that roof access would not be provided and electrical panels would not be installed within the kiosk.

Assume $3000/m3 for additional concrete slab required. 2.4m^2 (1m additional width, 8m length and 0.3m height based on Option 1 combined kiosk which is the more conservative option)

Project Management - Assume 3% of subtotal construction cost. 1% of which is spent in Year 1 and 2% in Year 2.

Design Fee - Assume 7% of subtotal construction cost. 2% of which is spent in Year 1 and 5% in Year 2.

Construction Management - Assume 5% of subtotal construction cost. 2% of which is spent in Year 1 and 3% in Year 2.

Labour Annual - Cost provided by supplier ($14,000 in 2022) escalated and converted to USD (Assume 1 USD = 1.3 CAD)

Labour (every 5 years) - Assumed labour cost every 5 years will be 60% of the cost of annual labour, escalated cost to respective year and converted to USD.

Inflows

Energy Production - Cost savings from not having to pay for energy. Assumed microturbine will produce 968,000 kWh annually based on flows expected at Humpback PCS and assumed average cost of electricity at PCS Site to be $0.115/kWh (CAD). Escalated cost of every item to determine cost in 2027 and onwards.

Estimated annual energy consumption at the PCS is 27,500 kWh as provided by CRD and the rolling electricity rate based on a 12-month average is $0.13/kWh.

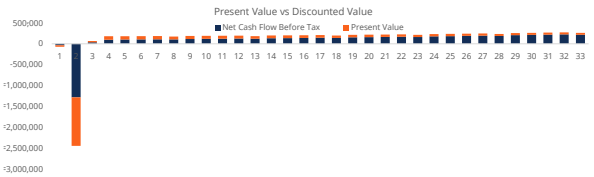
Carbon Cost Savings - Starting from April 2025, the carbon tax in British Columbia is being abolished. Direct cost savings from reduced GHG emissions will not contribute to the inflows. However, environmental impacts from producing renewable energy have been considered using the typical levels of GHG in the surrounding area.

Net Present Value of Humpback Microturbine Sensitivity Energy Import High

Assumed Parameters	
Discount Rate	5%
Escalation Rate	3%
Evaluation Period (Years)	30.00
Current Financial Year	2025
Design Year	2026
Start of Construction	2027
USD to CAD Conversion	1.30
Cost of Electricity Import ($/kWh)	0.23
Cost of Electricity export ($/kWh)	0.100
Assumed Scenario	Self Generation

Project Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**
Financial Year Ending	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057
Discount Factor	0.95	0.91	0.86	0.82	0.78	0.75	0.71	0.68	0.64	0.61	0.58	0.56	0.53	0.51	0.48	0.46	0.44	0.42	0.40	0.38	0.36	0.34	0.33	0.31	0.30	0.28	0.27	0.26	0.24	0.23	0.22	0.21	0.20
Outflows																																	
Capital Expenditure																																	
Microturbine		1,165,617																															
Kiosk		22,326																															
Concrete Slab		7,416																															
Project Management (3% of capital cost)	11,954	23,907																															
Design Fee (7% of total capital cost)	23,907	59,768																															
Construction Management (5% of total capital cost)			59,768																														
Total Captial Expenditure	35,861	1,279,034	59,768	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Present Value	34,153	1,160,121	51,630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total Capital Net Present Value	**1,245,904**																																
Operational Expenditure																																	
Labour (Annual)			10,549	10,866	11,192	11,528	11,873	12,230	12,597	12,974	13,364	13,765	14,178	14,603	15,041	15,492	15,957	16,436	16,929	17,437	17,960	18,498	19,053	19,625	20,214	20,820	21,445	22,088	22,751	23,433	24,136	24,860	25,606
Labour (Required every 5 years)								7,338					8,507					9,861					11,432					13,253					15,364
Total Operational Expenditure	0	0	10,549	10,866	11,192	11,528	11,873	19,567	12,597	12,974	13,364	13,765	22,684	14,603	15,041	15,492	15,957	26,297	16,929	17,437	17,960	18,498	30,485	19,625	20,214	20,820	21,445	35,341	22,751	23,433	24,136	24,860	40,970
Present Value	0	0	9,113	8,939	8,769	8,602	8,438	13,244	8,120	7,965	7,813	7,665	12,030	7,375	7,235	7,097	6,962	10,927	6,699	6,572	6,446	6,324	9,925	6,085	5,969	5,855	5,744	9,015	5,527	5,422	5,319	5,217	8,189
Total Operational Net Present Value	**238,604**																																
Total Outflows	35,861	1,279,034	70,317	10,866	11,192	11,528	11,873	19,567	12,597	12,974	13,364	13,765	22,684	14,603	15,041	15,492	15,957	26,297	16,929	17,437	17,960	18,498	30,485	19,625	20,214	20,820	21,445	35,341	22,751	23,433	24,136	24,860	40,970
Present Value	34,153	1,160,121	60,743	8,939	8,769	8,602	8,438	13,244	8,120	7,965	7,813	7,665	12,030	7,375	7,235	7,097	6,962	10,927	6,699	6,572	6,446	6,324	9,925	6,085	5,969	5,855	5,744	9,015	5,527	5,422	5,319	5,217	8,189
Net Present Value (Total Outflows)	**1,484,508**																																
Inflows																																	
Reference: estimated energy production (kWh)			968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000
Reference: estimated energy consumption (kWh)			27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500
Assumed: Energy sold to BC Hydro (kWh)			940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500
Cost Savings:																																	
Energy use on site	0	0	6,710	6,911	7,119	7,332	7,552	7,779	8,012	8,253	8,500	8,755	9,018	9,288	9,567	9,854	10,150	10,454	10,768	11,091	11,424	11,766	12,119	12,483	12,857	13,243	13,640	14,050	14,471	14,905	15,352	15,813	16,287
Energy Credit sold to BC Hydro	0	0	99,778	102,771	105,854	109,030	112,301	115,670	119,140	122,714	126,395	130,187	134,093	138,116	142,259	146,527	150,923	155,450	160,114	164,917	169,865	174,961	180,210	185,616	191,184	196,920	202,827	208,912	215,180	221,635	228,284	235,133	242,187
Energy Use on Site Present Value	**136,664**																																
Total Inflows	0	0	106,488	109,682	112,973	116,362	119,853	123,449	127,152	130,967	134,896	138,942	143,111	147,404	151,826	156,381	161,072	165,905	170,882	176,008	181,288	186,727	192,329	198,099	204,042	210,163	216,468	222,962	229,651	236,540	243,636	250,946	258,474
Present Value	0	0	91,988	90,236	88,517	86,831	85,177	83,555	81,963	80,402	78,871	77,368	75,895	74,449	73,031	71,640	70,275	68,937	67,624	66,336	65,072	63,833	62,617	61,424	60,254	59,106	57,981	56,876	55,793	54,730	53,688	52,665	51,662
Net Present Value (Total Inflows)	**2,168,796**																																
Net Cash Flow Before Tax	-35,861	-1,279,034	36,171	98,817	101,781	104,835	107,980	103,881	114,556	117,992	121,532	125,178	120,427	132,801	136,785	140,889	145,116	139,608	153,953	158,572	163,329	168,229	161,843	178,474	183,828	189,343	195,023	187,621	206,900	213,107	219,500	226,085	217,504
Present Value	-34,153	-1,160,121	31,245	81,297	79,748	78,229	76,739	70,311	73,844	72,437	71,057	69,704	63,865	67,074	65,796	64,543	63,313	58,010	60,924	59,764	58,626	57,509	52,692	55,339	54,285	53,251	52,237	47,861	50,266	49,308	48,369	47,448	43,473
Discounted Value	-1,708	-118,912	4,925	17,520	22,033	26,605	31,241	33,570	40,712	45,555	50,475	55,474	56,562	65,728	70,989	76,346	81,802	81,598	93,029	98,808	104,703	110,720	109,152	123,135	129,543	136,092	142,786	139,760	156,634	163,799	171,131	178,638	174,031

Net Present Value	**684,288**
Discounted Return on Investment (DROI)	**0.46**
Payback Period	



Assumptions:

Outflows

Microturbine Facility, Includes:

Direct turbine assets - $-725,000- $800,000- (USD) provided by InPipe Energy as total cost for microturbine infrastructure and installation. Assumed 75% of cost for infrastructure and 25% for installation. Escalated cost provided by supplier in 2025 to determine cost in 2026 (1 year worth of escalation). Multiplied by 1.3 to convert from USD to CAD (assumed 1USD=1.3 CAD). $75,000 subtracted from cost of InPipe kiosk and $125,000 subtracted for cost of redundant PRV that would be installed in microturbine wasn;t

Microturbine capital expenditure cost from InPipe energy includes a kiosk. It was assumed that the cost is 75,000 USD. CRD will be procuring a separate kiosk so this was removed from their quote. With the installation of a microturbine a redundant PRV is not required. This cost was subtracted from the microturbine cost estimated at CA$125,000.

Spare Parts - Assumed this cost was included in budgetary quote from InPipe Energy

Kiosk Costs Include:

An individual kiosk for the PRV is estimated to cost$95,227 ($86,570+10% for 1.2m wider kiosk required than quoted) and a combined kiosk for the PRV and microturbine is estimated to cost $137,940 ($125,400+10% for 1.2m wider kiosk required than quoted) . It is assumed that a redundant 500mm PRV is required if a microturbine is not installed. This allows an approximate reduction of 1m in width to the combined kiosk. The kiosk cost for the additional 1m is estimated to be $19,705.

At this time it was assumed that roof access would not be provided and electrical panels would not be installed within the kiosk.

Assume $3000/m3 for additional concrete slab required. 2.4m^2 (1m additional width, 8m length and 0.3m height based on Option 1 combined kiosk which is the more conservative option)

Project Management - Assume 3% of subtotal construction cost. 1% of which is spent in Year 1 and 2% in Year 2.

Design Fee - Assume 7% of subtotal construction cost. 2% of which is spent in Year 1 and 5% in Year 2.

Construction Management - Assume 5% of subtotal construction cost. 2% of which is spent in Year 1 and 3% in Year 2.

Labour Annual - Cost provided by supplier ($14,000 in 2022) escalated and converted to USD (Assume 1 USD = 1.3 CAD)

Labour (every 5 years) - Assumed labour cost every 5 years will be 60% of the cost of annual labour, escalated cost to respective year and converted to USD.

Inflows

Energy Production - Cost savings from not having to pay for energy. Assumed microturbine will produce 968,000 kWh annually based on flows expected at Humpback PCS and assumed average cost of electricity at PCS Site to be $0.115/kWh (CAD). Escalated cost of every item to determine cost in 2027 and onwards.

Estimated annual energy consumption at the PCS is 27,500 kWh as provided by CRD and the rolling electricity rate based on a 12-month average is $0.13/kWh.

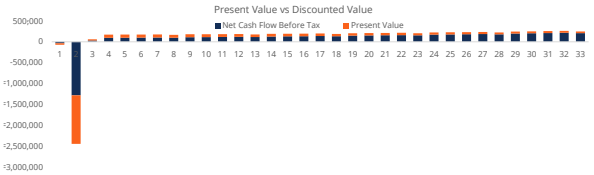
Carbon Cost Savings - Starting from April 2025, the carbon tax in British Columbia is being abolished. Direct cost savings from reduced GHG emissions will not contribute to the inflows. However, environmental impacts from producing renewable energy have been considered using the typical levels of GHG in the surrounding area.

Net Present Value of Humpback Microturbine Sensitivity Energy Import Low

Assumed Parameters	
Discount Rate	5%
Escalation Rate	3%
Evaluation Period (Years)	30.00
Current Financial Year	2025
Design Year	2026
Start of Construction	2027
USD to CAD Conversion	1.30
Cost of Electricity Import ($/kWh)	0.08
Cost of Electricity export ($/kWh)	0.100
Assumed Scenario	Self Generation

Project Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Financial Year Ending	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057
Discount Factor	0.95	0.91	0.86	0.82	0.78	0.75	0.71	0.68	0.64	0.61	0.58	0.56	0.53	0.51	0.48	0.46	0.44	0.42	0.40	0.38	0.36	0.34	0.33	0.31	0.30	0.28	0.27	0.26	0.24	0.23	0.22	0.21	0.20
Outflows																																	
Capital Expenditure																																	
Microturbine		1,165,617																															
Kiosk		22,326																															
Concrete Slab		7,416																															
Project Management (3% of capital cost)	11,954	23,907																															
Design Fee (7% of total capital cost)	23,907	59,768																															
Construction Management (5% of total capital cost)			59,768																														
Total Captial Expenditure	35,861	1,279,034	59,768	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Present Value	34,153	1,160,121	51,630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total Capital Net Present Value	**1,245,904**																																
Operational Expenditure																																	
Labour (Annual)			10,549	10,866	11,192	11,528	11,873	12,230	12,597	12,974	13,364	13,765	14,178	14,603	15,041	15,492	15,957	16,436	16,929	17,437	17,960	18,498	19,053	19,625	20,214	20,820	21,445	22,088	22,751	23,433	24,136	24,860	25,606
Labour (Required every 5 years)								7,338					8,507					9,861					11,432					13,253					15,364
Total Operational Expenditure	0	0	10,549	10,866	11,192	11,528	11,873	19,567	12,597	12,974	13,364	13,765	22,684	14,603	15,041	15,492	15,957	26,297	16,929	17,437	17,960	18,498	30,485	19,625	20,214	20,820	21,445	35,341	22,751	23,433	24,136	24,860	40,970
Present Value	0	0	9,113	8,939	8,769	8,602	8,438	13,244	8,120	7,965	7,813	7,665	12,030	7,375	7,235	7,097	6,962	10,927	6,699	6,572	6,446	6,324	9,925	6,085	5,969	5,855	5,744	9,015	5,527	5,422	5,319	5,217	8,189
Total Operational Net Present Value	**238,604**																																
Total Outflows	35,861	1,279,034	70,317	10,866	11,192	11,528	11,873	19,567	12,597	12,974	13,364	13,765	22,684	14,603	15,041	15,492	15,957	26,297	16,929	17,437	17,960	18,498	30,485	19,625	20,214	20,820	21,445	35,341	22,751	23,433	24,136	24,860	40,970
Present Value	34,153	1,160,121	60,743	8,939	8,769	8,602	8,438	13,244	8,120	7,965	7,813	7,665	12,030	7,375	7,235	7,097	6,962	10,927	6,699	6,572	6,446	6,324	9,925	6,085	5,969	5,855	5,744	9,015	5,527	5,422	5,319	5,217	8,189
Net Present Value (Total Outflows)	**1,484,508**																																
Inflows																																	
Reference: estimated energy production (kWh)			968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000
Reference: estimated energy consumption (kWh)			27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500
Assumed: Energy sold to BC Hydro (kWh)			940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500
Cost Savings:																																	
Energy use on site	0	0	2,334	2,404	2,476	2,550	2,627	2,706	2,787	2,871	2,957	3,045	3,137	3,231	3,328	3,428	3,530	3,636	3,745	3,858	3,973	4,093	4,215	4,342	4,472	4,606	4,745	4,887	5,033	5,184	5,340	5,500	5,665
Energy Credit sold to BC Hydro	0	0	99,778	102,771	105,854	109,030	112,301	115,670	119,140	122,714	126,395	130,187	134,093	138,116	142,259	146,527	150,923	155,450	160,114	164,917	169,865	174,961	180,210	185,616	191,184	196,920	202,827	208,912	215,180	221,635	228,284	235,133	242,187
Energy Use on Site Present Value	**47,535**																																
Total Inflows	0	0	102,112	105,175	108,330	111,580	114,928	118,375	121,927	125,584	129,352	133,233	137,229	141,346	145,587	149,954	154,453	159,087	163,859	168,775	173,838	179,053	184,425	189,958	195,656	201,526	207,572	213,799	220,213	226,819	233,624	240,633	247,852
Present Value	0	0	88,208	86,528	84,880	83,263	81,677	80,121	78,595	77,098	75,629	74,189	72,776	71,390	70,030	68,696	67,387	66,104	64,845	63,610	62,398	61,209	60,043	58,900	57,778	56,677	55,598	54,539	53,500	52,481	51,481	50,501	49,539
Net Present Value (Total Inflows)	**2,079,667**																																
Net Cash Flow Before Tax	-35,861	-1,279,034	31,794	94,309	97,138	100,053	103,054	98,808	109,330	112,610	115,988	119,468	114,545	126,744	130,546	134,462	138,496	132,790	146,931	151,338	155,879	160,555	153,940	170,333	175,443	180,706	186,127	178,458	197,462	203,386	209,488	215,772	206,882
Present Value	-34,153	-1,160,121	27,465	77,588	76,110	74,661	73,239	66,877	70,475	69,133	67,816	66,524	60,746	64,014	62,795	61,599	60,425	55,177	58,145	57,038	55,951	54,886	50,118	52,815	51,809	50,822	49,854	45,524	47,973	47,059	46,163	45,283	41,350
Discounted Value	-1,708	-118,912	4,329	16,721	21,028	25,392	29,815	31,931	38,855	43,477	48,172	52,944	53,800	62,729	67,751	72,864	78,071	77,613	88,785	94,301	99,927	105,669	103,821	117,518	123,634	129,884	136,273	132,935	149,490	156,327	163,325	170,489	165,532

Net Present Value	**595,159**
Discounted Return on Investment (DROI)	**0.40**
Payback Period	



Assumptions:

Outflows

Microturbine Facility, Includes:

Direct turbine assets - $-725,000- $800,000- (USD) provided by InPipe Energy as total cost for microturbine infrastructure and installation. Assumed 75% of cost for infrastructure and 25% for installation. Escalated cost provided by supplier in 2025 to determine cost in 2026 (1 year worth of escalation). Multiplied by 1.3 to convert from USD to CAD (assumed 1USD=1.3 CAD). $75,000 subtracted from cost of InPipe kiosk and $125,000 subtracted for cost of redundant PRV that would be installed in microturbine wasn;t

Microturbine capital expenditure cost from InPipe energy includes a kiosk. It was assumed that the cost is 75,000 USD. CRD will be procuring a separate kiosk so this was removed from their quote. With the installation of a microturbine a redundant PRV is not required. This cost was subtracted from the microturbine cost estimated at CA$125,000.

Spare Parts - Assumed this cost was included in budgetary quote from InPipe Energy

Kiosk Costs Include:

An individual kiosk for the PRV is estimated to cost$95,227 ($86,570+10% for 1.2m wider kiosk required than quoted) and a combined kiosk for the PRV and microturbine is estimated to cost $137,940 ($125,400+10% for 1.2m wider kiosk required than quoted) . It is assumed that a redundant 500mm PRV is required if a microturbine is not installed. This allows an approximate reduction of 1m in width to the combined kiosk. The kiosk cost for the additional 1m is estimated to be $19,705.

At this time it was assumed that roof access would not be provided and electrical panels would not be installed within the kiosk.

Assume $3000/m3 for additional concrete slab required. 2.4m^2 (1m additional width, 8m length and 0.3m height based on Option 1 combined kiosk which is the more conservative option)

Project Management - Assume 3% of subtotal construction cost. 1% of which is spent in Year 1 and 2% in Year 2.

Design Fee - Assume 7% of subtotal construction cost. 2% of which is spent in Year 1 and 5% in Year 2.

Construction Management - Assume 5% of subtotal construction cost. 2% of which is spent in Year 1 and 3% in Year 2.

Labour Annual - Cost provided by supplier ($14,000 in 2022) escalated and converted to USD (Assume 1 USD = 1.3 CAD)

Labour (every 5 years) - Assumed labour cost every 5 years will be 60% of the cost of annual labour, escalated cost to respective year and converted to USD.

Inflows

Energy Production - Cost savings from not having to pay for energy. Assumed microturbine will produce 968,000 kWh annually based on flows expected at Humpback PCS and assumed average cost of electricity at PCS Site to be $0.115/kWh (CAD). Escalated cost of every item to determine cost in 2027 and onwards.

Estimated annual energy consumption at the PCS is 27,500 kWh as provided by CRD and the rolling electricity rate based on a 12-month average is $0.13/kWh.

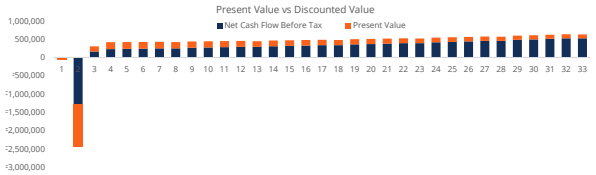
Carbon Cost Savings - Starting from April 2025, the carbon tax in British Columbia is being abolished. Direct cost savings from reduced GHG emissions will not contribute to the inflows. However, environmental impacts from producing renewable energy have been considered using the typical levels of GHG in the surrounding area.

Net Present Value of Humpback Microturbine Sensitivity Energy Export High

Assumed Parameters	
Discount Rate	5%
Escalation Rate	3%
Evaluation Period (Years)	30.00
Current Financial Year	2025
Design Year	2026
Start of Construction	2027
USD to CAD Conversion	1.30
Cost of Electricity Import ($/kWh)	0.13
Cost of Electricity export ($/kWh)	0.230
Assumed Scenario	Self Generation

Project Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Financial Year Ending	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057
Discount Factor	0.95	0.91	0.86	0.82	0.78	0.75	0.71	0.68	0.64	0.61	0.58	0.56	0.53	0.51	0.48	0.46	0.44	0.42	0.40	0.38	0.36	0.34	0.33	0.31	0.30	0.28	0.27	0.26	0.24	0.23	0.22	0.21	0.20
Outflows																																	
Capital Expenditure																																	
Microturbine		1,165,617																															
Kiosk		22,326																															
Concrete Slab		7,416																															
Project Management (3% of capital cost)	11,954	23,907																															
Design Fee (7% of total capital cost)	23,907	59,768																															
Construction Management (5% of total capital cost)			59,768																														
Total Captial Expenditure	35,861	1,279,034	59,768	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Present Value	34,153	1,160,121	51,630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total Capital Net Present Value	**1,245,904**																																
Operational Expenditure																																	
Labour (Annual)			10,549	10,866	11,192	11,528	11,873	12,230	12,597	12,974	13,364	13,765	14,178	14,603	15,041	15,492	15,957	16,436	16,929	17,437	17,960	18,498	19,053	19,625	20,214	20,820	21,445	22,088	22,751	23,433	24,136	24,860	25,606
Labour (Required every 5 years)								7,338					8,507					9,861					11,432					13,253				15,364
Total Operational Expenditure	0	0	10,549	10,866	11,192	11,528	11,873	19,567	12,597	12,974	13,364	13,765	22,684	14,603	15,041	15,492	15,957	26,297	16,929	17,437	17,960	18,498	30,485	19,625	20,214	20,820	21,445	35,341	22,751	23,433	24,136	24,860	40,970
Present Value	0	0	9,113	8,939	8,769	8,602	8,438	13,244	8,120	7,965	7,813	7,665	12,030	7,375	7,235	7,097	6,962	10,927	6,699	6,572	6,446	6,324	9,925	6,085	5,969	5,855	5,744	9,015	5,527	5,422	5,319	5,217	8,189
Total Operational Net Present Value	**238,604**																																
Total Outflows	35,861	1,279,034	70,317	10,866	11,192	11,528	11,873	19,567	12,597	12,974	13,364	13,765	22,684	14,603	15,041	15,492	15,957	26,297	16,929	17,437	17,960	18,498	30,485	19,625	20,214	20,820	21,445	35,341	22,751	23,433	24,136	24,860	40,970
Present Value	34,153	1,160,121	60,743	8,939	8,769	8,602	8,438	13,244	8,120	7,965	7,813	7,665	12,030	7,375	7,235	7,097	6,962	10,927	6,699	6,572	6,446	6,324	9,925	6,085	5,969	5,855	5,744	9,015	5,527	5,422	5,319	5,217	8,189
Net Present Value (Total Outflows)	**1,484,508**																																
Inflows																																	
Reference: estimated energy production (kWh)			968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000
Reference: estimated energy consumption (kWh)			27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500
Assumed: Energy sold to BC Hydro (kWh)			940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500
Cost Savings:																																	
Energy use on site	0	0	3,793	3,906	4,024	4,144	4,269	4,397	4,529	4,665	4,805	4,949	5,097	5,250	5,408	5,570	5,737	5,909	6,086	6,269	6,457	6,651	6,850	7,056	7,267	7,485	7,710	7,941	8,179	8,425	8,677	8,938	9,206
Energy Credit sold to BC Hydro	0	0	229,489	236,373	243,464	250,768	258,291	266,040	274,021	282,242	290,709	299,431	308,413	317,666	327,196	337,012	347,122	357,536	368,262	379,310	390,689	402,410	414,482	426,916	439,724	452,916	466,503	480,498	494,913	509,760	525,053	540,805	557,029
Energy Use on Site Present Value	**77,245**																																
Total Inflows	0	0	233,281	240,280	247,488	254,913	262,560	270,437	278,550	286,907	295,514	304,379	313,511	322,916	332,603	342,581	352,859	363,445	374,348	385,578	397,146	409,060	421,332	433,972	446,991	460,401	474,213	488,439	503,092	518,185	533,731	549,743	566,235
Present Value	0	0	201,517	197,679	193,913	190,220	186,597	183,042	179,556	176,136	172,781	169,490	166,261	163,094	159,988	156,941	153,951	151,019	148,142	145,320	142,552	139,837	137,174	134,561	131,998	129,483	127,017	124,598	122,224	119,896	117,613	115,372	113,175
Net Present Value (Total Inflows)	**4,751,148**																																
Net Cash Flow Before Tax	-35,861	-1,279,034	162,964	229,414	236,296	243,385	250,687	250,870	265,954	273,932	282,150	290,615	290,827	308,313	317,562	327,089	336,902	337,148	357,419	368,142	379,186	390,562	390,847	414,347	426,777	439,581	452,768	453,098	480,342	494,752	509,594	524,882	525,265
Present Value	-34,153	-1,160,121	140,774	188,739	185,144	181,618	178,158	169,798	171,436	168,171	164,967	161,825	154,232	155,719	152,753	149,843	146,989	140,092	141,443	138,749	136,106	133,513	127,248	128,476	126,029	123,628	121,273	115,582	116,697	114,474	112,294	110,155	104,986
Discounted Value	-1,708	-118,912	22,190	40,675	51,152	61,767	72,528	81,071	94,518	105,762	117,183	128,790	136,595	152,594	164,809	177,246	189,913	197,056	215,976	229,393	243,080	257,048	263,598	285,871	300,749	315,953	331,495	337,516	363,644	380,277	397,301	414,727	420,279

Net Present Value	**3,266,640**
Discounted Return on Investment (DROI)	**2.20**
Payback Period	



Assumptions:

Outflows

Microturbine Facility, Includes:

Direct turbine assets - $-725,000- $800,000- (USD) provided by InPipe Energy as total cost for microturbine infrastructure and installation. Assumed 75% of cost for infrastructure and 25% for installation. Escalated cost provided by supplier in 2025 to determine cost in 2026 (1 year worth of escalation). Multiplied by 1.3 to convert from USD to CAD (assumed 1USD=1.3 CAD). $75,000 subtracted from cost of InPipe kiosk and $125,000 subtracted for cost of redundant PRV that would be installed in microturbine wasn;t

Microturbine capital expenditure cost from InPipe energy includes a kiosk. It was assumed that the cost is 75,000 USD. CRD will be procuring a separate kiosk so this was removed from their quote. With the installation of a microturbine a redundant PRV is not required. This cost was subtracted from the microturbine cost estimated at CA$125,000.

Spare Parts - Assumed this cost was included in budgetary quote from InPipe Energy

Kiosk Costs Include:

An individual kiosk for the PRV is estimated to cost$95,227 ($86,570+10% for 1.2m wider kiosk required than quoted) and a combined kiosk for the PRV and microturbine is estimated to cost $137,940 ($125,400+10% for 1.2m wider kiosk required than quoted) . It is assumed that a redundant 500mm PRV is required if a microturbine is not installed. This allows an approximate reduction of 1m in width to the combined kiosk. The kiosk cost for the additional 1m is estimated to be $19,705.

At this time it was assumed that roof access would not be provided and electrical panels would not be installed within the kiosk.

Assume $3000/m3 for additional concrete slab required. 2.4m^2 (1m additional width, 8m length and 0.3m height based on Option 1 combined kiosk which is the more conservative option)

Project Management - Assume 3% of subtotal construction cost. 1% of which is spent in Year 1 and 2% in Year 2.

Design Fee - Assume 7% of subtotal construction cost. 2% of which is spent in Year 1 and 5% in Year 2.

Construction Management - Assume 5% of subtotal construction cost. 2% of which is spent in Year 1 and 3% in Year 2.

Labour Annual - Cost provided by supplier ($14,000 in 2022) escalated and converted to USD (Assume 1 USD = 1.3 CAD)

Labour (every 5 years) - Assumed labour cost every 5 years will be 60% of the cost of annual labour, escalated cost to respective year and converted to USD.

Inflows

Energy Production - Cost savings from not having to pay for energy. Assumed microturbine will produce 968,000 kWh annually based on flows expected at Humpback PCS and assumed average cost of electricity at PCS Site to be $0.115/kWh (CAD). Escalated cost of every item to determine cost in 2027 and onwards.

Estimated annual energy consumption at the PCS is 27,500 kWh as provided by CRD and the rolling electricity rate based on a 12-month average is $0.13/kWh.

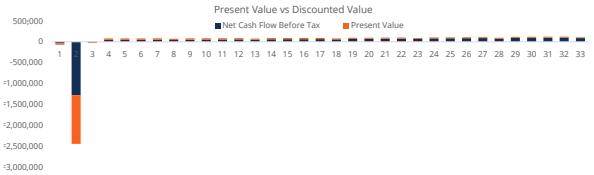
Carbon Cost Savings - Starting from April 2025, the carbon tax in British Columbia is being abolished. Direct cost savings from reduced GHG emissions will not contribute to the inflows. However, environmental impacts from producing renewable energy have been considered using the typical levels of GHG in the surrounding area.

Net Present Value of Humpback Microturbine Sensitivity Energy Export Low

Assumed Parameters	
Discount Rate	5%
Escalation Rate	3%
Evaluation Period (Years)	30.00
Current Financial Year	2025
Design Year	2026
Start of Construction	2027
USD to CAD Conversion	1.30
Cost of Electricity Import ($/kWh)	0.13
Cost of Electricity export ($/kWh)	0.050
Assumed Scenario	Self Generation

Project Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**
Financial Year Ending	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057
Discount Factor	0.95	0.91	0.86	0.82	0.78	0.75	0.71	0.68	0.64	0.61	0.58	0.56	0.53	0.51	0.48	0.46	0.44	0.42	0.40	0.38	0.36	0.34	0.33	0.31	0.30	0.28	0.27	0.26	0.24	0.23	0.22	0.21	0.20
Outflows																																	
Capital Expenditure																																	
Microturbine		1,165,617																															
Kiosk		22,326																															
Concrete Slab		7,416																															
Project Management (3% of capital cost)	11,954	23,907																															
Design Fee (7% of total capital cost)	23,907	59,768																															
Construction Management (5% of total capital cost)			59,768																														
Total Captial Expenditure	35,861	1,279,034	59,768	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Present Value	34,153	1,160,121	51,630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total Capital Net Present Value	**1,245,904**																																
Operational Expenditure																																	
Labour (Annual)			10,549	10,866	11,192	11,528	11,873	12,230	12,597	12,974	13,364	13,765	14,178	14,603	15,041	15,492	15,957	16,436	16,929	17,437	17,960	18,498	19,053	19,625	20,214	20,820	21,445	22,088	22,751	23,433	24,136	24,860	25,606
Labour (Required every 5 years)								7,338					8,507					9,861					11,432					13,253					15,364
Total Operational Expenditure	0	0	10,549	10,866	11,192	11,528	11,873	19,567	12,597	12,974	13,364	13,765	22,684	14,603	15,041	15,492	15,957	26,297	16,929	17,437	17,960	18,498	30,485	19,625	20,214	20,820	21,445	35,341	22,751	23,433	24,136	24,860	40,970
Present Value	0	0	9,113	8,939	8,769	8,602	8,438	13,244	8,120	7,965	7,813	7,665	12,030	7,375	7,235	7,097	6,962	10,927	6,699	6,572	6,446	6,324	9,925	6,085	5,969	5,855	5,744	9,015	5,527	5,422	5,319	5,217	8,189
Total Operational Net Present Value	**238,604**																																
Total Outflows	35,861	1,279,034	70,317	10,866	11,192	11,528	11,873	19,567	12,597	12,974	13,364	13,765	22,684	14,603	15,041	15,492	15,957	26,297	16,929	17,437	17,960	18,498	30,485	19,625	20,214	20,820	21,445	35,341	22,751	23,433	24,136	24,860	40,970
Present Value	34,153	1,160,121	60,743	8,939	8,769	8,602	8,438	13,244	8,120	7,965	7,813	7,665	12,030	7,375	7,235	7,097	6,962	10,927	6,699	6,572	6,446	6,324	9,925	6,085	5,969	5,855	5,744	9,015	5,527	5,422	5,319	5,217	8,189
Net Present Value (Total Outflows)	**1,484,508**																																
Inflows																																	
Reference: estimated energy production (kWh)			968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000
Reference: estimated energy consumption (kWh)			27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500
Assumed: Energy sold to BC Hydro (kWh)			940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500
Cost Savings:																																	
Energy use on site	0	0	3,793	3,906	4,024	4,144	4,269	4,397	4,529	4,665	4,805	4,949	5,097	5,250	5,408	5,570	5,737	5,909	6,086	6,269	6,457	6,651	6,850	7,056	7,267	7,485	7,710	7,941	8,179	8,425	8,677	8,938	9,206
Energy Credit sold to BC Hydro	0	0	49,889	51,385	52,927	54,515	56,150	57,835	59,570	61,357	63,198	65,094	67,046	69,058	71,130	73,263	75,461	77,725	80,057	82,459	84,932	87,480	90,105	92,808	95,592	98,460	101,414	104,456	107,590	110,817	114,142	117,566	121,093
Energy Use on Site Present Value	**77,245**																																
Total Inflows	0	0	53,682	55,292	56,951	58,659	60,419	62,232	64,099	66,022	68,002	70,042	72,144	74,308	76,537	78,833	81,198	83,634	86,143	88,727	91,389	94,131	96,955	99,863	102,859	105,945	109,124	112,397	115,769	119,242	122,819	126,504	130,299
Present Value	0	0	46,372	45,489	44,622	43,772	42,939	42,121	41,319	40,531	39,759	39,002	38,259	37,530	36,816	36,114	35,426	34,752	34,090	33,440	32,803	32,179	31,566	30,964	30,375	29,796	29,229	28,672	28,126	27,590	27,064	26,549	26,043
Net Present Value (Total Inflows)	**1,093,311**																																
Net Cash Flow Before Tax	-35,861	-1,279,034	-16,636	44,426	45,759	47,132	48,546	42,664	51,502	53,047	54,639	56,278	49,459	59,705	61,496	63,341	65,241	57,337	69,214	71,291	73,430	75,632	66,469	80,238	82,646	85,125	87,679	77,056	93,018	95,809	98,683	101,644	89,329
Present Value	-34,153	-1,160,121	-14,371	36,549	35,853	35,170	34,500	28,877	33,199	32,566	31,946	31,338	26,229	30,155	29,581	29,017	28,465	23,825	27,391	26,869	26,357	25,855	21,641	24,879	24,405	23,941	23,485	19,657	22,598	22,168	21,746	21,332	17,854
Discounted Value	-1,708	-118,912	-2,265	7,877	9,906	11,961	14,045	13,787	18,303	20,481	22,693	24,940	23,230	29,550	31,915	34,324	36,777	33,512	41,824	44,422	47,073	49,778	44,829	55,359	58,240	61,184	64,194	57,400	70,420	73,641	76,937	80,312	71,475

Net Present Value	**(391,197)**
Discounted Return on Investment (DROI)	**-0.26**
Payback Period	



Assumptions:

Outflows

Microturbine Facility, Includes:

Direct turbine assets - $-725,000- $800,000- (USD) provided by InPipe Energy as total cost for microturbine infrastructure and installation. Assumed 75% of cost for infrastructure and 25% for installation. Escalated cost provided by supplier in 2025 to determine cost in 2026 (1 year worth of escalation). Multiplied by 1.3 to convert from USD to CAD (assumed 1USD=1.3 CAD). $75,000 subtracted from cost of InPipe kiosk and $125,000 subtracted for cost of redundant PRV that would be installed in microturbine wasn;t

Microturbine capital expenditure cost from InPipe energy includes a kiosk. It was assumed that the cost is 75,000 USD. CRD will be procuring a separate kiosk so this was removed from their quote. With the installation of a microturbine a redundant PRV is not required. This cost was subtracted from the microturbine cost estimated at CA$125,000.

Spare Parts - Assumed this cost was included in budgetary quote from InPipe Energy

Kiosk Costs Include:

An individual kiosk for the PRV is estimated to cost$95,227 ($86,570+10% for 1.2m wider kiosk required than quoted) and a combined kiosk for the PRV and microturbine is estimated to cost $137,940 ($125,400+10% for 1.2m wider kiosk required than quoted) . It is assumed that a redundant 500mm PRV is required if a microturbine is not installed. This allows an approximate reduction of 1m in width to the combined kiosk. The kiosk cost for the additional 1m is estimated to be $19,705.

At this time it was assumed that roof access would not be provided and electrical panels would not be installed within the kiosk.

Assume $3000/m3 for additional concrete slab required. 2.4m^2 (1m additional width, 8m length and 0.3m height based on Option 1 combined kiosk which is the more conservative option)

Project Management - Assume 3% of subtotal construction cost. 1% of which is spent in Year 1 and 2% in Year 2.

Design Fee - Assume 7% of subtotal construction cost. 2% of which is spent in Year 1 and 5% in Year 2.

Construction Management - Assume 5% of subtotal construction cost. 2% of which is spent in Year 1 and 3% in Year 2.

Labour Annual - Cost provided by supplier ($14,000 in 2022) escalated and converted to USD (Assume 1 USD = 1.3 CAD)

Labour (every 5 years) - Assumed labour cost every 5 years will be 60% of the cost of annual labour, escalated cost to respective year and converted to USD.

Inflows

Energy Production - Cost savings from not having to pay for energy. Assumed microturbine will produce 968,000 kWh annually based on flows expected at Humpback PCS and assumed average cost of electricity at PCS Site to be $0.115/kWh (CAD). Escalated cost of every item to determine cost in 2027 and onwards.

Estimated annual energy consumption at the PCS is 27,500 kWh as provided by CRD and the rolling electricity rate based on a 12-month average is $0.13/kWh.

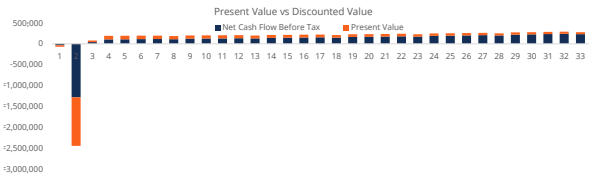
Carbon Cost Savings - Starting from April 2025, the carbon tax in British Columbia is being abolished. Direct cost savings from reduced GHG emissions will not contribute to the inflows. However, environmental impacts from producing renewable energy have been considered using the typical levels of GHG in the surrounding area.

Net Present Value of Humpback Microturbine Sensitivity Power Prod High

Assumed Parameters	
Discount Rate	5%
Escalation Rate	3%
Evaluation Period (Years)	30.00
Current Financial Year	2025
Design Year	2026
Start of Construction	2027
USD to CAD Conversion	1.30
Cost of Electricity Import ($/kWh)	0.13
Cost of Electricity export ($/kWh)	0.100
Assumed Scenario	Self Generation

Project Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Financial Year Ending	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057
Discount Factor	0.95	0.91	0.86	0.82	0.78	0.75	0.71	0.68	0.64	0.61	0.58	0.56	0.53	0.51	0.48	0.46	0.44	0.42	0.40	0.38	0.36	0.34	0.33	0.31	0.30	0.28	0.27	0.26	0.24	0.23	0.22	0.21	0.20
Outflows																																	
Capital Expenditure																																	
Microturbine		1,165,617																															
Kiosk		22,326																															
Concrete Slab		7,416																															
Project Management (3% of capital cost)	11,954	23,907																															
Design Fee (7% of total capital cost)	23,907	59,768																															
Construction Management (5% of total capital cost)			59,768																														
Total Captial Expenditure	35,861	1,279,034	59,768	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Present Value	34,153	1,160,121	51,630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total Capital Net Present Value	**1,245,904**																																
Operational Expenditure																																	
Labour (Annual)			10,549	10,866	11,192	11,528	11,873	12,230	12,597	12,974	13,364	13,765	14,178	14,603	15,041	15,492	15,957	16,436	16,929	17,437	17,960	18,498	19,053	19,625	20,214	20,820	21,445	22,088	22,751	23,433	24,136	24,860	25,606
Labour (Required every 5 years)								7,338					8,507					9,861					11,432					13,253					15,364
Total Operational Expenditure	0	0	10,549	10,866	11,192	11,528	11,873	19,567	12,597	12,974	13,364	13,765	22,684	14,603	15,041	15,492	15,957	26,297	16,929	17,437	17,960	18,498	30,485	19,625	20,214	20,820	21,445	35,341	22,751	23,433	24,136	24,860	40,970
Present Value	0	0	9,113	8,939	8,769	8,602	8,438	13,244	8,120	7,965	7,813	7,665	12,030	7,375	7,235	7,097	6,962	10,927	6,699	6,572	6,446	6,324	9,925	6,085	5,969	5,855	5,744	9,015	5,527	5,422	5,319	5,217	8,189
Total Operational Net Present Value	**238,604**																																
Total Outflows	35,861	1,279,034	70,317	10,866	11,192	11,528	11,873	19,567	12,597	12,974	13,364	13,765	22,684	14,603	15,041	15,492	15,957	26,297	16,929	17,437	17,960	18,498	30,485	19,625	20,214	20,820	21,445	35,341	22,751	23,433	24,136	24,860	40,970
Present Value	34,153	1,160,121	60,743	8,939	8,769	8,602	8,438	13,244	8,120	7,965	7,813	7,665	12,030	7,375	7,235	7,097	6,962	10,927	6,699	6,572	6,446	6,324	9,925	6,085	5,969	5,855	5,744	9,015	5,527	5,422	5,319	5,217	8,189
Net Present Value (Total Outflows)	**1,484,508**																																
Inflows																																	
Reference: estimated energy production (kWh)			1,050,000	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000
Reference: estimated energy consumption (kWh)			27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500
Assumed: Energy sold to BC Hydro (kWh)			1,022,500	1,022,500	1,022,500	1,022,500	1,022,500	1,022,500	1,022,500	1,022,500	1,022,500	1,022,500	1,022,500	1,022,500	1,022,500	1,022,500	1,022,500	1,022,500	1,022,500	1,022,500	1,022,500	1,022,500	1,022,500	1,022,500	1,022,500	1,022,500	1,022,500	1,022,500	1,022,500	1,022,500	1,022,500	1,022,500	1,022,500
Cost Savings:																																	
Energy use on site	0	0	3,793	3,906	4,024	4,144	4,269	4,397	4,529	4,665	4,805	4,949	5,097	5,250	5,408	5,570	5,737	5,909	6,086	6,269	6,457	6,651	6,850	7,056	7,267	7,485	7,710	7,941	8,179	8,425	8,677	8,938	9,206
Energy Credit sold to BC Hydro	0	0	108,477	111,731	115,083	118,536	122,092	125,755	129,527	133,413	137,415	141,538	145,784	150,158	154,662	159,302	164,081	169,004	174,074	179,296	184,675	190,215	195,922	201,799	207,853	214,089	220,511	227,127	233,941	240,959	248,188	255,633	263,302
Energy Use on Site Present Value	**77,245**																																
Total Inflows	0	0	112,270	115,638	119,107	122,680	126,361	130,151	134,056	138,078	142,220	146,487	150,881	155,408	160,070	164,872	169,818	174,913	180,160	185,565	191,132	196,866	202,772	208,855	215,120	221,574	228,221	235,068	242,120	249,384	256,865	264,571	272,508
Present Value	0	0	96,983	95,136	93,323	91,546	89,802	88,092	86,414	84,768	83,153	81,569	80,015	78,491	76,996	75,530	74,091	72,680	71,295	69,937	68,605	67,299	66,017	64,759	63,526	62,316	61,129	59,964	58,822	57,702	56,603	55,525	54,467
Net Present Value (Total Inflows)	**2,286,553**																																
Net Cash Flow Before Tax	-35,861	-1,279,034	41,952	104,772	107,915	111,153	114,487	110,584	121,459	125,103	128,856	132,722	128,197	140,805	145,029	149,380	153,861	148,616	163,231	168,128	173,172	178,367	172,286	189,230	194,907	200,754	206,777	199,727	219,369	225,950	232,729	239,711	231,538
Present Value	-34,153	-1,160,121	36,240	86,196	84,554	82,944	81,364	74,848	78,294	76,803	75,340	73,905	67,986	71,116	69,761	68,433	67,129	61,753	64,596	63,366	62,159	60,975	56,091	58,674	57,556	56,460	55,385	50,949	53,295	52,280	51,284	50,307	46,278
Discounted Value	-1,708	-118,912	5,712	18,576	23,361	28,209	33,123	35,736	43,166	48,301	53,517	58,817	60,211	69,689	75,268	80,947	86,732	86,863	98,635	104,762	111,013	117,392	116,195	130,556	137,350	144,294	151,392	148,778	166,074	173,670	181,445	189,404	185,260

Net Present Value	**802,045**
Discounted Return on Investment (DROI)	**0.54**
Payback Period	



Assumptions:

Outflows

Microturbine Facility, Includes:

Direct turbine assets - $-725,000- $800,000- (USD) provided by InPipe Energy as total cost for microturbine infrastructure and installation. Assumed 75% of cost for infrastructure and 25% for installation. Escalated cost provided by supplier in 2025 to determine cost in 2026 (1 year worth of escalation). Multiplied by 1.3 to convert from USD to CAD (assumed 1USD=1.3 CAD). $75,000 subtracted from cost of InPipe kiosk and $125,000 subtracted for cost of redundant PRV that would be installed in microturbine wasn;t

Microturbine capital expenditure cost from InPipe energy includes a kiosk. It was assumed that the cost is 75,000 USD. CRD will be procuring a separate kiosk so this was removed from their quote. With the installation of a microturbine a redundant PRV is not required. This cost was subtracted from the microturbine cost estimated at CA$125,000.

Spare Parts - Assumed this cost was included in budgetary quote from InPipe Energy

Kiosk Costs Include:

An individual kiosk for the PRV is estimated to cost$95,227 ($86,570+10% for 1.2m wider kiosk required than quoted) and a combined kiosk for the PRV and microturbine is estimated to cost $137,940 ($125,400+10% for 1.2m wider kiosk required than quoted) . It is assumed that a redundant 500mm PRV is required if a microturbine is not installed. This allows an approximate reduction of 1m in width to the combined kiosk. The kiosk cost for the additional 1m is estimated to be $19,705.

At this time it was assumed that roof access would not be provided and electrical panels would not be installed within the kiosk.

Assume $3000/m3 for additional concrete slab required. 2.4m^2 (1m additional width, 8m length and 0.3m height based on Option 1 combined kiosk which is the more conservative option)

Project Management - Assume 3% of subtotal construction cost. 1% of which is spent in Year 1 and 2% in Year 2.

Design Fee - Assume 7% of subtotal construction cost. 2% of which is spent in Year 1 and 5% in Year 2.

Construction Management - Assume 5% of subtotal construction cost. 2% of which is spent in Year 1 and 3% in Year 2.

Labour Annual - Cost provided by supplier ($14,000 in 2022) escalated and converted to USD (Assume 1 USD = 1.3 CAD)

Labour (every 5 years) - Assumed labour cost every 5 years will be 60% of the cost of annual labour, escalated cost to respective year and converted to USD.

Inflows

Energy Production - Cost savings from not having to pay for energy. Assumed microturbine will produce 968,000 kWh annually based on flows expected at Humpback PCS and assumed average cost of electricity at PCS Site to be $0.115/kWh (CAD). Escalated cost of every item to determine cost in 2027 and onwards.

Estimated annual energy consumption at the PCS is 27,500 kWh as provided by CRD and the rolling electricity rate based on a 12-month average is $0.13/kWh.

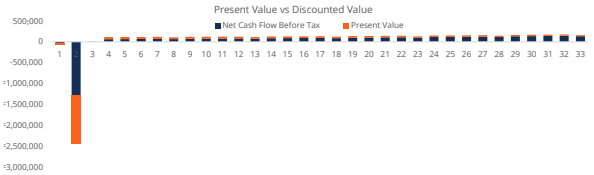
Carbon Cost Savings - Starting from April 2025, the carbon tax in British Columbia is being abolished. Direct cost savings from reduced GHG emissions will not contribute to the inflows. However, environmental impacts from producing renewable energy have been considered using the typical levels of GHG in the surrounding area.

Net Present Value of Humpback Microturbine Sensitivity Power Prod Low

Assumed Parameters	
Discount Rate	5%
Escalation Rate	3%
Evaluation Period (Years)	30.00
Current Financial Year	2025
Design Year	2026
Start of Construction	2027
USD to CAD Conversion	1.30
Cost of Electricity Import ($/kWh)	0.13
Cost of Electricity export ($/kWh)	0.100
Assumed Scenario	Self Generation

Project Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Financial Year Ending	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057
Discount Factor	0.95	0.91	0.86	0.82	0.78	0.75	0.71	0.68	0.64	0.61	0.58	0.56	0.53	0.51	0.48	0.46	0.44	0.42	0.40	0.38	0.36	0.34	0.33	0.31	0.30	0.28	0.27	0.26	0.24	0.23	0.22	0.21	0.20
Outflows																																	
Capital Expenditure																																	
Microturbine		1,165,617																															
Kiosk		22,326																															
Concrete Slab		7,416																															
Project Management (3% of capital cost)	11,954	23,907																															
Design Fee (7% of total capital cost)	23,907	59,768																															
Construction Management (5% of total capital cost)			59,768																														
Total Captial Expenditure	35,861	1,279,034	59,768	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Present Value	34,153	1,160,121	51,630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total Capital Net Present Value	**1,245,904**																																
Operational Expenditure																																	
Labour (Annual)			10,549	10,866	11,192	11,528	11,873	12,230	12,597	12,974	13,364	13,765	14,178	14,603	15,041	15,492	15,957	16,436	16,929	17,437	17,960	18,498	19,053	19,625	20,214	20,820	21,445	22,088	22,751	23,433	24,136	24,860	25,606
Labour (Required every 5 years)								7,338					8,507					9,861					11,432					13,253					15,364
Total Operational Expenditure	0	0	10,549	10,866	11,192	11,528	11,873	19,567	12,597	12,974	13,364	13,765	22,684	14,603	15,041	15,492	15,957	26,297	16,929	17,437	17,960	18,498	30,485	19,625	20,214	20,820	21,445	35,341	22,751	23,433	24,136	24,860	40,970
Present Value	0	0	9,113	8,939	8,769	8,602	8,438	13,244	8,120	7,965	7,813	7,665	12,030	7,375	7,235	7,097	6,962	10,927	6,699	6,572	6,446	6,324	9,925	6,085	5,969	5,855	5,744	9,015	5,527	5,422	5,319	5,217	8,189
Total Operational Net Present Value	**238,604**																																
Total Outflows	35,861	1,279,034	70,317	10,866	11,192	11,528	11,873	19,567	12,597	12,974	13,364	13,765	22,684	14,603	15,041	15,492	15,957	26,297	16,929	17,437	17,960	18,498	30,485	19,625	20,214	20,820	21,445	35,341	22,751	23,433	24,136	24,860	40,970
Present Value	34,153	1,160,121	60,743	8,939	8,769	8,602	8,438	13,244	8,120	7,965	7,813	7,665	12,030	7,375	7,235	7,097	6,962	10,927	6,699	6,572	6,446	6,324	9,925	6,085	5,969	5,855	5,744	9,015	5,527	5,422	5,319	5,217	8,189
Net Present Value (Total Outflows)	**1,484,508**																																
Inflows																																	
Reference: estimated energy production (kWh)			670,000	670,000	670,000	670,000	670,000	670,000	670,000	670,000	670,000	670,000	670,000	670,000	670,000	670,000	670,000	670,000	670,000	670,000	670,000	670,000	670,000	670,000	670,000	670,000	670,000	670,000	670,000	670,000	670,000	670,000	670,000
Reference: estimated energy consumption (kWh)			27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500
Assumed: Energy sold to BC Hydro (kWh)			642,500	642,500	642,500	642,500	642,500	642,500	642,500	642,500	642,500	642,500	642,500	642,500	642,500	642,500	642,500	642,500	642,500	642,500	642,500	642,500	642,500	642,500	642,500	642,500	642,500	642,500	642,500	642,500	642,500	642,500	642,500
Cost Savings:																																	
Energy use on site	0	0	3,793	3,906	4,024	4,144	4,269	4,397	4,529	4,665	4,805	4,949	5,097	5,250	5,408	5,570	5,737	5,909	6,086	6,269	6,457	6,651	6,850	7,056	7,267	7,485	7,710	7,941	8,179	8,425	8,677	8,938	9,206
Energy Credit sold to BC Hydro	0	0	68,163	70,208	72,314	74,483	76,718	79,019	81,390	83,832	86,347	88,937	91,605	94,353	97,184	100,099	103,102	106,195	109,381	112,663	116,043	119,524	123,110	126,803	130,607	134,525	138,561	142,718	146,999	151,409	155,952	160,630	165,449
Energy Use on Site Present Value	**77,245**																																
Total Inflows	0	0	71,956	74,114	76,338	78,628	80,987	83,416	85,919	88,496	91,151	93,886	96,702	99,603	102,591	105,669	108,839	112,104	115,468	118,932	122,499	126,174	129,960	133,859	137,874	142,010	146,271	150,659	155,179	159,834	164,629	169,568	174,655
Present Value	0	0	62,158	60,974	59,813	58,673	57,556	56,459	55,384	54,329	53,294	52,279	51,283	50,306	49,348	48,408	47,486	46,582	45,694	44,824	43,970	43,133	42,311	41,505	40,715	39,939	39,178	38,432	37,700	36,982	36,278	35,587	34,909
Net Present Value (Total Inflows)	**1,465,490**																																
Net Cash Flow Before Tax	-35,861	-1,279,034	1,638	63,248	65,146	67,100	69,113	63,849	73,322	75,522	77,787	80,121	74,018	85,000	87,550	90,177	92,882	85,807	98,539	101,495	104,540	107,676	99,474	114,234	117,661	121,190	124,826	115,318	132,428	136,401	140,493	144,708	133,685
Present Value	-34,153	-1,160,121	1,415	52,035	51,043	50,071	49,117	43,215	47,264	46,364	45,481	44,614	39,253	42,931	42,113	41,311	40,524	35,655	38,995	38,252	37,524	36,809	32,386	35,420	34,745	34,084	33,434	29,417	32,173	31,560	30,959	30,369	26,720
Discounted Value	-1,708	-118,912	223	11,214	14,102	17,029	19,996	20,633	26,058	29,158	32,307	35,507	34,765	42,069	45,437	48,866	52,358	50,153	59,544	63,243	67,016	70,867	67,088	78,813	82,915	87,107	91,392	85,901	100,255	104,841	109,534	114,338	106,965

Net Present Value	**(19,018)**
Discounted Return on Investment (DROI)	**-0.01**
Payback Period	



Assumptions:

Outflows

Microturbine Facility, Includes:

Direct turbine assets - $-725,000- $800,000- (USD) provided by InPipe Energy as total cost for microturbine infrastructure and installation. Assumed 75% of cost for infrastructure and 25% for installation. Escalated cost provided by supplier in 2025 to determine cost in 2026 (1 year worth of escalation). Multiplied by 1.3 to convert from USD to CAD (assumed 1USD=1.3 CAD). $75,000 subtracted from cost of InPipe kiosk and $125,000 subtracted for cost of redundant PRV that would be installed in microturbine wasn;t

Microturbine capital expenditure cost from InPipe energy includes a kiosk. It was assumed that the cost is 75,000 USD. CRD will be procuring a separate kiosk so this was removed from their quote. With the installation of a microturbine a redundant PRV is not required. This cost was subtracted from the microturbine cost estimated at CA$125,000.

Spare Parts - Assumed this cost was included in budgetary quote from InPipe Energy

Kiosk Costs Include:

An individual kiosk for the PRV is estimated to cost$95,227 ($86,570+10% for 1.2m wider kiosk required than quoted) and a combined kiosk for the PRV and microturbine is estimated to cost $137,940 ($125,400+10% for 1.2m wider kiosk required than quoted) . It is assumed that a redundant 500mm PRV is required if a microturbine is not installed. This allows an approximate reduction of 1m in width to the combined kiosk. The kiosk cost for the additional 1m is estimated to be $19,705.

At this time it was assumed that roof access would not be provided and electrical panels would not be installed within the kiosk.

Assume $3000/m3 for additional concrete slab required. 2.4m^2 (1m additional width, 8m length and 0.3m height based on Option 1 combined kiosk which is the more conservative option)

Project Management - Assume 3% of subtotal construction cost. 1% of which is spent in Year 1 and 2% in Year 2.

Design Fee - Assume 7% of subtotal construction cost. 2% of which is spent in Year 1 and 5% in Year 2.

Construction Management - Assume 5% of subtotal construction cost. 2% of which is spent in Year 1 and 3% in Year 2.

Labour Annual - Cost provided by supplier ($14,000 in 2022) escalated and converted to USD (Assume 1 USD = 1.3 CAD)

Labour (every 5 years) - Assumed labour cost every 5 years will be 60% of the cost of annual labour, escalated cost to respective year and converted to USD.

Inflows

Energy Production - Cost savings from not having to pay for energy. Assumed microturbine will produce 968,000 kWh annually based on flows expected at Humpback PCS and assumed average cost of electricity at PCS Site to be $0.115/kWh (CAD). Escalated cost of every item to determine cost in 2027 and onwards.

Estimated annual energy consumption at the PCS is 27,500 kWh as provided by CRD and the rolling electricity rate based on a 12-month average is $0.13/kWh.

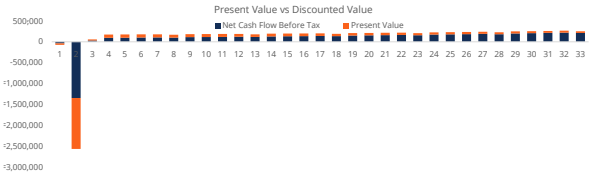
Carbon Cost Savings - Starting from April 2025, the carbon tax in British Columbia is being abolished. Direct cost savings from reduced GHG emissions will not contribute to the inflows. However, environmental impacts from producing renewable energy have been considered using the typical levels of GHG in the surrounding area.

Net Present Value of Humpback Microturbine Sensitivity Capita Cost High

Assumed Parameters	
Discount Rate	5%
Escalation Rate	3%
Evaluation Period (Years)	30.00
Current Financial Year	2025
Design Year	2026
Start of Construction	2027
USD to CAD Conversion	1.30
Cost of Electricity Import ($/kWh)	0.13
Cost of Electricity export ($/kWh)	0.100
Assumed Scenario	Self Generation

Project Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Financial Year Ending	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057
Discount Factor	0.95	0.91	0.86	0.82	0.78	0.75	0.71	0.68	0.64	0.61	0.58	0.56	0.53	0.51	0.48	0.46	0.44	0.42	0.40	0.38	0.36	0.34	0.33	0.31	0.30	0.28	0.27	0.26	0.24	0.23	0.22	0.21	0.20
Outflows																																	
Capital Expenditure																																	
Microturbine		1,165,617																															
Kiosk		22,326																															
Concrete Slab		7,416																															
Project Management (3% of capital cost)	11,954	23,907																															
Design Fee (7% of total capital cost)	23,907	59,768																															
Construction Management (5% of total capital cost)			59,768																														
Total Captial Expenditure	37,654	1,342,985	62,756	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Present Value	35,861	1,218,127	54,211	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total Capital Net Present Value	**1,308,199**																																
Operational Expenditure																																	
Labour (Annual)			10,549	10,866	11,192	11,528	11,873	12,230	12,597	12,974	13,364	13,765	14,178	14,603	15,041	15,492	15,957	16,436	16,929	17,437	17,960	18,498	19,053	19,625	20,214	20,820	21,445	22,088	22,751	23,433	24,136	24,860	25,606
Labour (Required every 5 years)								7,338					8,507					9,861					11,432					13,253					15,364
Total Operational Expenditure	0	0	10,549	10,866	11,192	11,528	11,873	19,567	12,597	12,974	13,364	13,765	22,684	14,603	15,041	15,492	15,957	26,297	16,929	17,437	17,960	18,498	30,485	19,625	20,214	20,820	21,445	35,341	22,751	23,433	24,136	24,860	40,970
Present Value	0	0	9,113	8,939	8,769	8,602	8,438	13,244	8,120	7,965	7,813	7,665	12,030	7,375	7,235	7,097	6,962	10,927	6,699	6,572	6,446	6,324	9,925	6,085	5,969	5,855	5,744	9,015	5,527	5,422	5,319	5,217	8,189
Total Operational Net Present Value	**238,604**																																
Total Outflows	37,654	1,342,985	73,306	10,866	11,192	11,528	11,873	19,567	12,597	12,974	13,364	13,765	22,684	14,603	15,041	15,492	15,957	26,297	16,929	17,437	17,960	18,498	30,485	19,625	20,214	20,820	21,445	35,341	22,751	23,433	24,136	24,860	40,970
Present Value	35,861	1,218,127	63,324	8,939	8,769	8,602	8,438	13,244	8,120	7,965	7,813	7,665	12,030	7,375	7,235	7,097	6,962	10,927	6,699	6,572	6,446	6,324	9,925	6,085	5,969	5,855	5,744	9,015	5,527	5,422	5,319	5,217	8,189
Net Present Value (Total Outflows)	**1,546,803**																																
Inflows																																	
Reference: estimated energy production (kWh)			968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000
Reference: estimated energy consumption (kWh)			27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500
Assumed: Energy sold to BC Hydro (kWh)			940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500
Cost Savings:																																	
Energy use on site	0	0	3,793	3,906	4,024	4,144	4,269	4,397	4,529	4,665	4,805	4,949	5,097	5,250	5,408	5,570	5,737	5,909	6,086	6,269	6,457	6,651	6,850	7,056	7,267	7,485	7,710	7,941	8,179	8,425	8,677	8,938	9,206
Energy Credit sold to BC Hydro	0	0	99,778	102,771	105,854	109,030	112,301	115,670	119,140	122,714	126,395	130,187	134,093	138,116	142,259	146,527	150,923	155,450	160,114	164,917	169,865	174,961	180,210	185,616	191,184	196,920	202,827	208,912	215,180	221,635	228,284	235,133	242,187
Energy Use on Site Present Value	**77,245**																																
Total Inflows	0	0	103,570	106,677	109,878	113,174	116,569	120,066	123,668	127,378	131,200	135,136	139,190	143,366	147,667	152,097	156,659	161,359	166,200	171,186	176,322	181,611	187,060	192,671	198,452	204,405	210,537	216,853	223,359	230,060	236,961	244,070	251,392
Present Value	0	0	89,468	87,764	86,092	84,452	82,844	81,266	79,718	78,199	76,710	75,249	73,815	72,409	71,030	69,677	68,350	67,048	65,771	64,518	63,289	62,084	60,901	59,741	58,603	57,487	56,392	55,318	54,264	53,231	52,217	51,222	50,246
Net Present Value (Total Inflows)	**2,109,377**																																
Net Cash Flow Before Tax	-37,654	-1,342,985	30,265	95,812	98,686	101,647	104,696	100,499	111,072	114,404	117,836	121,371	116,506	128,763	132,626	136,604	140,703	135,062	149,271	153,749	158,362	163,113	156,574	173,046	178,238	183,585	189,092	181,512	200,608	206,626	212,825	219,210	210,423
Present Value	-35,861	-1,218,127	26,144	78,824	77,323	75,850	74,405	68,022	71,598	70,234	68,896	67,584	61,786	65,034	63,795	62,580	61,388	56,121	59,072	57,947	56,843	55,760	50,976	53,656	52,634	51,632	50,648	46,303	48,737	47,809	46,898	46,005	42,058
Discounted Value	-1,793	-124,858	4,121	16,987	21,363	25,796	30,290	32,477	39,474	44,170	48,940	53,787	54,720	63,729	68,830	74,024	79,314	78,941	90,200	95,803	101,519	107,353	105,598	119,390	125,604	131,953	138,444	135,210	151,871	158,818	165,927	173,205	168,365

Net Present Value	**562,573**
Discounted Return on Investment (DROI)	**0.36**
Payback Period	



Assumptions:

Outflows

Microturbine Facility, Includes:

Direct turbine assets - $-725,000- $800,000- (USD) provided by InPipe Energy as total cost for microturbine infrastructure and installation. Assumed 75% of cost for infrastructure and 25% for installation. Escalated cost provided by supplier in 2025 to determine cost in 2026 (1 year worth of escalation). Multiplied by 1.3 to convert from USD to CAD (assumed 1USD=1.3 CAD). $75,000 subtracted from cost of InPipe kiosk and $125,000 subtracted for cost of redundant PRV that would be installed in microturbine wasn;t

Microturbine capital expenditure cost from InPipe energy includes a kiosk. It was assumed that the cost is 75,000 USD. CRD will be procuring a separate kiosk so this was removed from their quote. With the installation of a microturbine a redundant PRV is not required. This cost was subtracted from the microturbine cost estimated at CA$125,000.

Spare Parts - Assumed this cost was included in budgetary quote from InPipe Energy

Kiosk Costs Include:

An individual kiosk for the PRV is estimated to cost$95,227 ($86,570+10% for 1.2m wider kiosk required than quoted) and a combined kiosk for the PRV and microturbine is estimated to cost $137,940 ($125,400+10% for 1.2m wider kiosk required than quoted) . It is assumed that a redundant 500mm PRV is required if a microturbine is not installed. This allows an approximate reduction of 1m in width to the combined kiosk. The kiosk cost for the additional 1m is estimated to be $19,705.

At this time it was assumed that roof access would not be provided and electrical panels would not be installed within the kiosk.

Assume $3000/m3 for additional concrete slab required. 2.4m^2 (1m additional width, 8m length and 0.3m height based on Option 1 combined kiosk which is the more conservative option)

Project Management - Assume 3% of subtotal construction cost. 1% of which is spent in Year 1 and 2% in Year 2.

Design Fee - Assume 7% of subtotal construction cost. 2% of which is spent in Year 1 and 5% in Year 2.

Construction Management - Assume 5% of subtotal construction cost. 2% of which is spent in Year 1 and 3% in Year 2.

Labour Annual - Cost provided by supplier ($14,000 in 2022) escalated and converted to USD (Assume 1 USD = 1.3 CAD)

Labour (every 5 years) - Assumed labour cost every 5 years will be 60% of the cost of annual labour, escalated cost to respective year and converted to USD.

Inflows

Energy Production - Cost savings from not having to pay for energy. Assumed microturbine will produce 968,000 kWh annually based on flows expected at Humpback PCS and assumed average cost of electricity at PCS Site to be $0.115/kWh (CAD). Escalated cost of every item to determine cost in 2027 and onwards.

Estimated annual energy consumption at the PCS is 27,500 kWh as provided by CRD and the rolling electricity rate based on a 12-month average is $0.13/kWh.

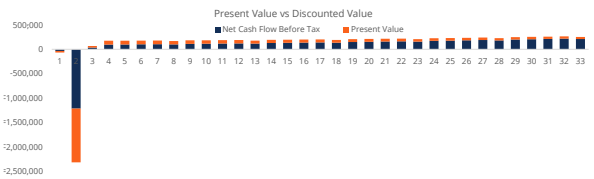
Carbon Cost Savings - Starting from April 2025, the carbon tax in British Columbia is being abolished. Direct cost savings from reduced GHG emissions will not contribute to the inflows. However, environmental impacts from producing renewable energy have been considered using the typical levels of GHG in the surrounding area.

Net Present Value of Humpback Microturbine Sensitivity Capita Cost Low

Assumed Parameters	
Discount Rate	5%
Escalation Rate	3%
Evaluation Period (Years)	30.00
Current Financial Year	2025
Design Year	2026
Start of Construction	2027
USD to CAD Conversion	1.30
Cost of Electricity Import ($/kWh)	0.13
Cost of Electricity export ($/kWh)	0.100
Assumed Scenario	Self Generation

Project Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Financial Year Ending	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057
Discount Factor	0.95	0.91	0.86	0.82	0.78	0.75	0.71	0.68	0.64	0.61	0.58	0.56	0.53	0.51	0.48	0.46	0.44	0.42	0.40	0.38	0.36	0.34	0.33	0.31	0.30	0.28	0.27	0.26	0.24	0.23	0.22	0.21	0.20
Outflows																																	
Capital Expenditure																																	
Microturbine		1,165,617																															
Kiosk		22,326																															
Concrete Slab		7,416																															
Project Management (3% of capital cost)	11,954	23,907																															
Design Fee (7% of total capital cost)	23,907	59,768																															
Construction Management (5% of total capital cost)			59,768																														
Total Captial Expenditure	34,068	1,215,082	56,780	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Present Value	32,445	1,102,115	49,048	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total Capital Net Present Value	**1,183,609**																																
Operational Expenditure																																	
Labour (Annual)			10,549	10,866	11,192	11,528	11,873	12,230	12,597	12,974	13,364	13,765	14,178	14,603	15,041	15,492	15,957	16,436	16,929	17,437	17,960	18,498	19,053	19,625	20,214	20,820	21,445	22,088	22,751	23,433	24,136	24,860	25,606
Labour (Required every 5 years)								7,338					8,507					9,861					11,432					13,253					15,364
Total Operational Expenditure	0	0	10,549	10,866	11,192	11,528	11,873	19,567	12,597	12,974	13,364	13,765	22,684	14,603	15,041	15,492	15,957	26,297	16,929	17,437	17,960	18,498	30,485	19,625	20,214	20,820	21,445	35,341	22,751	23,433	24,136	24,860	40,970
Present Value	0	0	9,113	8,939	8,769	8,602	8,438	13,244	8,120	7,965	7,813	7,665	12,030	7,375	7,235	7,097	6,962	10,927	6,699	6,572	6,446	6,324	9,925	6,085	5,969	5,855	5,744	9,015	5,527	5,422	5,319	5,217	8,189
Total Operational Net Present Value	**238,604**																																
Total Outflows	34,068	1,215,082	67,329	10,866	11,192	11,528	11,873	19,567	12,597	12,974	13,364	13,765	22,684	14,603	15,041	15,492	15,957	26,297	16,929	17,437	17,960	18,498	30,485	19,625	20,214	20,820	21,445	35,341	22,751	23,433	24,136	24,860	40,970
Present Value	32,445	1,102,115	58,161	8,939	8,769	8,602	8,438	13,244	8,120	7,965	7,813	7,665	12,030	7,375	7,235	7,097	6,962	10,927	6,699	6,572	6,446	6,324	9,925	6,085	5,969	5,855	5,744	9,015	5,527	5,422	5,319	5,217	8,189
Net Present Value (Total Outflows)	**1,422,213**																																
Inflows																																	
Reference: estimated energy production (kWh)			968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000	968,000
Reference: estimated energy consumption (kWh)			27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500	27,500
Assumed: Energy sold to BC Hydro (kWh)			940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500	940,500
Cost Savings:																																	
Energy use on site	0	0	3,793	3,906	4,024	4,144	4,269	4,397	4,529	4,665	4,805	4,949	5,097	5,250	5,408	5,570	5,737	5,909	6,086	6,269	6,457	6,651	6,850	7,056	7,267	7,485	7,710	7,941	8,179	8,425	8,677	8,938	9,206
Energy Credit sold to BC Hydro	0	0	99,778	102,771	105,854	109,030	112,301	115,670	119,140	122,714	126,395	130,187	134,093	138,116	142,259	146,527	150,923	155,450	160,114	164,917	169,865	174,961	180,210	185,616	191,184	196,920	202,827	208,912	215,180	221,635	228,284	235,133	242,187
Energy Use on Site Present Value	**77,245**																																
Total Inflows	0	0	103,570	106,677	109,878	113,174	116,569	120,066	123,668	127,378	131,200	135,136	139,190	143,366	147,667	152,097	156,659	161,359	166,200	171,186	176,322	181,611	187,060	192,671	198,452	204,405	210,537	216,853	223,359	230,060	236,961	244,070	251,392
Present Value	0	0	89,468	87,764	86,092	84,452	82,844	81,266	79,718	78,199	76,710	75,249	73,815	72,409	71,030	69,677	68,350	67,048	65,771	64,518	63,289	62,084	60,901	59,741	58,603	57,487	56,392	55,318	54,264	53,231	52,217	51,222	50,246
Net Present Value (Total Inflows)	**2,109,377**																																
Net Cash Flow Before Tax	-34,068	-1,215,082	36,241	95,812	98,686	101,647	104,696	100,499	111,072	114,404	117,836	121,371	116,506	128,763	132,626	136,604	140,703	135,062	149,271	153,749	158,362	163,113	156,574	173,046	178,238	183,585	189,092	181,512	200,608	206,626	212,825	219,210	210,423
Present Value	-32,445	-1,102,115	31,307	78,824	77,323	75,850	74,405	68,022	71,598	70,234	68,896	67,584	61,786	65,034	63,795	62,580	61,388	56,121	59,072	57,947	56,843	55,760	50,976	53,656	52,634	51,632	50,648	46,303	48,737	47,809	46,898	46,005	42,058
Discounted Value	-1,622	-112,967	4,935	16,987	21,363	25,796	30,290	32,477	39,474	44,170	48,940	53,787	54,720	63,729	68,830	74,024	79,314	78,941	90,200	95,803	101,519	107,353	105,598	119,390	125,604	131,953	138,444	135,210	151,871	158,818	165,927	173,205	168,365

Net Present Value	**687,164**
Discounted Return on Investment (DROI)	**0.48**
Payback Period	



Assumptions:

Outflows

Microturbine Facility, Includes:

Direct turbine assets - $-725,000- $800,000- (USD) provided by InPipe Energy as total cost for microturbine infrastructure and installation. Assumed 75% of cost for infrastructure and 25% for installation. Escalated cost provided by supplier in 2025 to determine cost in 2026 (1 year worth of escalation). Multiplied by 1.3 to convert from USD to CAD (assumed 1USD=1.3 CAD). $75,000 subtracted from cost of InPipe kiosk and $125,000 subtracted for cost of redundant PRV that would be installed in microturbine wasn;t

Microturbine capital expenditure cost from InPipe energy includes a kiosk. It was assumed that the cost is 75,000 USD. CRD will be procuring a separate kiosk so this was removed from their quote. With the installation of a microturbine a redundant PRV is not required. This cost was subtracted from the microturbine cost estimated at CA$125,000.

Spare Parts - Assumed this cost was included in budgetary quote from InPipe Energy

Kiosk Costs Include:

An individual kiosk for the PRV is estimated to cost$95,227 ($86,570+10% for 1.2m wider kiosk required than quoted) and a combined kiosk for the PRV and microturbine is estimated to cost $137,940 ($125,400+10% for 1.2m wider kiosk required than quoted) . It is assumed that a redundant 500mm PRV is required if a microturbine is not installed. This allows an approximate reduction of 1m in width to the combined kiosk. The kiosk cost for the additional 1m is estimated to be $19,705.

At this time it was assumed that roof access would not be provided and electrical panels would not be installed within the kiosk.

Assume $3000/m3 for additional concrete slab required. 2.4m^2 (1m additional width, 8m length and 0.3m height based on Option 1 combined kiosk which is the more conservative option)

Project Management - Assume 3% of subtotal construction cost. 1% of which is spent in Year 1 and 2% in Year 2.

Design Fee - Assume 7% of subtotal construction cost. 2% of which is spent in Year 1 and 5% in Year 2.

Construction Management - Assume 5% of subtotal construction cost. 2% of which is spent in Year 1 and 3% in Year 2.

Labour Annual - Cost provided by supplier ($14,000 in 2022) escalated and converted to USD (Assume 1 USD = 1.3 CAD)

Labour (every 5 years) - Assumed labour cost every 5 years will be 60% of the cost of annual labour, escalated cost to respective year and converted to USD.

Inflows

Energy Production - Cost savings from not having to pay for energy. Assumed microturbine will produce 968,000 kWh annually based on flows expected at Humpback PCS and assumed average cost of electricity at PCS Site to be $0.115/kWh (CAD). Escalated cost of every item to determine cost in 2027 and onwards.

Estimated annual energy consumption at the PCS is 27,500 kWh as provided by CRD and the rolling electricity rate based on a 12-month average is $0.13/kWh.

Carbon Cost Savings - Starting from April 2025, the carbon tax in British Columbia is being abolished. Direct cost savings from reduced GHG emissions will not contribute to the inflows. However, environmental impacts from producing renewable energy have been considered using the typical levels of GHG in the surrounding area.

Attachment 7
BC Hydro Self Generation Power Connection Updates

Outlook

Re: Self Generation at Pressure Control Station

From Gill, Tania <Tania.Gill@jacobs.com>
Date Fri 5/1/2026 10:47 AM
To Gill, Tania <Tania.Gill@jacobs.com>

From: Keegan Hardy <kjhardy@crd.bc.ca>
Sent: Wednesday, April 8, 2026 9:39 AM
To: Adrian Wardle <AWardle@crd.bc.ca>; Moore, Patrick <Patrick.Moore@jacobs.com>
Cc: Le, Anita <Anita.Le@jacobs.com>; Jared Kelly <jkelly@crd.bc.ca>
Subject: [EXTERNAL] RE: Self Generation at Pressure Control Station

This Message Is From an External Sender
This message came from outside your organization.

Hey Adrian,

Sorry for the delay on this! Took me sometime to catch up to my email back-log from vacation.

Yes, I can confirm that the newly approved rate structure still includes an increase of injection limit from 100 kW total to 100 kW per phase, or 300 kW for three phase systems. This is stated in section 2.4 of the G-64-26 order.

Great news for us!

Keegan

Keegan Hardy
Corporate Energy Specialist | Climate Action Program
T: 250.360.3099 | C: 672.922.1352 – New!
Facebook | Instagram | LinkedIn | www.crd.bc.ca

Making a difference...together

Capital Regional District
625 Fisgard Street
Victoria, BC V8W 1R7

From: Adrian Wardle <AWardle@crd.bc.ca>
Sent: Monday, March 30, 2026 3:33 PM
To: patrick.moore@jacobs.com; Keegan Hardy <kjhardy@crd.bc.ca>
Cc: anita.le@jacobs.com; Jared Kelly <jkelly@crd.bc.ca>
Subject: FW: Self Generation at Pressure Control Station

Hi Patrick,

Please take note of the changes BC Hydro has implemented below. The buyback rate will only be 10 cents per kWh rather than the 11.5 cents we had assumed in the feasibility study.

Keegan – can you confirm if the 220kW turbine would be acceptable under these new guidelines? It used to be 100kW, and there was speculation that would increase to 100kW per phase (so 300kW). But now I see that it's a 2MW limit for multiple customers, so presumably we should be ok unless there are a bunch of other customers in the community looking to self-generate?

Thank you,

Adrian Wardle, P.Eng. (He/Him/His)
Project Engineer | Corporate Capital Project Delivery Services
T: 250.474.9521| C: 250.508.6729 | E: awardle@crd.bc.ca
Facebook | Instagram | LinkedIn | www.crd.ca

Making a difference...together

Capital Regional District
479 Island Hwy
Victoria, BC V9B 1H7

From: Fahey, Meaghan <Meaghan.Fahey@bchydro.com>
Sent: Monday, March 30, 2026 3:09 PM
To: Keegan Hardy <kjhardy@crd.bc.ca>
Cc: Adrian Wardle <AWardle@crd.bc.ca>
Subject: RE: [External] FW: Self Generation at Pressure Control Station

Hi Keegan,

I wanted to follow up to let you know that the net metering service proposals with the BCUC were approved last week. A few notes on the changes and the news release and order are below:

The following has been approved **effective July 1, 2026** instead of the proposed April 1, 2026:

- Closing the current Net Metering Rate to new customers and establishing a 10-year transition for existing customers;
- Implementing a new Self-Generation Rate which compensates customers for excess generation at a fixed energy price of 10 cents per kWh;
- Launching a new Community Generation Rate for multiple customers to collectively contribute to and benefit from community generating facilities, with a maximum injection limit of 2 MW.

BCUC News Release and BCUC Decision and Order G-64-26.
Thanks very much,
Meaghan

Meaghan Fahey | Senior Key Account Manager, Customer Service

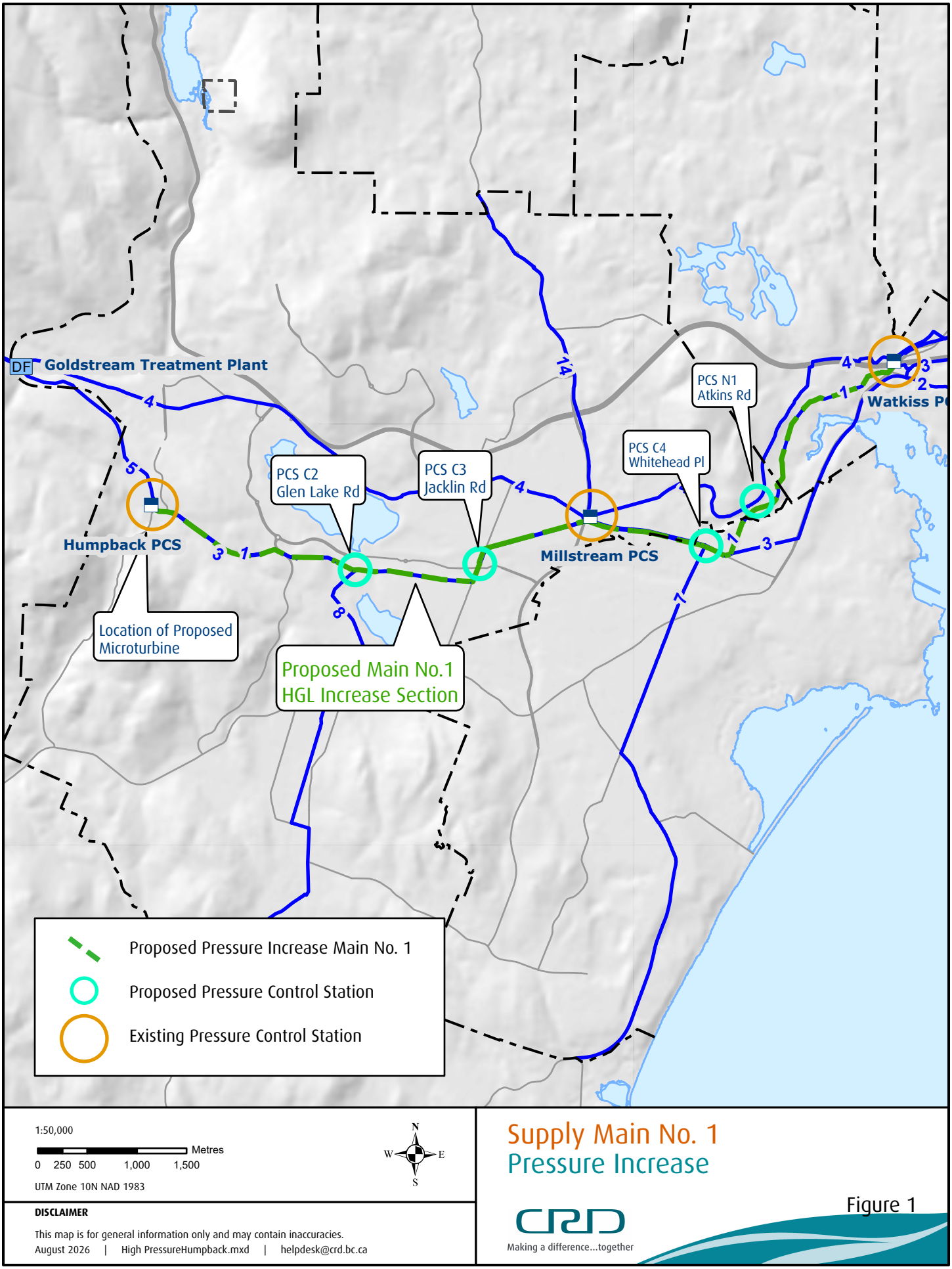
BC Hydro
333 Dunsmuir St, 4th floor
Vancouver, BC V6B 5R3

P 604 699 9421
C 604 209 6465
E meaghan.fahey@bchydro.com

bchydro.com

Smart about power in all we do.

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Metres

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N W E S

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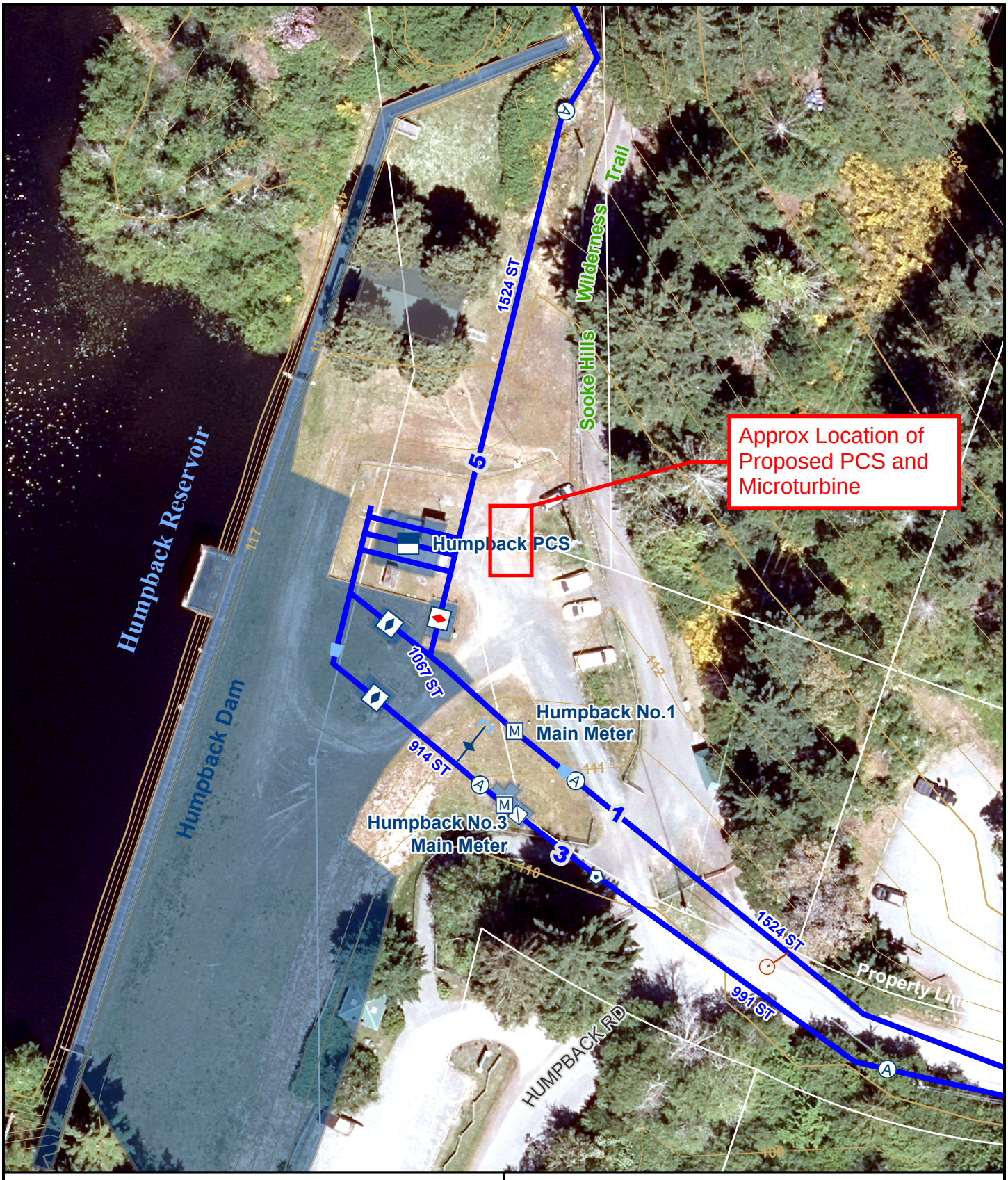
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Supply Main No. 1
Pressure Increase

Figure 1

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1:650

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UTM Zone 10N NAD 1983

N W E S

Humpback PCS General Area

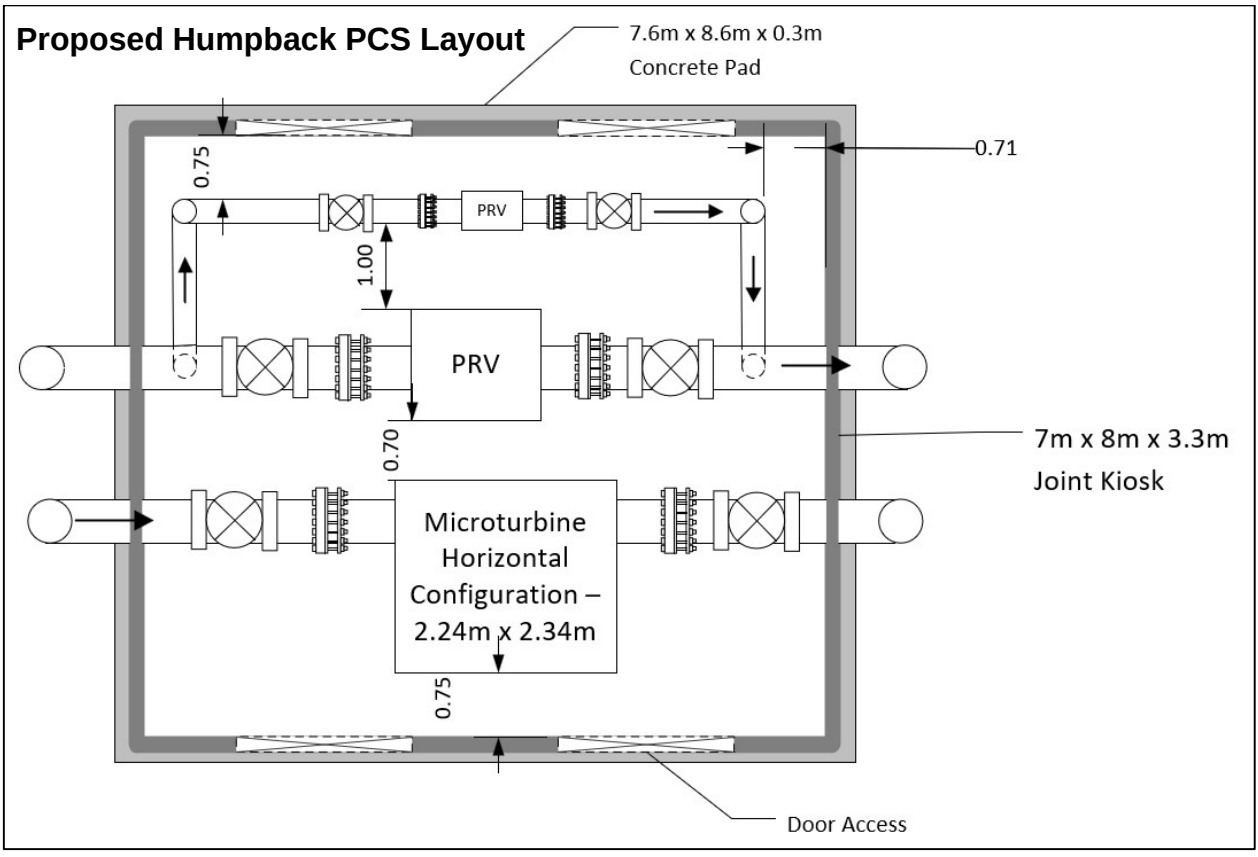
DISCLAIMER

This map is for general information only and may contain inaccuracies.

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CRD

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Proposed Humpback PCS Layout
7.6m x 8.6m x 0.3m
Concrete Pad
0.75
0.71
PRV
1.00
PRV
0.70
7m x 8m x 3.3m
Joint Kiosk
Microturbine
Horizontal
Configuration –
2.24m x 2.34m
0.75
Door Access

Making a difference...together

REPORT TO REGIONAL WATER SUPPLY COMMISSION
MEETING OF WEDNESDAY, SEPTEMBER 16, 2026

SUBJECT **Transmission Main Upgrade Program Update and Award Recommendation**

ISSUE SUMMARY

To provide a status update on the Transmission Main Upgrade Program and recommend awarding subsequent stages of consulting services.

BACKGROUND

The 2022 Regional Water Supply (RWS) Master Plan (Master Plan) identifies multiple treated water transmission main projects to be completed, with several of the identified projects already reflected in the RWS Capital Plan (Capital Plan).

To gain efficiencies in delivering some of these critical transmission main projects, the Capital Regional District (CRD) developed a Transmission Main Upgrade Program (TM Program) and ran a Request for Proposals (RFP), with the resulting contract being awarded to Jacobs Consultancy Canada Inc. (Jacobs) in November of 2023. The TM Program included seven (7) different projects divided between the RWS Service and Saanich Peninsula Water Supply (SPWS) Service. These projects are outlined in Table 1 below.

Table 1 –Transmission Main Upgrade Program – Projects List

RFP Ref #	Projects	Municipality	Service & Cap Plan Ref#	Length (m)	Ex. Dia. (mm)
A2.1	Main No. 4 Upgrade, Goldstream Ave. Alignment (Leigh Rd. to Veterans Memorial Parkway)	Langford	RWS 21-11	1,900	1,372
A2.2	Main No. 3 Upgrade, Wale Rd. and Island Hwy. Alignment (Goldstream Ave. to Adams Pl.)	Colwood, View Royal	RWS 18-18	2,800	1,219
A2.3	Main No. 1 HGL Increase (Humpback PCS to Watkiss PCS)	Langford, Colwood, View Royal	RWS 21-11	N/A	Varies
A2.4	Main No. 4 Upgrade, Central Saanich Rd. Alignment (Mt Newton Cross Rd. to Highway 17)	Central Saanich	RWS 23-17	1,950	762
A2.5	Bear Hill Trunk Extension, East Saanich Rd. Alignment (Wallace Dr. to Dean Park Lower Tank)	DoCS, DoNS	RWS 23-17 SPWS 21-05	3,000	N/A
A2.6	Peninsula Trunk Main Upgrade, Cresswell Rd. & Willingdon Ave. Alignment (McTavish Tank to Mills Rd.)	DoNS	SPWS 21-05	3,600	500
A2.7	Dean Park Feedermain, Dean Park Rd. Alignment (Dean Park Lower Tank to Dean Park Middle Tank)	DoNS	SPWS 21-05	1,300	300
Project Location Plans in Appendix A.					

The consulting services RFP was structured to break the TM Program into the seven (7) projects noted in Table 1, but also to break out the work of each of these projects into the following stages:

- Stage 1a: Concept Development Services
- Stage 1b: Preliminary Design Services
- Stage 2: Detailed Design Services
- Stage 3: Construction Services
- Stage 4: Post Construction Services
- Additional Services as Requested by the CRD

Proponents were advised to omit pricing for some stages of work, either based on uncertainty about construction scheduling or inability to price subsequent stages in advance of earlier work. Table 2 outlines the scope of work assigned in the RFP, with updates to indicate status.

Table 2 – RWS Transmission Main Upgrade Projects – Project Status Summary

Projects		Stage 1a Services	Stage 1b Services	Stage 2 Services	Stage 3 Services	Stage 4 Services
A2.1 – Main No. 4 Upgrade, Goldstream Ave. Alignment (Leigh Rd. to Veterans Memorial Parkway)		Complete	Complete	Recommend to Award (1)	Recommend to Award (1)	Recommend to Award (1)
A2.2 – Main No. 3 Upgrade, A) Wale Rd. and Island Hwy. Alignment	**Part A**	Complete	Complete	(2)	(2)	(2)
B) Goldstream Ave. to Adams Pl.	**Part B**	Complete	Complete	(3)	(3)	(3)
A2.3 – Main No. 1 HGL Increase (Humpback PCS to Watkiss PCS)		Complete	Complete	In Progress	In Progress	
A2.4 – Main No. 4 Upgrade, Central Saanich Rd. Alignment (Mt Newton Cross Rd. to Highway 17)		(4)	Complete	Complete	In Progress	
A2.5 – Bear Hill Trunk Extension, East Saanich Rd. Alignment (Wallace Dr. to Dean Park Lower Tank)		(4)	Complete	Complete	In Progress	
A2.6 – Peninsula Trunk Main Upgrade, Cresswell Rd. & Willingdon Ave. Alignment (McTavish Tank to Mills Rd.)		(4)	Complete	(2)	(2)	(2)
A2.7 – Dean Park Feedermain, Dean Park Rd. Alignment (Dean Park Lower Tank to Dean Park Middle Tank)		(4)	Complete	(2)	(2)	(2)

Awarded Recommended to Award

Numbering referenced below:

(1) Pricing for these stages of work was omitted from the original RFP as the routing analysis required in Stage 1a would have a significant impact on overall level of effort required for subsequent stage. CRD reserved the option to direct award subsequent stages and are requesting this under this staff report.

(2) Pricing for these stages of work was omitted from the original RFP as the timeline for construction was uncertain and anticipated to be too far into the future and subject to prioritization with other projects and funding requirements.

(3) Pricing for these stages of work were originally submitted in response to the RFP, but removed by negative change order based on the preferred alignment determined for Part A, which would have reduced the value of this investment.

(4) Pricing for these stages of work was omitted from the original RFP as initial starting point was better defined.

More detailed project status updates have been included in Appendix B, and a schedule update has been included in Appendix C.

Recommended Carry-On Work

As indicated above, proponents were not asked to provide all pricing in response to the RFP submission, but the original RFP did clearly state:

> *"For those projects that are not listed as progressing through to construction, CRD will reserve the option to award subsequent stages of work as carry on work to this contract."*

As outlined in Table 2, all stages of design work (Stages 1a, 1b & 2) originally assigned to Jacobs are now nearing completion. Projects A2.4 & A2.5 are also under construction, and Jacobs has been progressing well with Stage 3: Construction Services for these projects. Pending direction from the Regional Water Supply Commission (Commission) in response to staff report 26-0929: *Renewable Energy Generation Proposal at Humpback PCS*, the TM Program will also have a path forward to bring Project A2.3 through to construction, which would complete phase 1 of the treated water transmission main updates outlined in the Master Plan.

Aside from work that has already been assigned to Jacobs' contract, the next critical project to advance to detailed design and construction is Project A2.1. This project represents a critical portion of the phase 3 treated water transmission main updates outlined in the Master Plan and subsequently shown as advancing as part of the RWS Master Plan Implementation Plan (Implementation Plan). This 1.9km segment of Supply Main No. 4 has been highlighted as high priority as it will not only be increased in size for future capacity but also target replacement of a 1,372mm diameter segment of 50+ year old concrete pressure pipe (CPP), currently located in Langford's urban core. This CPP pipe segment along Goldstream Avenue (Leigh Road to Veterans Memorial Parkway) would be replaced with a more seismically resilient 1,524mm welded steel pipeline. The preferred alignment for this replacement was determined through a multi-criteria alternative alignment assessment, which is included as part of the Preliminary Design Report in Appendix E.

Pricing for detailed design and construction services for Project A2.1 was not requested from the proponents at the time of the RFP because these stages of work could not be effectively priced prior to the alignment assessment that was required as part of the earlier stages of work. With a preferred alignment now identified, Jacobs has provided pricing to continue with these subsequent stages of work, which have been outlined in the draft change orders in Appendix D for reference. Given that these changes would result in a total contract value exceeding the $5,000,000 delegated authority of the CAO and requires approval of the Commission.

A summary of the consulting services awarded to Jacobs to date and associated fees under this contract in outlined in Table 3, as well as the recommended authorization for subsequent stages of work. Change Orders issued to date have been aligned with the original scope of services contemplated in the RFP. Notable changes include the utility locate program, which was requested in the RFP to be omitted from pricing, and the additional work to incorporate underground and surface works improvements for both the District of Central Saanich (DoCS) and District of North Saanich (DoNS) in collaboration on projects A2.4 and A2.5. A more detailed breakdown of change orders issued to date is included in Appendix D.

Table 3 - Consulting Services Contract Award and Changes to Date – Financial Summary

Base Contract & Authorization	
Base Contract Award	$3,997,931.20
Contingency Authorized by CAO to date	$1,002,068.80
Total Authorized to date	**$5,000,000.00**
Total Value Awarded to Date	
Awarded Change Orders To-Date (as of CO17) (1)	$432,305.25
Total Contract Value To-Date	**$4,430,236.45**
Recommended Additional Award and Contingency	
CO-18 (Humpback Above-Grade & Microturbine Design) (2)	$246,264.05
CO-19 (A2.1 Stages 2, 3 & 4)	$1,454,738.00
Total	**$6,131,238.50**
Recommended Contingency (3)	$368,761.50
Total Recommended Authorization	**$6,500,000.00**

(1) Includes credits from unused scope items.

(2) RWS Commission authorization not required based on dollar value but requested based on unknown outcome of staff report 26-0929.

(3) Recommended contingency is to address further unknown conditions, including engagement with interested parties, construction duration uncertainties, and other unforeseen conditions. CRD staff would authorize subsequent changes only to the cap authorized and as aligned with scope originally contemplated in the RFP.

ALTERNATIVES

Alternative 1
That the Regional Water Supply Commission:

1. Authorize the award of Change Order #18 and Change Order #19 to Jacobs Consultancy Canada Inc. and authorize staff to award subsequent changes to a total of $6,131,238.50 up to a maximum contract value of $6,500,000; and
2. Direct Staff to amend the maximum payable under the contract to the new maximum amount of $6,500,000.

Alternative 2
That the Regional Water Supply Commission:

1. Not authorize the award of Change Order #18 and Change Order #19 to Jacobs Consultancy Canada Inc. and that staff not exceed the previously authorized contract limited of $5,000,000; and
2. Direct staff to issue a separate competitive procurement to advance the subsequent stages of work.

IMPLICATIONS

Alignment with Existing Plans & Strategies

The RWS Strategic Plan (Strategic Plan) was most recently updated in December 2025 and outlines a mission statement, commitments and priorities for the water service. The infrastructure improvements that are recommended through capital planning are aligned with this Strategic Plan, most notably the commitment to “provide efficient, effective and innovative operations of our water system infrastructure”.

The projects that were included within the TM Program are also directly aligned with the treated water transmission main capital improvements outlined in the Master Plan. The ongoing status of the TM Program was also reviewed and considered during the development of the more recent Implementation Plan and the advancement of these initiatives was confirmed as a priority and included as some of the more advanced works within the larger RWS Strategic Program schedule.

Financial Implications

It is forecasted that projects being advanced within the TM Program can be completed within the budgets already approved in the Capital Plan. The recommendation in front of the Commission today is specifically focused on the consulting services for design and construction oversight, which typically average approximately 10% of overall project costs. The pricing that Jacobs has submitted for changes to date, and the subsequent detailed design work for Project A2.1 have been reviewed and are aligned with the level of effort of the original submission. Construction services fees are largely a cost that is dictated by construction duration which is defined by contractor schedules, somewhat outside the control of a consultant but reasonable efforts have been made to estimate construction duration based on the preferred alignment. CRD and Jacobs will monitor forecasted fees to actual costs during construction stages to try and monitor progress and mitigate overruns, but the contingency recommended will support unknowns that arise.

Project delivery staff have reviewed with CRD's Procurement Manager and with CRD Legal Services who have confirmed that the additional scope being recommended is considered to have been originally contemplated and is directly aligned with carry-on stages of work originally contemplated in the original RFP. There has been a significant amount of collaborative effort to date to advance the TM Program and embed key members of Jacobs staff with wider the CRD team. Jacobs has been meeting performance expectations on design and construction engineering services, and has demonstrated good value for the cost of these scopes of work. Going back out to market for the carry-on stages of work would result in project delays, duplicated effort and risk of losing much of the history developed through the early design stages resulting in additional costs to the program. Awarding this carry-on work also sends a message that CRD is an organization that will seek opportunities to reward strong performance, if aligned with applicable trade law and deemed to be in the public interest.

Intergovernmental & Social Implications

The TM Program has had a successful track record of intergovernmental relationships thus far. With projects A2.4 and A2.5 being actively in construction, and project A2.1 being the primary subject of the recommendation today, the intergovernmental coordination for these projects is briefly outlined below:

Projects A2.4 & A2.5: CRD entered into agreements with both District of Central Saanich (DoCS) and District of North Saanich (DoNS) in Q2 of 2024, with both municipalities contributing funds to the A2.4 & A2.5 projects to support improvements to their own underground and above ground infrastructure. This added scope also accounts for some of the additional fees awarded to Jacobs thus far. Senior levels of government have also contributed a $6,000,000 grant through the Union of British Columbia Municipalities, Strategic Priorities Fund. Detailed coordination with the Canadian Food Inspection Agency in the design stage was critical to obtain clarification and remove some significant project risks related to golden nematodes. CRD is also working effectively between departments, including close coordination with Hartland Landfill to provide

reclaimed asphalt from this project for use in landfill road maintenance. The recommendations of this staff report do not have a direct impact on the continued coordination for these projects.

Project A2.1: The work stages that would be awarded based on the recommendations in this staff report are focused primarily on Project A2.1. Preliminary consultation with City of Langford (CoL) occurred through the routing assessment and preliminary design stages of this project. Given that the proposed alignment of part of this project is on the E&N Trail, coordination with Island Corridor Foundation (ICF) and CRD's Regional Planning and Transportation department was also facilitated. A more detailed summary of early engagement is expanded upon in the Preliminary Design Report that has been included in Appendix E. Valuable input has been gathered from all these relationships, but it is known that focused engagement will be required through the detailed design and construction stages to mitigate impacts to the extent possible. Both CoL and ICF have indicated their support of the alignment on the E&N Trail, even suggesting utilizing more of this alignment, all the way to Leigh Road. This additional route option was considered based on this feedback (refer to Option 6A in Appendix E) but was determined to present separate challenges and comes at a substantial cost increase for the extra alignment length. It is understood that the proposed alignment currently selected will require business impact mitigation plans and engagement with affected parties on Dunford Avenue to mitigate impacts to the extent possible and this will be better facilitated through the subsequent stages of work that are being recommended to award. Impact mitigation to the E&N Trail will also be assessed in more detail once the next stage of design is completed and ready to review with ICF and CRD's Regional Planning and Transportation department.

First Nations Implications

In January 2024, the CRD reached out to W̱SÁNEĆ Leadership Council (WLC) and STÁUTW (Tsawout) First Nation providing notification of the upcoming projects. These were presented in further detail at the subsequent quarterly Land Altering Works (LAW) meeting. In February 2024, Millennia Research Ltd. conducted an Archaeological Overview Assessment and a Preliminary Field Reconnaissance (PFR) for both Projects A2.4 and A2.5 and a representative from Tsawout First Nation was present. Subsequently, the AOA was updated in July 2024 for Project A2.4 after the initial alignment had changed and there was a new segment of proposed work to take into consideration.

Project A2.4: The AOA identified two areas of moderate archaeological potential. Details have been shared with involved First Nations at the LAW meetings. These areas will be subject to an Archaeological Impact Assessment (AIA) under the CRD's Multi-Assessment *Heritage Conservation Act* Permit. This will involve archaeological assessment concurrent with construction. The archaeological field crew will include the project archaeologist (WSP) and a cultural monitor from the Tsawout First Nation.

Project A2.5: The AOA did not identify any areas of archeological potential and recommended that the *CRD's General Guidelines for Archaeological Chance Find Management* be in place for the duration of the work. Given that the initial PFR did not include a member of the WLC a second PFR of the A2.5 Alignment was conducted with two cultural monitors from WLC and the CRD's Archaeology Manager and archaeologist. This PFR identified areas of cultural interest that includes Dean Park Road, and select locations along East Saanich Rd, where the potential for

cultural bearing soils was thought to exist.

A similar approach will be taken with future projects in the Transmission Main Upgrade Program, with notice provided to First Nations during LAW meetings.

Service Delivery Implications

The RWS funded projects listed in the TM Program are critical initiatives that are recommended in the Master Plan and supported by the Capital Plan. The Implementation Plan also supports advancing the projects outlined in this report. Authorizing the recommendations of this report will allow staff to continue to progress design and consultation work required for the replacement of a 1.9km section of CPP pipe through CoL's urban core with a more resilient and higher capacity steel pipe. Retaining Jacobs to continue with this scope will maintain the knowledge and relationships developed through the conceptual and preliminary design stage.

While it can be easier to put the focus of large infrastructure investments on new infrastructure expansions, replacement of existing assets, such as underground transmission mains, is critical to the resilience of a water system. This reality has become even more evident in recent years considering some of the significant pipe failures that have occurred in other municipalities throughout the country.

CONCLUSION

The Transmission Main Upgrade Program is delivering critical infrastructure improvements identified through the 2022 Regional Water Supply (RWS) Master Plan. Through a coordinated program approach, the Capital Regional District (CRD) has successfully advanced multiple high-priority transmission main projects from concept development through design and, in some cases, into construction. These projects collectively support the long-term reliability, capacity, seismic resilience, and operational performance of the RWS system while maximizing efficiencies in project delivery, intergovernmental coordination, and consultant resources.

The work completed to date by Jacobs Consultancy Canada Inc. has established the technical foundation, relationships, and project knowledge necessary to advance the next phase of priority infrastructure upgrades. In particular, Project A2.1 will replace approximately 1.9km of aging concrete pressure pipe within the City of Langford with a larger-diameter, seismically resilient steel transmission main, addressing both asset renewal objectives and future growth-related capacity requirements identified in the Master Plan.

Authorizing the recommendations of this report will allow the TM Program to proceed with the detailed design, construction support, and post-construction services required to advance Project A2.1, while maintaining continuity of project knowledge, minimizing procurement-related delays, and preserving the value generated through the substantial work completed under the existing contract. The recommended authorization remains aligned with the scope originally contemplated through the procurement process and supports timely implementation of critical capital investments already identified within the approved RWS Capital Plan.

Approval of the recommendations in this report will enable continued progress toward the Master Plan's strategic objectives, ensure momentum is maintained on priority transmission main

improvements, and help deliver long-term value to RWS customers through the renewal and enhancement of essential water infrastructure.

RECOMMENDATION

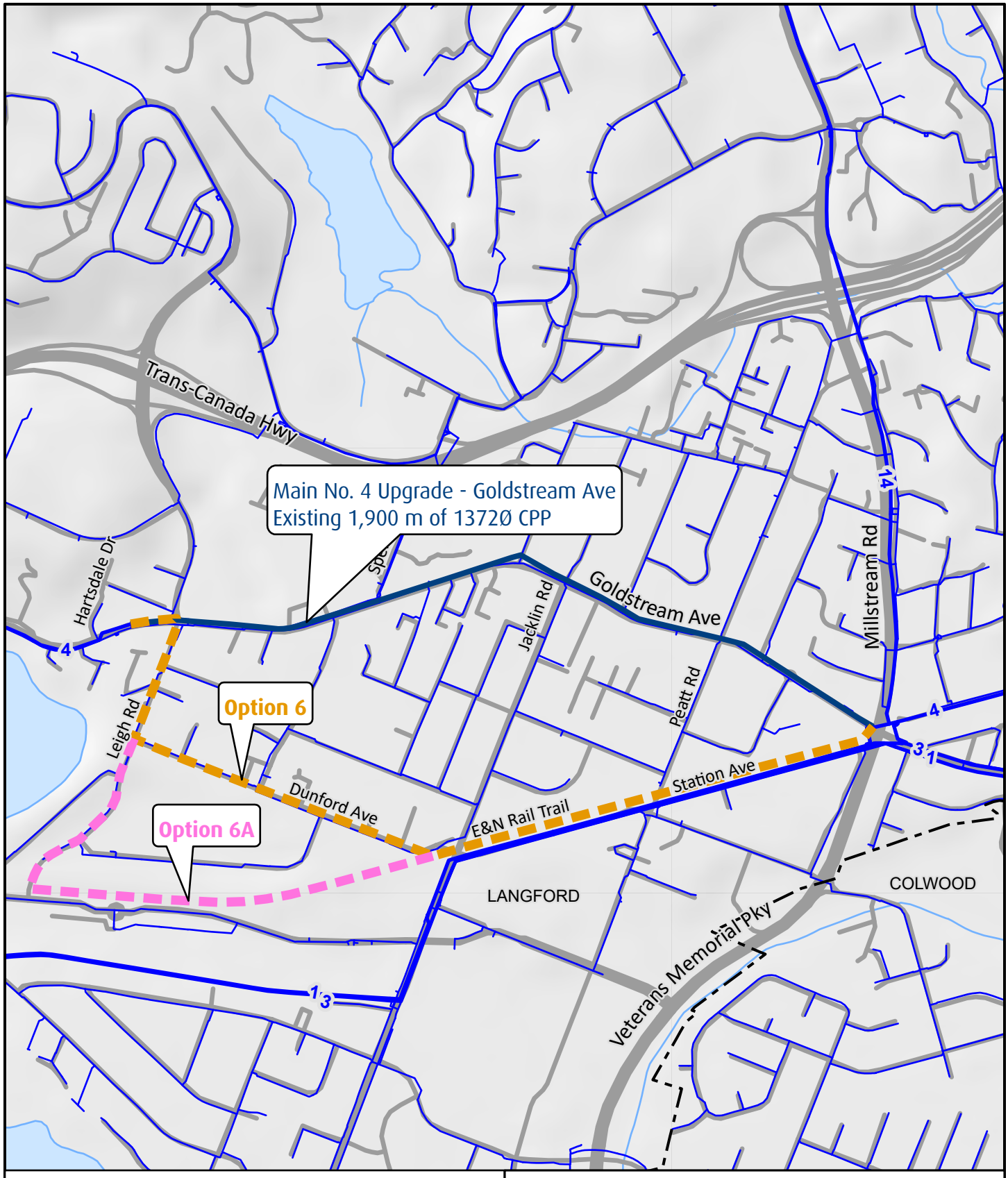
That the Regional Water Supply Commission:

1. Authorize the award of Change Order #18 and Change Order #19 to Jacobs Consultancy Canada Inc. and authorize staff to award subsequent changes to a total of $6,131,238.50 up to a maximum contract value of $6,500,000; and
2. Direct Staff to amend the maximum payable under the contract to the new maximum amount of $6,500,000.

Submitted by:	Jared Kelly, P.Eng., PMP, Senior Manager, Regional Water Strategic Program
Concurrence:	Alicia Fraser, P. Eng., General Manager, Infrastructure and Water Services
Concurrence:	Nelson Chan, MBA, FCPA, FCMA, Chief Financial Officer & General Manager, Finance & Technology
Concurrence:	Ted Robbins, B. Sc., C. Tech., Chief Administrative Officer

ATTACHMENT(S)

Appendix A: Project Location Plans
Appendix B: Project Specific Status Updates
Appendix C: Program Schedule Update
Appendix D: Summary of Changes to Date and Draft CO#18 and CO#19
Appendix E: Main No. 4 (Leigh Rd to VMP) – Preliminary Design Report



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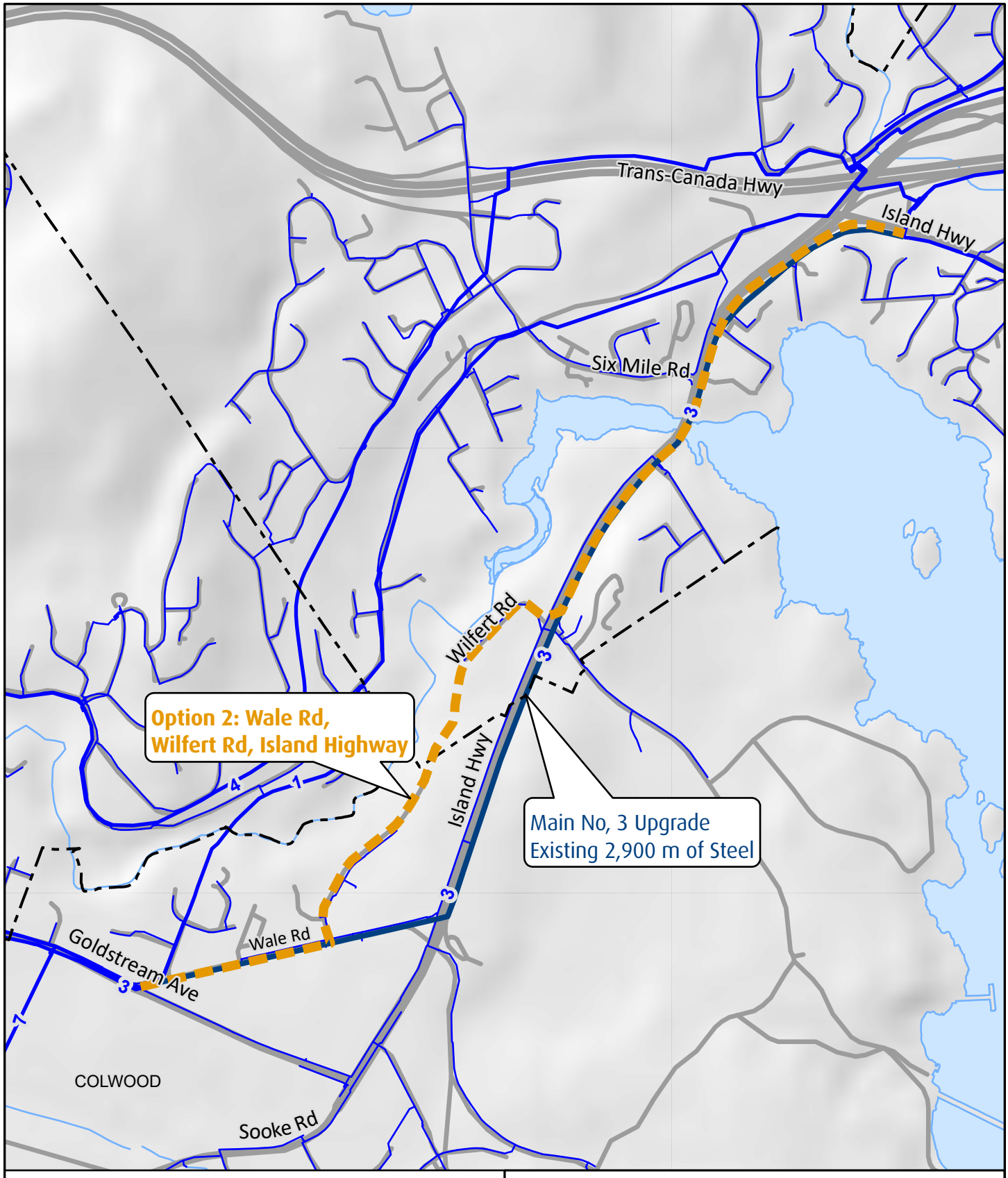
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A2.1 - Main No. 4 Upgrade Goldstream Ave Alignment

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APPENDIX A



Metres
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UTM Zone 10N NAD 1983

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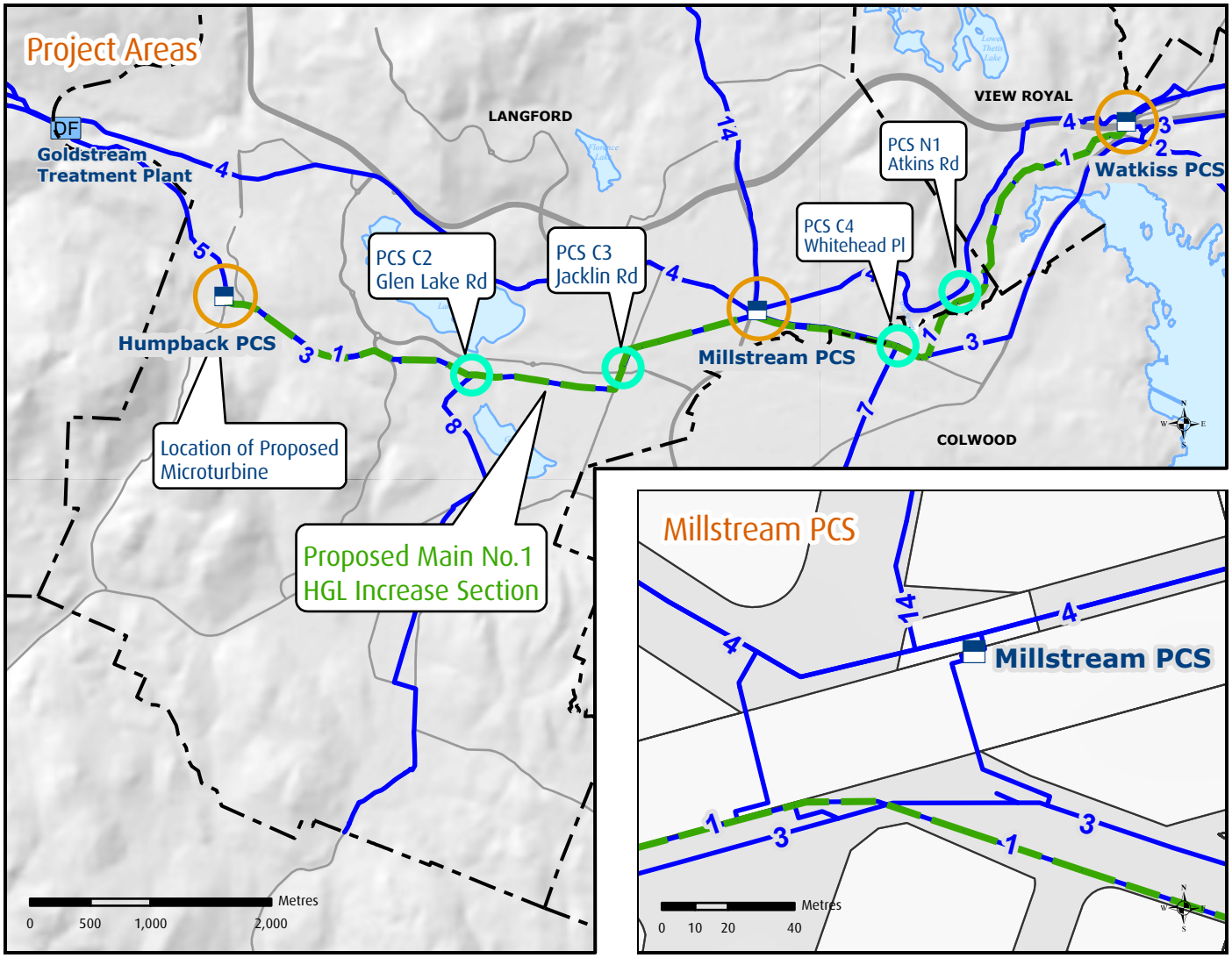
A2.2 - Main No. 3 Upgrade
Wale Rd & Island Hwy Alignment

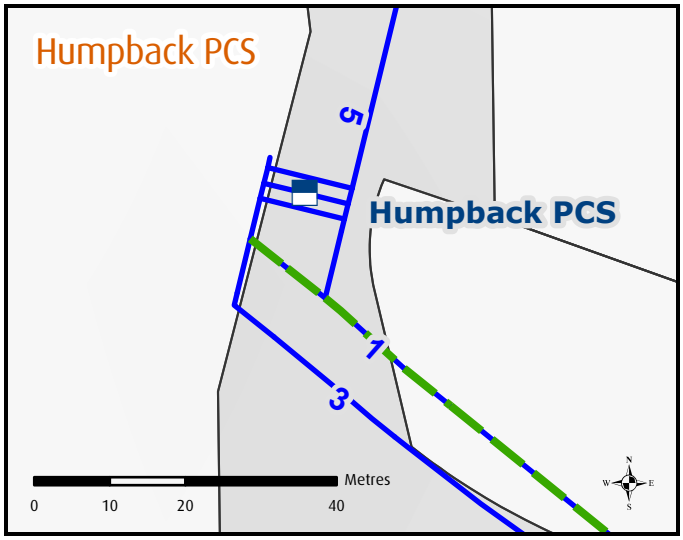
DISCLAIMER
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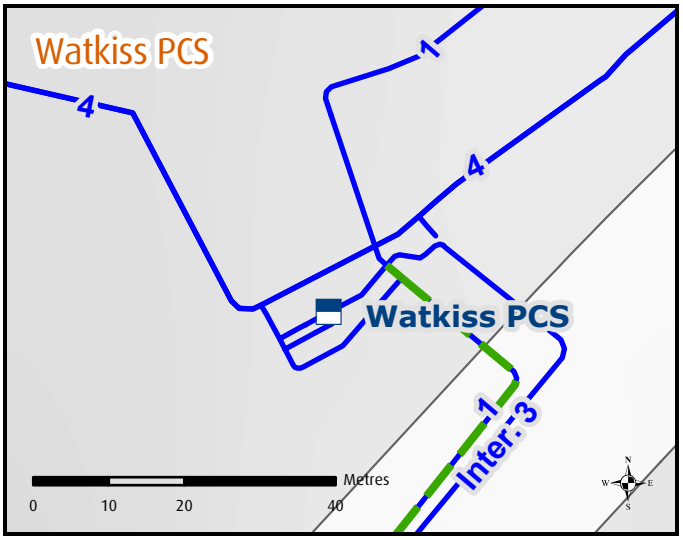
August 2026 | A2-2_MainNo3UpgradeWale.mxd | helpdesk@crd.bc.ca

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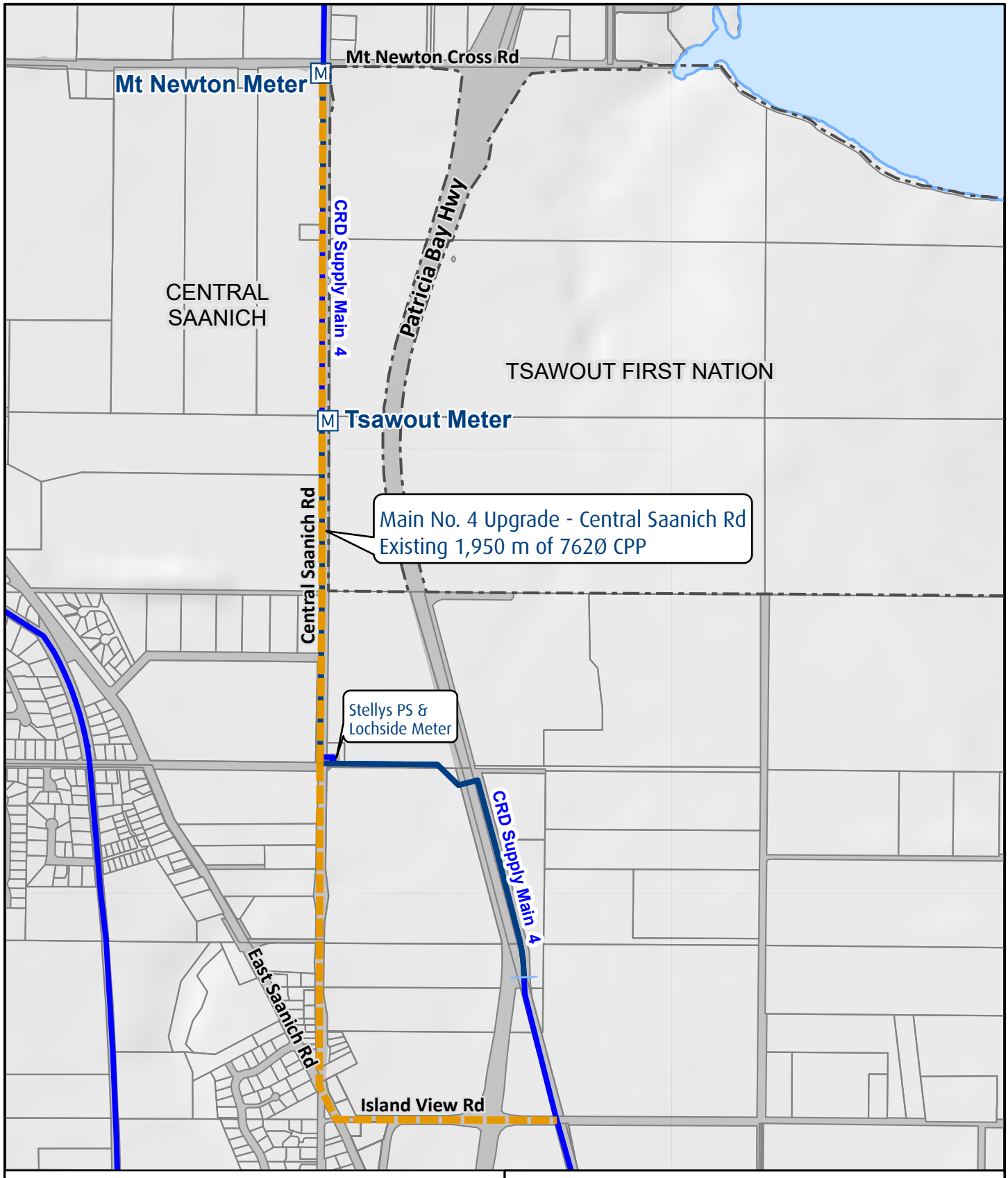
A2.3 - Main No. 1 HGL Increase Humpback PCS to Watkiss PCS

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August 2026 | A2-3MainNo1UpgradeHGLIncrease.mxd | helpdesk@crd.bc.ca

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Metres
0 50 100 200 300
UTM Zone 10N NAD 1983

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W E
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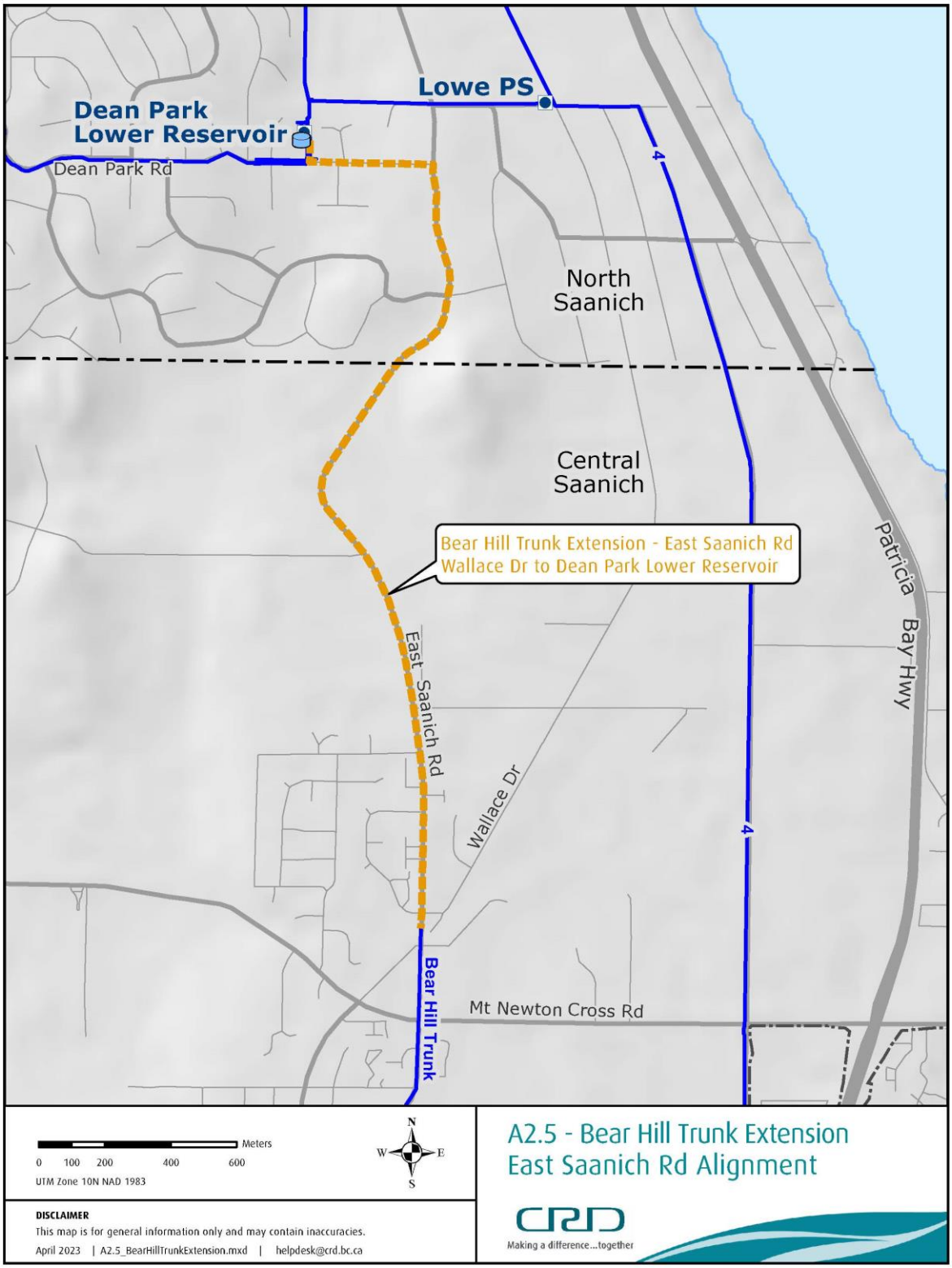
DISCLAIMER
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August 2026 | A2-4_MainNo4UpgradeCentralSaanich.mxd | helpdesk@crd.bc.ca

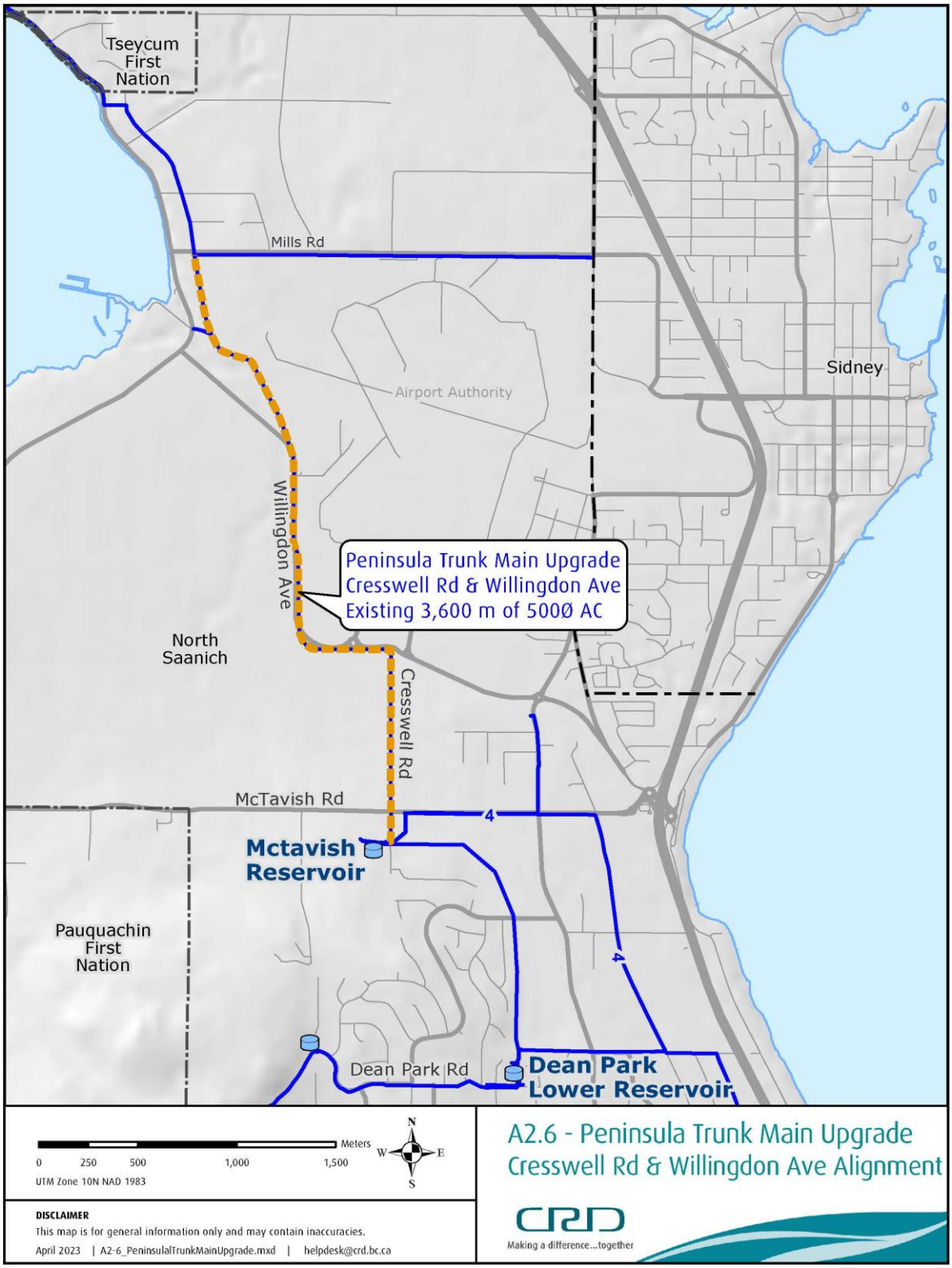
A2.4 - Main No. 4 Upgrade Central Saanich Rd Alignment

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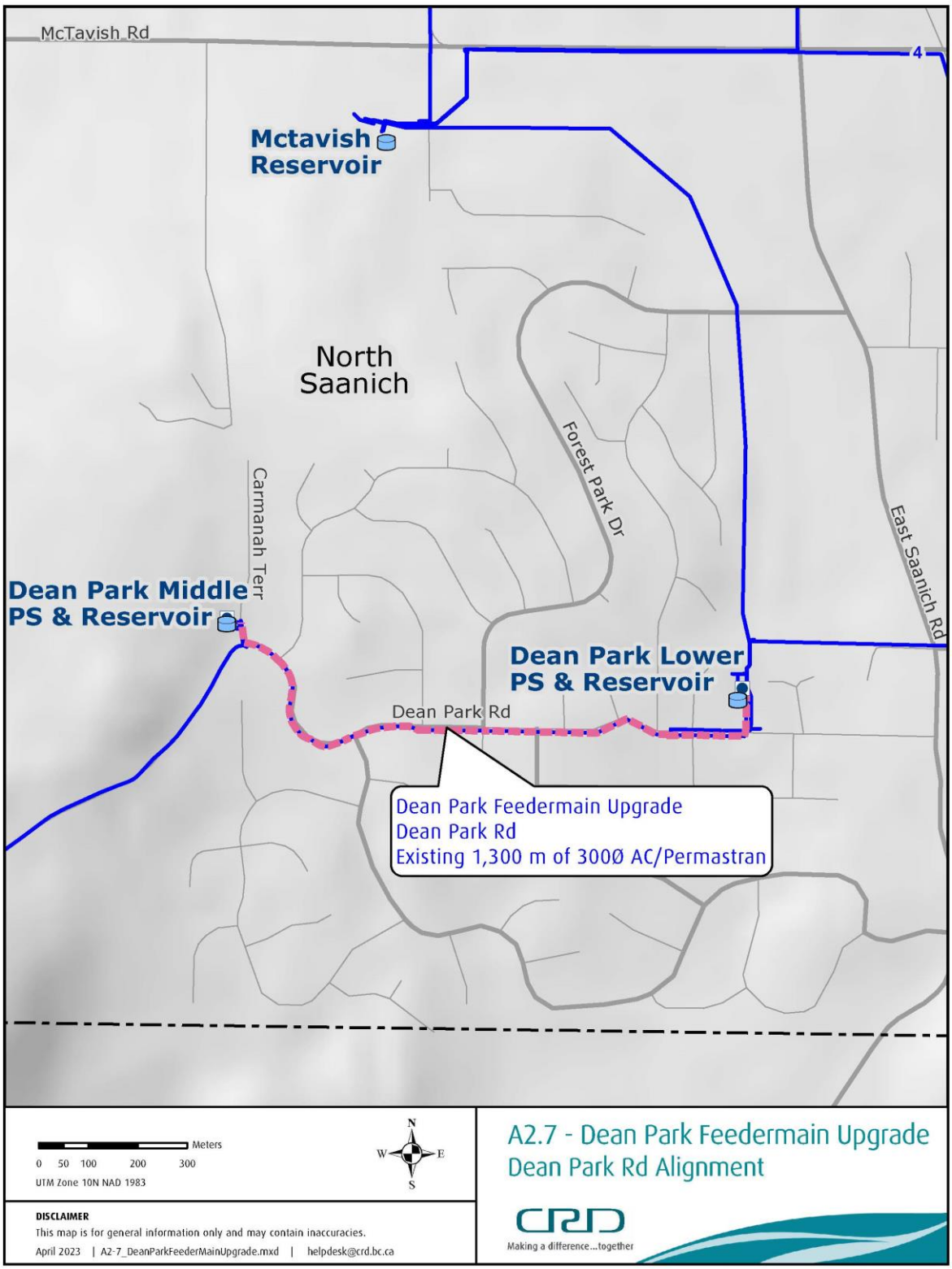
APPENDIX A


Lowe PS
Dean Park
Lower Reservoir
Dean Park Rd
North
Saanich
Central
Saanich
Bear Hill Trunk Extension - East Saanich Rd
Wallace Dr to Dean Park Lower Reservoir
East Saanich Rd
Wallace Dr
Patricia Bay Hwy
Bear Hill Trunk
Mt Newton Cross Rd
4
4
Meters
0 100 200 400 600
UTM Zone 10N NAD 1983
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DISCLAIMER
This map is for general information only and may contain inaccuracies.
April 2023 | A2.5_BearHillTrunkExtension.mxd | helpdesk@crd.bc.ca
A2.5 - Bear Hill Trunk Extension
East Saanich Rd Alignment
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Tseycum First Nation
Mills Rd
Airport Authority
Sidney
Willingdon Ave
Peninsula Trunk Main Upgrade
Cresswell Rd & Willingdon Ave
Existing 3,600 m of 500Ø AC
North Saanich
Cresswell Rd
McTavish Rd
4
Mctavish Reservoir
Pauquachin First Nation
4
Dean Park Rd
Dean Park Lower Reservoir
0 250 500 1,000 1,500 Meters
UTM Zone 10N NAD 1983
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DISCLAIMER
This map is for general information only and may contain inaccuracies.
April 2023 | A2-6_PeninsulaTrunkMainUpgrade.mxd | helpdesk@crd.bc.ca
A2.6 - Peninsula Trunk Main Upgrade
Cresswell Rd & Willingdon Ave Alignment
CRD
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APPENDIX A


McTavish Rd
4
Mctavish Reservoir
North Saanich
Forest Park Dr
East Saanich Rd
Carmanah Terr
Dean Park Middle PS & Reservoir
Dean Park Lower PS & Reservoir
Dean Park Rd
Dean Park Feedermain Upgrade
Dean Park Rd
Existing 1,300 m of 300Ø AC/Permastran
Meters
0 50 100 200 300
UTM Zone 10N NAD 1983
N
W
E
S
DISCLAIMER
This map is for general information only and may contain inaccuracies.
April 2023 | A2-7_DeanParkFeederMainUpgrade.mxd | helpdesk@crd.bc.ca
A2.7 - Dean Park Feedermain Upgrade
Dean Park Rd Alignment
CRD
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Transmission Main Upgrade Program – Project Specific Status Updates

RFP Ref#	Cap Plan Ref#	Project Title	Total Budget	Project Stage	Project Update
A2.1	RWS 21-11	Main No. 4 Upgrade, Goldstream Ave. Alignment (Leigh Rd. to Veterans Memorial Parkway)	$93,000,000 (1)	Prelim Design	Preliminary design stage completed (see Appendix E for prelim design report) and recommendation to proceed with detailed design stage.
A2.3	RWS 21-11	Main No. 1 HGL Increase (Humpback PCS to Watkiss PCS)		Prelim / Detailed Design	Project is advancing to 90% detailed design stage with the exception of the Humpback PCS location which still requires preliminary design effort pending a final decision as to whether incorporate a microturbine at this location.
A2.2	RWS 18-18	Main No. 3 Upgrade, Wale Rd. and Island Hwy. Alignment (Goldstream Ave. to Adams Pl.)	$700,000 (2)	Prelim Design [Scope Complete]	The multi-criteria alternative alignment assessment completed in the preliminary design stage resulted in a preferred alignment that deviates from the existing for part of the route, utilizing Wilfert Rd. Given the preferred future alignment, decision was made not to invest in the replacement of the Wale Road segment at this time. Preliminary coordination with Colwood and View Royal occurred through these early stages but more focused effort will be required in future stages, when this project advances. There is potential to combine this future improvement with improvements to the Western Community Trunk Sewer twinning project that also runs along Island Highway. The potential to utilize the old Supply Main No. 3 as a conduit to slip line with the new sewer forcemain. This potential initiative needs to be further assessed in detailed design of both projects.
A2.4	RWS 23-17	Main No. 4 Upgrade, Central Saanich Rd. Alignment (Mt Newton Cross Rd. to Highway 17)	$39,000,000 (3)	Construction	Project A2.4 was prioritized to advance to construction based on receipt of a $6.0M Union of British Columbia Municipalities, Strategic Priorities Fund. In order to mitigate risks of damage to this existing main, it was also determined to include project A2.5 in the same construction package as the Bear Hill Trunk Extension as this would provide a redundant means of supplying water to the District of North Saanich (“DoNS”), Town of Sidney and portions of District of Central Saanich (“DoCS”) and Tsawout First Nation if any planned or unplanned loss of service were to occur on Main No. 4 during the construction of Project A2.4. Further assessment determined that the SPWS Bear Hill Trunk Extension would achieve much of the benefits contemplated under the RWS Master Plan project M11 that called for twinning of critical sections of Main No. 4 and a staff report was provided to the RWS Commission on September 25, 2024, where it was agreed to share construction costs for project A2.5 equally between RWS and SPWS. CRD is also entered into agreements with both DoCS and DoNS to include water and surface works improvements for both municipalities within this project.
A2.5	RWS 23-17 SPWS 21-05	Bear Hill Trunk Extension, East Saanich Rd. Alignment (Wallace Dr. to Dean Park Lower Tank)	$14,700,000 (4)	Construction	

RFP Ref#	Cap Plan Ref#	Project Title	Total Budget	Project Stage	Project Update
					Given the complexity and scale of this project, CRD elected to utilize a Construction RFP as opposed to a standard tender. Following the evaluation period, entered into a Contract with Windley Contracting Ltd. (WCL) on November 27, 2025. This project has been progressing well through construction and as of the date of this report, WCL is approximately 80% complete the ~3km Bear Hill Trunk Extension and steel pipe is being manufactured for Supply Main No. 4 with the intent to begin construction improvements in Q1 of 2027. The project is on schedule to achieve the contractual substantial completion deadline of December 1, 2027. Construction photos are included below this table.
A2.6	SPWS 21-05	Peninsula Trunk Main Upgrade, Cresswell Rd. & Willingdon Ave. Alignment (McTavish Tank to Mills Rd.)		Prelim Design [Scope Complete]	The scope of the TP Program only contemplated this project to prelim design, to support initial planning and budgeting for future years. Coordination with the Victoria Airport Authority (VAA) was facilitated in the preliminary design but some uncertainty that remains on future airport expansion needs to be reassessed in future years as VAA's plans progress. The Provisional 2027 SPWS Capital Plan has been updated to show this project progressing into detailed design within the next 4 years, subject to approval and funding.
A2.7	SPWS 21-05	Dean Park Feedermain, Dean Park Rd. Alignment (Dean Park Lower Tank to Dean Park Middle Tank)		Prelim Design [Scope Complete]	The scope of the TP Program only contemplated this project to prelim design, to support initial planning and budgeting for future years. The Provisional 2027 SPWS Capital Plan has been updated to show this project progressing into detailed design within the next 4 years, subject to approval and funding.

(1) Capital Project #21-11 includes both projects within one budget item. High pressurization of Supply Main No. 1 is planned to be completed prior to the shutdowns of Supply Main No. 4 required for tie-in's. This combined budget is believed to have ample contingency that has been spread into future years to mitigate the impact of current year rate increases.

(2) This budget reflects actual funds to complete the conceptual and preliminary design stages and to determine a preferred alignment. Following these stages, the project is on hold while other priorities progress and remaining amounts of previously approved funds have been released.

(3) Per the recommendations of a staff report presented to the RWS Commission on September 25, 2024, this budget also includes funding for 50% of the value of the Bear Hill Trunk extension (Project A2.5) given the value of offsetting costs of project M11 that had been previously identified in the RWS Master Plan.

(4) This SPWS budget was only to fund 50% of the SPWS portion of project A2.5 and preliminary design portion of projects A2.6 & A2.7. It is anticipated that the scope will be completed with ample remaining budget, which has been reapportioned to future upgrades in the provisional SPWS 2027 Capital Plan.

Bear Hill Trunk Construction Photos:









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Project	2023 Q1	2023 Q2	2023 Q3	2023 Q4	2024 Q1	2024 Q2	2024 Q3	2024 Q4	2025 Q1	2025 Q2	2025 Q3	2025 Q4	2026 Q1	2026 Q2	2026 Q3	2026 Q4	2027 Q1	2027 Q2	2027 Q3	2027 Q4	2028 Q1	2028 Q2	2028 Q3	2028 Q4	2029 Q1	2029 Q2	2029 Q3	2029 Q4	Beyond
A2.1 – Main No. 4 Upgrade, Goldstream Ave Alignment																													
Conceptual/Preliminary Design: Q4 2023 – Q4 2026					■	■	■	■	■	■	■	■	■	■	■	■													
Detailed Design: Q4 2026 – Q2 2028																■	■	■	■	■	■	■							
Construction: Q2 2028 – Q4 2030																						■	■	■	■	■	■	■	■
A2.2 – Main No. 3 Upgrade, Wale Rd and Island Hwy Alignment																													
Conceptual Design: Q4 2023 – Q3 2025					■	■	■	■	■	■	■																		
Preliminary/Detailed Design [Not in current scope]:																													■
Construction [Not in current scope]:																													■
A2.3 – Main No. 1 HGL Increase, Humpback PCS to Watkiss PCS																													
Conceptual/Preliminary Design: Q4 2023 – Q4 2026					■	■	■	■	■	■	■	■	■	■	■	■													
Detailed Design: Q4 2024 – Q4 2027								■	■	■	■	■	■	■	■	■	■	■	■	■									
Construction: Q4 2027 – Q2 2029																				■	■	■	■	■	■	■			
A2.4 – Main No. 4 Upgrade, Mt Newton Cross Rd to Lochside Dr																													
Design: Q4 2023 – Q4 2025				■	■	■	■	■	■	■	■	■																	
Construction: Q4 2025 – Q4 2027												■	■	■	■	■	■	■	■	■									
A2.5 – Bear Hill Trunk Extension, Wallace Dr to Dean Park Lower Tank																													
Design: Q4 2023 – Q4 2025				■	■	■	■	■	■	■	■	■																	
Construction: Q4 2025 – Q1 2027												■	■	■	■	■	■												
A2.6 – Peninsula Trunk Main Upgrade																													
Preliminary Design: Q4 2023 – Q4 2025						■	■	■	■	■	■																		
Detailed Design [Not in current scope]: Anticipated 2028-2029																													
Construction [Not in current scope]: Anticipated 2030-2031																													■
A2.7 – Dean Park Feedermain, Dean Park Lower Tank to Dean Park Middle Tank																													
Preliminary Design: Q4 2023 – Q4 2025							■	■	■	■	■																		
Detailed Design [Not in current scope]: Anticipated 2031-2032																													■
Construction [Not in current scope]: Anticipated 2032-2033																													■

APPENDIX D

Contract 2023-892 - Change Order Log			
CO #	**Change Description**	**Costs**	**Date Approved**
1	A2.4 – Main No. 4 Upgrade – Central Saanich Rd Alignment: 1) Replacing an additional 464.19m of 762mm dia. CPP at the southern boundary	$219,398.69	2024-04-22
2	District of North Saanich: A2.5 – Bear Hill Trunk Extension – East Saanich Rd Alignment: 1) 430m of existing AC 100mm and 700m of existing 150mm watermain to be replaced with PVC. This scope includes 23 new service laterals and 4 hydrants. 2) Replace 15m of 150mm AC (including removal of decommissioned PRV vault immediately north of Dean Park Road intersection) 3) Intersection Improvements – The intersection of East Saanich Road and Dean Park Road has poor geometry, specifically, a long roadway pedestrian crossing length. The scope of work for the existing east-west pedestrian crossing of East Saanich Rd at Dean Park Rd should consider confirmation of appropriate sight distances and consider the feasibility of shortening crossing lengths by reducing intersection corner radii. Impacts on turning movements will be evaluated to consider if curb alignment changes are possible	$154,129.25	2024-04-26
3	District of Central Saanich: A2.4 – Main No. 4 Upgrade – Central Saanich Rd Alignment: 1) 700m of existing AC 150mm watermain to be replaced with 200mm PVC. A2.5 – Bear Hill Trunk Extension – East Saanich Rd Alignment: 3) 1,145m of existing AC 150mm watermain to be replaced with 200mm PVC. 4) Construction of 430m of sidewalk infill – MMCD standard curb, gutter, and sidewalk.	$167,192.88	2024-04-26
4	A2.4 and A2.5 - Oversight of utility pothole field investigations, including on-site supervision and review of traffic management plan.	$14,831.75	2024-04-26
5	Geotechnical field investigations associated with projects A2.4 and A2.5. Subcontractor activities were overseen by Thurber Engineering Ltd whose costs will be covered in a subsequent change order. Subcontractors for the geotechnical field investigations include: • Traffic Management (6 days) • Hydrovac (2 days) • Utility Locates (2 days) • Drilling (4 days)	$66,047.92	2024-05-24
6	Efforts to undertake hydraulic analysis associated with the TCH option presented for the alignment options analysis for projects A2.1 and A2.2.	$19,998.73	2024-06-27
7	Efforts to undertake the utility investigation and topographic survey for the revised portion of the A2.4 Island View Road Alignment, as well as additional subsurface utility locates around the Dean Lower driveway access for project A2.5	$28,935.50	2024-07-26
8	Effort required to undertake the geotechnical field investigations for projects A2.4 & A2.5	$132,838.46	2024-07-26
9	Effort to incorporate the Island View Road Alignment into the preliminary design, detailed design, construction and post construction services for project A2.4	$51,222.80	2024-10-01
10	Effort to undertake the geotechnical field investigations for project A2.3	$99,868.63	2024-11-01
11	Effort to undertake the development of the Traffic Management Strategy for the Main No. 4 crossing of Highway 17 on project A2.4	$9,147.38	2025-01-22
12	Effort to include an electrically actuated butterfly valve on the outlet of the Dean Park Lower Tank southern cell as part of project A2.5	$9,988.63	2025-02-11
13	Effort to produce an electricity regeneration study technical memorandum for the Humpback Pressure Control Station.	$ -	2025-06-11
14	Effort to produce a survey at the proposed PCS site on the Royal Colwood Golf Course (RCGC). These additional features were requested to be surveyed following a meeting between the CRD and the RCGC.	$1,506.13	2025-06-23
15	Effort to quantify the number of households expecting to experience improved water service as part of Project A2.3 to assist in the CRD's grant application for the project.	$3,037.80	2025-08-19
16	Effort to undertake the geotechnical field investigations at the Humpback PCS site for project A2.3	$3,586.50	2025-08-29
17	Credits available for scopes that are either complete or will not be progressed any further. This includes: • A2.2 - Conceptual, Preliminary, & Detailed Design • A2.4 - Preliminary & Detailed Design • A2.5 - Preliminary & Detailed Design • A2.6 - Preliminary Design • A2.7 - Preliminary Design	-$549,425.80	2026-09-02
	Total:	**$ 432,305.25**	

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Integrated Water Services

Change Order No. 18 – Humpback Above-Grade & Microturbine Design

Contract Title: Transmission Main Upgrade Program

Ref: Contract #: 2023-892
Ref: PO #: 4500107607

The Owner is issuing a change to the subject Contract.

Item#	Description of Change
1	This scope of work includes all additional effort to complete the Detailed Design for changing the Humpback PCS station to be above-grade. It also includes all additional design effort required to incorporate the microturbine into the station, noting that a separate procurement activity will be initiated by the CRD for a microturbine vendor to work on the portions of the design within their area of expertise from the 60% design phase onwards. This is broken out further within the proposal in CCO-15B. Key tasks involved with this additional scope include: • Hydraulic analysis to determine the impacts of bringing Main No. 3 above grade at this location and the set points for the PCS. • Civil site layout, including the layout of the kiosk at the existing site, consideration for the redesign of site access and parking, grading plan, pipework design to bring Main no. 3 above ground, and layout requirements for microturbine integration. • Mechanical layout plan and design for the pipework, valves, and microturbine within the kiosk. • Functional design for the microturbine including a functional specification, drawings, and data sheet. • Structural design of the kiosk and footing. • Seismic design review for the pipework. • Electrical, instrumentation, and control design for the new station and microturbine. • Environmental permitting and approvals work for the required permits associated with the design of a new kiosk at this location. • Constructability review of the new kiosk, including tie-ins and staging with the operation of the existing system and PCS. • Class B cost estimate at the 60% design stage and Class A cost estimate at the 90% design stage. • Support CRD in preparation of procurement materials, including corporate qualification requirements for vendors and a performance specification for microturbine. The value of CO-18 is a result of the pricing obtained from CCO-15B.

DRAFT

Value of Contract prior to Change Order No.18, excluding GST:	$ 4,430,236.45
Total value of this Change, excluding GST:	$ 246,264.05
Updated value of Contract, excluding GST:	**$ 4,676,500.50**

Attachments: One (1)
- Contemplated Change Order 015B – September 1, 2026 (7 pages)

Jacobs Consultancy Canada Ltd.	Capital Regional District
Consultant	**Owner**
203-740 Hillside Avenue Victoria, BC V8T 1Z4	625 Fisgard Street Victoria, BC V8W 2S6
Address	**Address**
Date (DD-MM-YY)	Date (DD-MM-YY)
Signature	Signature

This Change Order:
- Does not change, vary or affect the contract other than as is expressly set out in the terms of each change order;
- Represents the full and final amount to which the Consultant is entitled for the items of work and materials; and
- Is made strictly on the understanding that the Consultant will make no further claims relating to the items of work and materials or omitted work and materials set out in each change order.

DRAFT

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www.jacobs.com

September 1, 2026

Project Name: Regional Water Supply and Saanich Peninsula Water Services 2023-2026 Transmission Main Upgrade Program
Project Number: CE881400

Subject: Regional Water Supply and Saanich Peninsula Water Services 2023-2026 Transmission Main Upgrade Program - CCO15B

In this letter, Jacobs Consultancy Canada Inc. (Jacobs) provides the proposed scope change and fees relating to the additional engineering services requested for the Regional Water Supply and Saanich Peninsula Water Services 2023-2026 Transmission Main Upgrade Program (the Project). The scope includes the services requested for the design of the replacement of existing below ground, confined space, Humpback Pressure Control Station (PCS) with a new above ground station including an electricity regeneration turbine (microturbine).

1. CCO15B

1.1 Scope of Work

CCO15B includes the scope of work to be undertaken for the replacement of the existing Humpback PCS with a new above ground station as part of Project A2.3.

The initial scope of works proposed for the Humpback PCS as per the RFP was to redesign the existing station to account for the flow reduction, due to Main No. 1 bypassing the station following high pressurization, setpoint adjustment, and improving the control philosophy to mitigate impacts of low outlet pressures. These works were expected to all be conducted within the existing station, with the 60% design for this scope of work focusing on the replacement of one of the existing valves with a smaller valve to operate during low flows and updated valve controls to increase the responsiveness of the valves to large spikes in demand.

This change order also includes the removal of a portion of the scope of work for the Detailed Design of the Wale Road section of Project A2.2 (Main No. 3 upgrade on Wale Road / Island Highway), which is no longer expected to be included as part of this transmission upgrade program. Additional scope has also been added to allow for the design to incorporate a microturbine in place of one of the PRVs.

The key tasks for CCO15B include:

- Design of the replacement of the existing Humpback PCS with a new above ground station including:
  - Hydraulic analysis to determine the impacts of bringing Main No. 3 above ground at this location and the setpoints for the PCS

  - Civil site layout, including the layout of the kiosk at the existing site, consideration for the redesign of site access and parking, grading plan, pipework design to bring Main No. 3 above ground, and layout requirements for microturbine integration.
  - Mechanical layout plan and design for the pipework, valves, and microturbine within the kiosk
  - Functional design for microturbine including a functional specification, drawings, and data sheet
  - Structural design of the kiosk and footing
  - Seismic design review for the pipework
  - Electrical, instrumentation, and control design for the new station and microturbine
  - Environmental, permitting and approvals work for the required permits associated with the design of a new kiosk at this location
  - Constructability review of the new kiosk, including tie-ins and staging with the operation of the existing system and PCS
  - Class B cost estimate at the 60% design stage and Class A cost estimate at the 90% design stage
- Support CRD in preparation or procurement materials, including corporate qualification requirements for vendors and a performance specification for microturbine.

1.2 List of Deliverables

The deliverables for this work include the following additions or updates to Project A2.3 deliverables:

- For the microturbine initial design development following on from the feasibility study:
  - Performance specification for the microturbine vendor to support the CRD's RFQ / RFP for a microturbine supplier
  - Support for the CRD's evaluation of the microturbine supplier RFQ / RFP
  - Hydraulic Analysis Technical Memorandum for the new Humpback PCS (including microturbine)
- Humpback PCS above ground station drawings for 60% detailed design, 90% detailed design, issued for building permit, issued for tender/RFP, issued for construction:
  - Base plan and grading plan (2 sheets)
  - Site Layout (1 sheet)
  - Plan & profile drawing (4 sheets)
  - Connection details (2 sheets)
  - Welding details (1 sheet)
  - Mitre details (1 sheet)
  - Process Mechanical Drawings (8 sheets, 4 each for the kiosk and line valve chamber)
  - Microturbine layout drawing (1 sheet)
  - PCS EIC Drawings (2 sheets)
  - Microturbine EIC Drawings
    - P&ID (2 sheets including symbols drawing)

    - Single Line Diagram (2 sheets)
    - Panel Drawings (3 sheets)
        - Power Panel
        - Control Panel
        - Light Panel
  - Structural drawings (2 sheets)
- Class B and Class A cost estimate
- 60% and 90% detailed design workshop, in-person, with CRD staff
- Update to Project A2.3 detailed design report to include design of Humpback above ground PCS replacement and the microturbine details
- Update to project specifications to include Humpback above ground PCS replacement construction
- New specifications associated with the microturbine (2)
  - Panel specification
  - Microturbine Specification

1.3 Assumptions

The following assumptions have been made regarding CCO15B:

- The design for the Humpback above ground PCS will be delivered as part of Project A2.3.
- The design of the above ground PCS and includes the functional design of the associated electricity regeneration components. Allowance has been made to incorporate the microturbine into the civil layout and process mechanical design and provide functional specifications for the microturbine and associated equipment/components.
- It is assumed that the microturbine supplier will be confirmed before the 60% design deliverable stage and that the 60% design development will occur with a confirmed turbine supplier.
- Further archaeological considerations, reviews, and inputs will be completed by the CRD / CRD retained archaeologist. From the Archaeological Overview Assessment (AOA) completed for the preliminary design, it is Jacobs understanding that the Humpback PCS site is within an archaeological area of potential (AOP).
- The design of the above ground Humpback PCS will be based on the station having the long-term capability for reduction of Main No. 3 flows only, with Main No. 1 bypassing the station permanently and consideration only to be given to reducing Main No. 1 for the tie-in and commissioning of the new station and for the Main No. 1 High-Pressurisation project.
- The location of the new station will be located on the same Humpback PCS site as the existing station with the general arrangement as per the CRD's response to RFI #28 where the new station will include a new PCS with a microturbine as well as a new line valve chamber. No allowance has been made for consideration and assessment of alternate locations for the new station either upstream or downstream of this site.
- The new station is to be an above ground kiosk, no allowance has been made for considering below ground structures or above or below ground buildings.

- The scope for decommissioning of the existing station included in CCO15B is for redesigning the station to bypass the existing chamber only.
- Stakeholder engagement for this station replacement is expected to be conducted in line with the stakeholder engagement for Project A2.3. No separate stakeholder engagement, other than the workshop with the CRD listed in the deliverables.
- CRD will continue to engage with BC Hydro for all coordination regarding power supply, including completion of the power connection application with technical support from Jacobs.
- CRD will be completing SCADA integration for the microturbine in addition to the PRV.
- The design includes re-design of the site for operations and maintenance personnel access and parking but there is no allowance for assessment of broader traffic impacts.
- As the station is expected to be a kiosk, ventilation of the station is expected to be passive, as per the pressure control stations for connections to the Juan de Fuca (JdF) water distribution network which are also being designed for Project A2.3. It is assumed no HVAC design is required.
- A building permit will be required based on the expected size of the station.
- CCO15B includes level of design effort up to the issued for construction phase only. An additional level of effort for the construction and post-construction phase will be subject to a separate change order in future.
- CRD comments on the 90% submission are expected to be minor in nature, with only minor alterations required for the IFP and IFT stages.
- The new line valve chamber is expected to be manually actuated, with power supply only for the sump pump.

1.4 Project Schedule

CCO15B is expected to be delivered as part of Project A2.3. Following the acceptance of this CCO, the detailed schedule for the delivery of Project A2.3 to the IFT / IFRFP stage will be updated and submitted to the CRD for their review and acceptance.

Each stage is expected to have the following indicative durations:

- Microturbine initial design development to be ready for turbine procurement (not including procurement time) – 2 months
- 60% Detailed Design – 2 months following confirmation of turbine supplier
- 90% Detailed Design – 1 month from 60% design workshop and comments being received
- Issue for building permit – 1 month from 90% design comment closure
- Issued for building permit to IFT / IFRFP – 2 weeks
- Issued for construction – 2 weeks

1.5 Fee Summary

A summary of the hours and tasks is provided below.

RFP 2023-892 Regional Water Supply and Saanich Peninsula Water Services 2023-2026 Transmission Main Upgrade Program CCO15B	Total Fee
Hourly Rate	
Humpback PCS Above Ground Replacement and Microturbine	
Project Management & Coordination	**$12,710.00**
Microturbine Procurement	
Microturbine Performance Specification for Microturbine Procurement	**$8,564.90**
Microturbine RFP / RFQ Support	**$3,985.20**
60% Detailed Design	
Site Walk	**$1,414.50**
Hydraulic Analysis (Including transients)	**$7,922.85**
Basis of Design	**$2,197.60**
Civil Site Layout (Kiosk, Site Access, Grading Plan, Pipework)	**$9,421.80**
PCS and Line Valve Chamber Mechanical Layout Plan & Sections	**$6,576.40**
Structural Design	**$2,583.00**
Seismic Design	**$0.00**
EIC Design	**$5,133.20**
Environmental, Permitting and Approvals	**$1,291.50**
Constructability Review (Including Tie-Ins and Staging with Existing PCS)	**$2,490.75**
60% Design Drawings	**$12,857.60**
60% Detailed Design Report (Update to Project A2.3 Report)	**$7,526.58**
60% Technical Specifications	**$1,107.00**
60% Functional Microturbine System Design Drawings	**$33,000.90**
60% Functional Microturbine System Design Specifications	**$11,024.90**
60% Detailed Design Workshop	**$2,431.30**
Class B Cost Estimate	**$3,546.50**
90% Detailed Design	
Civil Site Layout (Chamber, Site Access, Grading Plan, Pipework)	**$5,623.15**
PCS and Line Valve Chamber Mechanical Layout Plan & Sections	**$4,618.65**
Structural Design	**$2,583.00**
Seismic Design	**$0.00**
EIC Design	**$5,133.20**
Environmental, Permitting and Approvals	**$1,783.50**
Constructability Review (Including Tie-Ins and Staging with Existing PCS)	**$2,183.25**
90% Design Drawings	**$13,841.60**
90% Detailed Design Report (Update to Project A2.3 Report)	**$5,531.93**
90% Technical Specifications	**$5,549.35**
90% Functional Microturbine System Design Drawings	**$22,144.10**
90% Functional Microturbine System Design Specifications	**$10,385.30**
90% Detailed Design Workshop	**$2,790.05**
Class A Cost Estimate	**$3,300.50**
Issued for Permit (IFP)	**$0.00**
IFP Drawings	**$6,769.10**
IFP Technical Specifications	**$4,022.10**
Issued for Tender (IFT)	
IFT Drawings	**$6,970.00**
IFT Technical Specifications and Supporting Documents	**$3,575.20**
Issued for Construction (IFC)	**$0.00**
IFC Drawings and Specifications	**$3,673.60**
Subtotal Hours	
Subtotal Fees	**$246,264.05**

Should you have any questions, please contact Patrick Moore at Patrick.Moore@jacobs.com or 236-971-6565 or Anita Le at Anita.Le@jacobs.com or 778-994-3348.

Yours sincerely,



Patrick Moore, P.Eng., Deputy Project Manager

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2. Attachment B – Detailed LOE

RFP 2023-892

Regional Water Supply and Saanich Peninsula Water Services
2023-2026 Transmission Main Upgrade Program CCO15B

	Ken Madill, Program Manager	Anita Le, Project Manager	Patrick Moore, Assistant Project Manager	Project Controls	Roger Beieler, Pipe Design	Mehrdad Panahi, Mechanical Lead	Paul Luscombe, Microturbine Lead	Tania Gill, Microturbine Designer	Bree Milne, Environmental, Permitting & Community Engagement	Ben Hung, Structural Engineer	Wendell Thiessen, Electrical Lead	Ramachandran Natarajan, Instrumentation and Controls Engineer	CAD Support Intermediate	CAD Support Junior	Rosemarie Gumba, Cost Estimator	Rafal Jadzinski, Civil Lead	Werner de Schaetzen, Hydraulics Lead	Ben Loewen, Water Modelling Expert	Sean Zoscike, Hydraulic Modeler	Environmental Support Intermediate	Engineering Support Intermediate	Craig Fourie, Resident Engineer	Jacobs	GeoAdvice	Total Hours	Subtotal Fee	Disbursements	GeoAdvice Disbursement	Total Fee
Hourly Rate	$230	$190	$150	$100	$260	$175	$186	$125	$150	$150	$221	$165	$110	$105	$165	$175	$285	$165	$135	$120	$120	$130					2.5%		
Humpback PCS Above Ground Replacement and Microturbine																													
Project Management & Coordination	4	32	32	6																			74	0	74	$12,400	$310		$12,710.00
Microturbine Procurement																													
Microturbine Performance Specification for Microturbine Procurement			4			4	8	16			8	8									4		52	0	52	$8,356	$209		$8,564.90
Microturbine RFP / RFQ Support			4				4	8			4	4											24	0	24	$3,888	$97		$3,985.20
60% Detailed Design																													
Site Walk			2			2		2												2	2		10	0	10	$1,380	$35		$1,414.50
Hydraulic Analysis (Including transients)																	8	10	24				0	42	42	$7,170	$179	$574	$7,922.85
Basis of Design							2	8			2	2											14	0	14	$2,144	$54		$2,197.60
Civil Site Layout (Kiosk, Site Access, Grading Plan, Pipework)			4				2	16					24			4					24		74	0	74	$9,192	$230		$9,421.80
PCS and Line Valve Chamber Mechanical Layout Plan & Sections						4	1	2						32							16		55	0	55	$6,416	$160		$6,576.40
Structural Design										4											16		20	0	20	$2,520	$63		$2,583.00
Seismic Design																							0	0	0	$0	$0		$0.00
EIC Design											8	8									16		32	0	32	$5,008	$125		$5,133.20
Environmental, Permitting and Approvals									2											8			10	0	10	$1,260	$32		$1,291.50
Constructability Review (Including Tie-Ins and Staging with Existing PCS)			4			4										2						6	16	0	16	$2,430	$61		$2,490.75
60% Design Drawings			4		2	8				4	4	4	16	40							16		98	0	98	$12,544	$314		$12,857.60
60% Detailed Design Report (Update to Project A2.3 Report)	0.5	2	4		1	2	1	4	1	2	2	2				2				2	24	2	52	0	52	$7,343	$184		$7,526.58
60% Technical Specifications		1	2			2															2		7	0	7	$1,080	$27		$1,107.00
60% Functional Microturbine System Design Drawings			2				8	16			28	28	40	80							40		242	0	242	$32,196	$805		$33,000.90
60% Functional Microturbine System Design Specifications			2				8	24			8	8									24		74	0	74	$10,756	$269		$11,024.90
60% Detailed Design Workshop		2	2			2	2	2													6		16	0	16	$2,372	$59		$2,431.30
Class B Cost Estimate		1	1												16						4		22	0	22	$3,460	$87		$3,546.50
90% Detailed Design																													
Civil Site Layout (Chamber, Site Access, Grading Plan, Pipework)			8				1	8								4					20		41	0	41	$5,486	$137		$5,623.15
PCS and Line Valve Chamber Mechanical Layout Plan & Sections						8	1	8													16		33	0	33	$4,506	$113		$4,618.65
Structural Design										4											16		20	0	20	$2,520	$63		$2,583.00
Seismic Design																							0	0	0	$0	$0		$0.00
EIC Design											8	8									16		32	0	32	$5,008	$125		$5,133.20
Environmental, Permitting and Approvals									2											12			14	0	14	$1,740	$44		$1,783.50
Constructability Review (Including Tie-Ins and Staging with Existing PCS)			2			4										2						6	14	0	14	$2,130	$53		$2,183.25
90% Design Drawings			4		2	8				4	4	4	16	40							24		106	0	106	$13,504	$338		$13,841.60
90% Detailed Design Report (Update to Project A2.3 Report)	0.5	2	2		1	2			1	2	2	2				2				2	16	2	37	0	37	$5,397	$135		$5,531.93
90% Technical Specifications		2	4		2	4			2	2	4	4				2				2	4		32	0	32	$5,414	$135		$5,549.35
90% Functional Microturbine System Design Drawings			2				8	16			16	16	24	40							40		162	0	162	$21,604	$540		$22,144.10
90% Functional Microturbine System Design Specifications			2				8	16			4	4									40		74	0	74	$10,132	$253		$10,385.30
90% Detailed Design Workshop		2	2			4	2	2													6		18	0	18	$2,722	$68		$2,790.05
Class A Cost Estimate		1	1												16						2		20	0	20	$3,220	$81		$3,300.50
Issued for Permit (IFP)																							0	0	0	$0	$0		$0.00
IFP Drawings			4				2	4			2	2	8	24							8		54	0	54	$6,604	$165		$6,769.10
IFP Technical Specifications						4	2	4	1	4	2	2				2					4		25	0	25	$3,924	$98		$4,022.10
Issued for Tender (IFT)																													
IFT Drawings			4			4	1	2			4	4	8	16							8		51	0	51	$6,800	$170		$6,970.00
IFT Technical Specifications and Supporting Documents						4	1	2	1	4	2	2				2					4		22	0	22	$3,488	$87		$3,575.20
Issued for Construction (IFC)																							0	0	0	$0	$0		$0.00
IFC Drawings and Specifications		2	2			4	2				2	2	2	8									24	0	24	$3,584	$90		$3,673.60
Subtotal Hours	5	47	104	6	8	74	64	160	10	30	114	114	138	280	32	22	8	10	24	28	418	16	1,670	42	1,712				
Subtotal Fees	$1,150	$8,930	$15,600	$600	$2,080	$12,950	$11,904	$20,000	$1,500	$4,500	$25,194	$18,810	$15,180	$29,400	$5,280	$3,850	$2,280	$1,650	$3,240	$3,360	$50,160	$2,080				$239,698	$5,992	$574	$246,264.05

Making a difference...together

Integrated Water Services

Change Order No. 19 – A2.1 Main No. 4 Detailed Design & Construction Services

Contract Title: Transmission Main Upgrade Program

Ref: Contract #: 2023-892
Ref: PO #: 4500107607

The Owner is issuing a change to the subject Contract.

Item#	Description of Change
1	This scope of work includes all additional effort to complete Detailed Design, Construction, and Post-Construction Services for project A2.1 Main No. 4 Upgrade in Langford. Key elements involved with this scope of work include: • Field investigations • Survey • Detailed Design o Permitting & Approvals o Environmental & Tree Removal o Geotechnical o Seismic Design o Traffic Management o Cathodic Protection o Constructability Review o Tender Ready Package • Construction Support • Post-Construction Support A more detailed breakdown of these tasks can be found within CCO-19R2.

Value of Contract prior to Change Order No.19, excluding GST:	$ 4,676,500.50
Total value of this Change, excluding GST:	$ 1,454,738.00
Updated value of Contract, excluding GST:	**$ 6,131,238.50**

Attachments: One (1)
- Contemplated Change Order 019R2 – August 7, 2026 (30 pages)

Jacobs Consultancy Canada Ltd.
Consultant

203-740 Hillside Avenue
Victoria, BC V8T 1Z4
Address

Capital Regional District
Owner

625 Fisgard Street
Victoria, BC V8W 2S6
Address

DRAFT

Date (DD-MM-YY)	Date (DD-MM-YY)
Signature	Signature

This Change Order:

- Does not change, vary or affect the contract other than as is expressly set out in the terms of each change order;
- Represents the full and final amount to which the Consultant is entitled for the items of work and materials; and
- Is made strictly on the understanding that the Consultant will make no further claims relating to the items of work and materials or omitted work and materials set out in each change order.

DRAFT

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August 7, 2026

Project Name: Regional Water Supply and Saanich Peninsula Water Services 2023-2026 Transmission Main Upgrade Program
Project Number: CE881400

Subject: Regional Water Supply and Saanich Peninsula Water Services 2023-2026 Transmission Main Upgrade Program - CCO19

In this letter, Jacobs Consultancy Canada Inc. (Jacobs) provides the proposed scope change and fees relating to the additional engineering services requested for the Regional Water Supply and Saanich Peninsula Water Services 2023-2026 Transmission Main Upgrade Program (the Project). The scope includes the services requested for the detailed design and services during construction for the Main No. 4 (Leigh Road to Veterans Memorial Parkway) replacement on Leigh Road, Dunford Avenue, Station Avenue (E&N Rail Trail) as per the preferred alignment and preliminary design of Project A2.1.

1. CCO19

1.1 Scope of Work

CCO19 includes the scope of work to be undertaken for the replacement of Main No. 4 in Langford from Leigh Road to Veterans Memorial Parkway (Project A2.1).

The initial scope of works for the Main No. 4 Replacement project was to complete an analysis of the potential replacement routes, selection of a preferred route, and delivery of the preliminary design. This was completed in May 2026 with the completion of the preliminary design workshop. The scope of works proposed in CCO19 are for continuing this design through detailed design and providing services during construction. This responsibilities and level of effort for Jacobs during detailed design and construction on this project are assumed to align with the effort for the steel pipe design for Main No. 4 in Central Saanich (Project A2.4), with exceptions where the effort for this project is different noted in this letter.

The field investigations are proposed to be undertaken prior to the formal commencement of the detailed design phase on this project and CCO19 is accordingly split into two phase – CCO19A for the field investigation and CCO19B for the remaining detailed design and construction services.

This change order also includes credit for the removal of the detailed design for Project A2.2 which is not being completed as part of this program of works.

The key tasks for CCO19 are detailed in the following sections.

1.2 CCO19A

1.2.1 Field Investigations

The field investigations listed in this section are planned to occur prior to the detailed design phase.

1.2.1.1 Survey

Jacobs will retain Polaris to undertaken topographic survey as well as investigations of maintenance holes along the alignment and survey of the potholes which will be excavated and restored by the CRD. Jacobs will provide the CRD with proposed locations for the pothole investigation.

Following review of the findings of the topographic survey, maintenance hole survey, and potholing there may be the need to conduct additional utility pothole investigations to validate the location of existing utilities of further utility scanning for any gaps identified. Should scanning be required, GeoScan will be retained to complete utility field investigations for scanning of the locations outlined in Attachment C as part of the detailed design phase.

1.3 CCO19B

1.3.1 Detailed Design Phase

The detailed design stage will build on the preliminary design and finish with a tender package. Key areas of focus during this phase of design include:

- Further engagement with key stakeholders to finalize requirements to include in the design package
- Remaining field investigations including the geotechnical borehole investigation
- Gather all necessary permits and approvals as well as highlighting those with long lead times that the construction Contractor will be required to obtain
- Develop a comprehensive drawing and specification package which clearly defines all critical and high-risk items
- Stipulate performance requirements in instances where providing construction Contractor flexibility is advantageous to CRD
- Develop a Class A construction cost estimate
- Potential pre-purchase of long-lead materials (subject to further development of procurement strategy during the detailed design phase)

The following sub-sections elaborate on our approach for key items in the detailed design phase.

1.3.1.1 Permitting and Approvals

Jacobs will coordinate the permitting requirements and application submissions. A Permit Registry will be used to identify and manage permits throughout the detailed design. Jacobs will support the CRD's Environmental, First Nations, and Regulatory Manager to engage regulatory agencies early in the detailed design process, continuing on with the engagement undertaken during the preliminary design.

We will collaborate with the CRD on regular contact with regulatory agencies and provide periodic briefings on project updates, address concerns, and verify that the permit application review is progressing

on schedule. We can support the CRD with identifying potential risks or opportunities to obtaining a permit and determine mitigation measures to de-risk critical path permits.

Where required, Jacobs will also support the CRD's effort to consult with the public, applicable stakeholders, and First Nations to address their concerns, finalize their alignment, and identify a construction sequence that helps reduce community impacts.

1.3.1.2 Environmental and Tree Removal

Jacobs will continue on from the desktop information review and findings, including potential environmental constraints and opportunities, and conduct field investigations to document and identify environmental features along the project. For this project in the urbanized area of Langford, we are not expecting to impact watercourses but there may be some vegetation impacts that will need to be assessed.

Information will be collected to support the preparation of permit applications and inform the development of mitigation measures. Bartlett Tree Experts will inventory potentially impacted significant trees and tree groupings to inform the overall Tree Protection Plan. The Tree Protection Plan will also include an overall assessment of likely level of impacts to the inventoried trees, and mitigation for construction.

1.3.1.3 Geotechnical

Based on our understanding of the soil conditions from the preliminary design, challenges that are likely to be encountered on this project includes:

- Interbedded sands and gravels of the Colwood delta and outwash plain
- Potentially some areas at the northern end of the alignment with thin organic layers
- Potential shallow rock around Leigh Road and Goldstream Avenue

Thurber will be engaged to complete the geotechnical field investigations and geotechnical design for the project. Thurber will complete a test hole investigation to assess subsurface conditions and consistency to develop design considerations for the proposed Main No. 4 relocation.

Sonic drilling investigation will be completed at nine locations along the Main No. 4 alignment at roughly 250 m spacing. The works will be undertaken using a track-mounted sonic drill rig and is estimated to take up to five days, including dynamic cone penetration tests (DCPTs) to provide an estimate of the density of the granular soils.

Test holes are anticipated to be advanced up to a depth of approx. 5.0 m or to an effective refusal (whichever is shallower). The soil and groundwater conditions will be logged in the field by geotechnical personnel, and select soil samples will be sent for testing in Thurber's geotechnical laboratory. All soil samples will be subjected to routine moisture content and visual classification testing. Gradation analyses, fines content (percent passing 75 um sieve) and Atterberg limit testing will be carried out on selected representative samples, as deemed appropriate.

Traffic control is expected to be required for most of the proposed test holes, with a traffic management plan (TMP) created for the safety of personnel on site.

Thurber will also complete BC One Call locate requests and retain the services of a private utility locator to scan the proposed test hole locations before proceeding with the subsurface investigation.

The proposed test hole locations are shown in Attachment D.

Following the geotechnical field investigations, Thurber will prepare a geotechnical data report to summarize the observed soil and groundwater conditions, test hole locations, and laboratory results. This report is intended to provide a factual overview of information gathered from the geotechnical investigation and will feed into the geotechnical design report that will include geotechnical recommendations for design and construction works.

1.3.1.4 Seismic Design

The seismic design of Main No. 4 will be based on the level of seismic hazard which has been specified for the Project and based on continuous steel pipe. We will review the ground conditions and seismic class of the site identified during the geotechnical field investigations and, as required, perform analytical assessments to determine seismic adequacy of the proposed replacement main.

Based on the preliminary desktop assessment, the anticipated relatively shallow depth of the existing pipe, lack of topographic relief, anticipated groundwater depth, and experience in the Colwood sand and gravel, Thurber noted in the preliminary design that liquefaction or lateral spreading is not expected to be of concern along the proposed alignment.

1.3.1.5 Traffic Management

Linear projects that follow road ROW can be highly disruptive to traffic. In particular, this project has particular areas which may disrupt traffic including:

- Dunford Avenue – during the preliminary design, the City of Langford raised concerns around construction in this ROW impacting access to businesses during construction.
- Intersection Crossings (Peatt Road, Jacklin Road) – while the pipeline will be running along the E&N rail trail and not expected to impact adjacent road users during construction, the open-cut construction of intersections will need to be planned to mitigate impacts as much as practical through construction
- Veterans Memorial Parkway Tie-In – the existing Main No. 4 runs directly through the middle of the intersection of Goldstream Avenue, Station Avenue, the E&N Rail Trail, and Veterans Memorial Parkway.

Jacobs will work with their subconsultant, Watt Consultant Group, to develop a traffic management strategy and traffic management plans for these key locations to be reviewed by the CRD and relevant stakeholders prior to being included in the tender specification package.

The traffic management strategy is proposed to include:

- Overall Traffic Management Plan (Traffic, Signage, and Pedestrian Management Plan) including an incident management plan, public information, and implementation plan
- 12 x Traffic Control Drawings, expected to be provided for:
  - 2 for Goldstream Avenue / Leigh Road
  - Leigh Road SLAT

- Dunford Avenue SLAT
- 2 for Dunford Avenue / Jacklin Road Intersection
- 2 for E&N Rail Trail Closure (Jacklin Road to Peatt Road and Peatt Road to Veterans Memorial Parkway)
- 2 for E&N Rail Train / Peatt Road Intersection
- 2 for Veterans Memorial Parkway Tie-In

Jacobs will also continue to develop the turn path sketches and aerial sketches developed to visualize the potential impact during construction on Dunford Avenue.

1.3.1.6 Cathodic Protection

We will retain Corrosion Services to complete the cathodic protection design scope for this project.

The key tasks for the cathodic protection design will include:

- Conducting field testing in conjunction with the geotechnical field design to determine soil corrosivity parameters
- Review of the alignment to identify CP system requirements, system components, and propose groundbed locations
- Identification of AC power requirements
- Determination of monitoring and electrical isolation points

Cathodic protection design drawings and specifications will be provided as part of the tender and construction package.

1.3.1.7 Constructability Reviews

Jacobs will build on the preliminary constructability reviews undertaken as part of the preliminary design to help mitigate impacts to stakeholders during construction. During the constructability review, Jacobs will:

- Review possible construction layouts to check the feasibility of the space provided as temporary workspace for the construction Contractor
- Review of surrounding existing infrastructure, no-go zones, and verification of shoring methods for the ground conditions

1.3.1.8 Tender Ready Package

The detailed design phase will conclude with the delivery of a tender-ready package including the following design drawings and specifications.

This will include listing of mandatory / important details for the construction Contractor and highlighting specific tasks which are critical-path to be undertaken early on in construction by the construction Contractor.

1.3.2 Construction Support

Jacobs propose to complete the following scope as part of our services during construction:

- Reviewing the Contractors' proposed construction schedules to establish baseline schedules and cash flow projections
- Conducting change management which will involve documents like RFIs, instructions, schedules, NCRs, substitutions, and so on
- Reviewing submittals, which will likely include initial set-up documents like health/safety, baseline quality (including ITPs), environmental, traffic, shoring/utility protection, and so on
- Reviewing RFIs, alternative materials, or means/methods proposed by the Contractor(s) and provide recommendations to the CRD as required
- Facilitate coordination between Vendors who might be supplying material and equipment on behalf of the CRD and the construction contractors
- Work with Jacobs' discipline leads to revise and re-issue drawings should there be significant updates that merit revised drawings
- Host regular progress meetings and distribute minutes. Perform regular site visits, payment certification, and maintain construction documentation
- Reviewing work to determine compliance with Contract documents, and verifying Contractor ITPs are followed
- Identifying items that are not conforming to the Contract for action by the Contractor
- Confirming key quality metrics such as ovality (on welded steel pipe), compaction, coating, lining, and pressure testing
- Generating daily reports to document site conditions, Contractor activities, progress, resources, and so on

1.3.3 Post-Construction Support

Jacobs will compile Contractor as-builts and develop a set of record drawings for the CRD These will be supported by other turnover documents detailed in the previous section. A project completion report will also be generated for submissions to the CRD.

Jacobs will assist the CRD in developing a maintenance schedule for the newly installed assets. This will be supplemented with an operational handover workshop with Jacobs and the CRD.

1.4 List of Deliverables

The deliverables for this work include the following:

- For the detailed design phase:
  - Geotechnical Reports (including Geotechnical Data Report and Geotechnical Design Report)
  - Pothole Data Reports (subject to completion of pothole investigations)
  - Utility Scanning Reports
  - Tree Protection Plan

  - Hydraulic & Transient Analysis Report (input into the detailed design report and/or attached memorandum)
  - Asset Life Cycle Assessment (input into detailed design deport)
  - Constructability, Tie-in and O&M Plan (input into detailed design report and/or attached memorandum)
  - List of Permits & Approvals (any permits required in advance of construction will be secured on behalf of CRD)
  - List of Advance Purchase Materials
  - Draft 60% detailed design report
  - Final design report
  - 60% Draft Specifications
  - Final Specifications (including Traffic Management Strategy)
  - 60% detailed design drawings
  - 90% detailed design drawings
  - IFT Design Drawings (including any sealed drawings required to be issued for permits)
  - IFC Design Drawing
  - Class A Cost Estimate
  - Inspection and Test Plan
  - Commissioning Plan
  - Submittal and Shop Drawing List
  - Meeting Minute(s)
  - Comment Log
- For the Construction Phase
  - Construction Contractor Tendering Support
  - Meeting Minute(s)
  - Progress Reports (including Claims and Payment Review)
  - Inspection/Non-Conformance Reports
  - O&M Manuals, Standard Operating Procedures, Maintenance Schedules
  - Commissioning Report
  - Redline Drawings
  - Site Instructions and Change Orders
  - Certificate of Completion, Deficiency List, and Notice of Acceptance
  - Record Drawings
  - Project Completion Reports

1.5 Assumptions

The following assumptions have been made regarding CCO19:

- During the preliminary design, Jacobs retained Millenia to complete an Archaeological Overview Assessment (AOA) in which no Archaeological Areas of Potential (AOPs) were identified. It is assumed the CRD will complete the remaining archaeological scope for the project and that the required permits will be obtained in sufficient time to meet the field investigation schedule
- Currently, we don't anticipate the need for site-specific spectral analysis, lateral modulus of soil reaction modelling, or soil structure interaction design. Though it is understood that seismic behaviour of adjacent steep slopes could potentially result in permanent ground displacements during the design earthquake, our review of the soils in the area do not identify any slopes steep enough to be of concern
- The following assumptions apply to the proposed geotechnical borehole investigation:
  - The investigation will span up to five, eight-hour days, including mobilization, demobilization, locates and test hole investigation time for Thurber personnel
  - Test holes will be advanced up to 5 m below ground surface or effective refusal (whichever is shallower)
  - No bedrock coring will be completed
  - Test holes will be backfilled upon completion in accordance with the BC Groundwater Regulations
  - Asphalt surfaces will be cored by the drill rig, and the road surface will be reinstated using cold patch asphalt. Any requirement for saw-cutting of the asphalt or additional repair (including hot mix asphalt surfacing) is assumed to be completed by the CRD.
  - While Thurber will endeavour to minimize disturbance to the site caused by the equipment, some disturbance is unavoidable. Any repair to the disturbed landscaping or hardscaping areas caused by drilling activities will be completed by others
  - Soil cuttings will be drummed during the investigation, and the soil drums will be placed in a pre-approved location for others to dispose of. Any contaminated soil disposal is not included in the base scope.
  - Thurber will retain the drilling utility locates and traffic control subcontractors directly.
  - Thurber will act as Prime Contractor for the purposes of the geotechnical test hole investigation
  - No hydro vacuum excavation is expected to clear the required test hole locations of underground infrastructure
  - Test hole locations will be logged using handheld GPS equipment which has a typical accuracy in the order of 3 m
  - Unimpeded access to the test hole locations proposed by Thurber will be available, and no access preparation will be required to access these locations
  - Test holes are anticipated to be drilled on public property or in the public right of way. No allowances have been made for permits to access private property. Jacobs, with support from the CRD Project Team, will liaise with the ICF and CRD Parks for access to the E&N Rail Trail for the investigation
  - No archaeological services are included for the proposed geotechnical investigation

  - Environmental sampling and testing of samples has been included as described in the scope, if field observations indicate the need for additional parameters or samples to be analyzed, we will seek approval prior to proceeding
  - Overnight security is not required for the geotechnical investigation
  - No well installations or monitoring is proposed for any test hole locations
  - The test hole investigation will be completed during regular business hours on weekdays
  - Any excess soil may be left on site
- The Project is assumed to be constructed using open-cut construction methodology. Trenchless design is able to be provided for an additional fee should this be required
- It is assumed no building permits are required for this project
- The valve chambers are to be precast chambers as agreed during the preliminary design phase
- Material pre-purchase will be confirmed in the 60% design workshop
- Stakeholder engagement is expected to involve engaging with the following stakeholders:
  - City of Langford
  - Island Corridor Foundation
  - CRD Transit Authority
  - CRD Parks & Trails
  - Third-Party Utility Owners (including FortisBC, Telus and BC Hydro)
- It is assumed that all relevant permits identified during the preliminary design are obtainable within 12 months of commencement of the detailed design
- The hours assumed for Jacobs resident engineer are based on an average of 3 days per week (0.6 FTE) for the duration of construction in the schedule. This will be reviewed following submission of the construction Contractor's schedule and based on the level of effort required from the CRD to complete the tasks required of the resident engineer
- It is expected that the CRD and their archaeological Contractor will obtain the relevant permit/s to allow for the field investigations to proceed on the proposed timeline
- No allowance has been made for any additional permits for the Island Corridor Foundation. The permitting scope for the use of this corridor is expected to comprise of assisting the CRD with
- No allowance has been made for development of legal survey plans for temporary workspaces or ROW, this will be determined during the detailed design following engagement with the relevant property owners
- Project management for detailed design phase only, ongoing requirements during construction of A2.1 and onwards to be reviewed at the time
- CRD comments on the 90% submission are expected to be minor in nature, with only minor alterations required for the IFP and IFT stages.

1.6 Project Schedule

A draft schedule for Project A2.1 design is provided in Attachment A. This is based on an expected preliminary design workshop in early May and detailed design commencing in June 2026.

From the preliminary design workshop, it is Jacobs understanding that some of these tasks may be expected to commence later than this to allow for sufficient engagement with the City of Langford prior to undertaking field investigations and detailed design. The impacts to be linear (i.e., if detailed design starts in July instead of June then the full schedule shifts by one month, there are no critical seasonal dependencies identified which would put any further delays on the schedule).

1.7 Escalation

Following correspondence with Adrian Wardle and Jared Kelly, the rates for this scope of works have been increased by 5% when compared to the rates used for the original scope of the 2023-2026 Transmission Main Upgrade Program. This is approximately in line with escalation from the commencement of the project at the end of 2023 to the submission of this CCO in May 2026.

The charge out rate for Craig Fourie is also proposed to be increased further based on the following factors:

- Based on the schedule below, the vast majority of hours for Craig are scheduled to take place from October 2027 onwards, rather than during the design phase
- Since the original proposal in mid-2023, Craig's experience and expertise as a senior construction engineer have continued to develop, enhancing his technical capabilities and leadership skills. His expanded role and increased responsibilities within Jacobs reflect his progression and the greater value he brings to complex construction phase activities, warranting an adjustment to his charge out rate to align with his current position and market conditions.

These rates will be held for the scope of work defined in this CCO for the schedule outlined in this CCO. Should the schedule extend significantly beyond this for reasons outside of Jacobs control, or additional effort be required, Jacobs will negotiate any updates to these rates with the CRD.

1.8 Fee Summary

A summary of the hours and tasks is provided below.

Jacobs			Price	Hours
		CRD Transmission Main Upgrade Program	CAD	Hr
			$1,454,738	7,049
		CCO 019 - Project A2.1 (Main No. 4 in Langford) Detailed Design and Services During Construction		
1		CCO019A	$ 36,380	54
1	1.1	Utility Field Investigations	$ 36,380	54
1	1.1	Topographic Survey (Polaris)	$ 16,500	
1	1.1	Utility Field Investigations (inc. manhole surveys and pothole survey)	$ 9,096	54
1	1.1	Utility Field Investigations for Manholes and Potholes (Polaris)	$ 9,896	
1	1.1	CCO019A General Disbursements (2.5%)	$ 887	
		CCO019B	$ 1,418,358	6,995
2		Detailed Design Project Management	$ 771,800	3,515
2	2.1	Remaining Field Investigations	$ 178,094	40
2	2.1	Utility Field Investigations (GeoScan)	$ 27,200	
2	2.1	Utility Field Investigations (GeoScan Subcontractors for TMP, Traffic Control, Permit Fees)	$ 16,700	
2	2.1	Geotechnical Investigation		
2	2.1	Project and Subcontractor Coordination, Meetings, Prime Contractor Safety Docs (Thurber)	$ 2,500	
2	2.1	Geotechnical Test Hole Investigation (Thurber)	$ 97,435	
2	2.1	Geotechnical Test Hole Investigation (Jacobs HSE Review & Coordination, including for E&N Trail Impacts)	$ 3,156	20
2	2.1	Geotechnical Data Report (Thurber)	$ 8,980	
2	2.1	Environmental Soil Sample Collection and Soil Characterization Report (Thurber)	$ 8,560	
2	2.1	Environmental Investigations	$ 2,748	20
2	2.1	Tree Survey and Arborist Report (Bartlett)	$ 10,815	
2	2.2	Detailed Design Project Management	$ 55,624	408
2	2.2	Progress Meetings (Bi-Weekly)	$ 12,384	72
2	2.2	Monthly Reporting and Invoicing (Monthly / All Stages)	$ 14,048	112
2	2.2	Project Schedule	$ 10,608	72
2	2.2	Subconsultant Coordination	$ 18,584	152
2	2.3	60% Detailed Design	$ 204,628	1,096
2	2.3	Site Walks	$ 10,588	58
2	2.3	Stakeholder Engagement	$ 18,768	108
2	2.3	Steady State Hydraulic Analysis (GeoAdvice)	$ 7,612	
2	2.3	Transient Hydraulic Analysis	$ 6,960	40
2	2.3	Construction Staging and Tie-In Plan	$ 5,928	28
2	2.3	Operations and Maintenance Plan	$ 3,384	24
2	2.3	Material Procurement Strategy	$ 4,396	28
2	2.3	Asset Life Cycle Assessment	$ 4,416	30
2	2.3	60% Detailed Design Delivery		
2	2.3	Permitting and Approvals	$ 3,756	28
2	2.3	Traffic Management (Watt Consulting Group)	$ 5,000	
2	2.3	Traffic Management Coordination	$ 2,000	10
2	2.3	Environmental and Geo-Environmental	$ 3,756	28
2	2.3	Geotechnical Design (Thurber)	$ 10,702	
2	2.3	Seismic Design (Doug Honegger)	$ 5,712	
2	2.3	Civil Design	$ 12,760	90
2	2.3	Mechanical Design	$ 9,456	64
2	2.3	E, I&C Design	$ 5,792	38
2	2.3	Structural Design	$ 5,600	34
2	2.3	Corrosion Protection Design (Corrosion Services)	$ 6,450	
2	2.3	60% Design Report	$ 19,572	114
2	2.3	60% Design Drawings	$ 32,450	268
2	2.3	60% Technical Specifications	$ 3,914	20
2	2.3	Class B Cost Estimate	$ 9,068	52
2	2.3	60% Design Review Workshop	$ 6,588	34
2	2.4	90% Detailed Design	$ 258,604	1,431
2	2.4	Site Walks	$ 2,280	12
2	2.4	Stakeholder Engagement	$ 18,036	104
2	2.4	Transient Hydraulic Analysis	$ 4,176	24
2	2.4	Construction Staging and Tie-In Plan	$ 16,440	92
2	2.4	Operations and Maintenance Plan	$ 5,068	32
2	2.4	Material Procurement Strategy	$ 5,724	34
2	2.4	Asset Life Cycle Assessment	$ 3,112	20
2	2.4	90% Detailed Design Delivery		
2	2.4	Permitting and Approvals	$ 5,772	44
2	2.4	Traffic Management Strategy (Watt Consulting Group)	$ 5,000	
2	2.4	Traffic Control Plans (Watt Consulting Group)	$ 14,400	
2	2.4	Traffic Management Coordination	$ 2,000	10
2	2.4	Environmental & Geo-Environmental	$ 3,756	28
2	2.4	Geotechnical Design (Thurber)	$ 10,702	
2	2.4	Seismic Design (Doug Honegger)	$ 5,712	
2	2.4	Civil Design	$ 9,104	62
2	2.4	Mechanical Design	$ 7,984	56
2	2.4	E, I&C Design	$ 10,236	68
2	2.4	Structural Design	$ 5,600	34
2	2.4	Corrosion Protection Design (Corrosion Services)	$ 6,450	
2	2.4	Final Design Report	$ 21,292	148
2	2.4	90% Design Drawings	$ 36,030	286
2	2.4	90% Technical Specifications	$ 29,860	190
2	2.4	Class A Cost Estimate	$ 12,588	72
2	2.4	Commissioning Plan	$ 8,698	63
2	2.4	Submittal and Shop Drawing List	$ 1,996	18
2	2.4	90% Design Review Workshop	$ 6,588	34
2	2.5	Issued for Tender / RFP	$ 33,316	262
2	2.5	Issue For Permits (e.g., Island Health Permit) & Permit Submissions	$ 7,812	62
2	2.5	IFT Drawings	$ 15,560	128
2	2.5	IFT Technical Specifications & Other Supporting Documents	$ 9,944	72
2	2.6	Construction Tendering Support	$ 41,534	278
2	2.6	RFI and Addenda	$ 15,238	94
2	2.6	Technical Bid Evaluation & Recommendation	$ 9,620	50
2	2.6	IFC Drawings and Specifications	$ 16,676	134
3		Construction Stage	$ 560,577	3,128
3	3.1	Construction Engineering Services	$ 560,577	3,128
3	3.1	Construction Progress Meetings	$ 35,120	208
3	3.1	Contract Administration	$ 28,320	168
3	3.1	Resident Engineering	$ 391,000	2,300
3	3.1	Engineering Support Services	$ 90,712	452
3	3.1	Inspection Services (Onsite and Offsite Materials, Thurber)	$ 10,300	
3	3.1	Construction Services Engineering Support (Thurber)	$ 5,125	
4		Post Construction Services	$ 51,387	352
4	4.1	Post Construction Engineering Services	$ 51,387	352
4	4.1	Post Construction Engineering Support	$ 39,032	292
4	4.1	Operational Handover Workshop	$ 10,080	60
4	4.1	Cathodic Protection Record Drawings (Corrosion Services)	$ 2,275	
5		Escalation, Disbursements, MR, Contingency	$ 34,594	
5	5.1	General Disbursements (2.5%)	$ 34,594	

Should you have any questions, please contact Anita Le at Anita.Le@jacobs.com or 778-994-3348.

Yours sincerely,



Anita Le, P.Eng. MBA, PMP

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2. Attachment A – Project Schedule

DATE	Jun-26	Jul-26	Aug-26	Sep-26	Oct-26	Nov-26	Dec-26	Jan-27	Feb-27	Mar-27	Apr-27	May-27	Jun-27	Jul-27	Aug-27	Sep-27	Oct-27	Nov-27	Dec-27	Jan-28	Feb-28	Mar-28	Apr-28	May-28	Jun-28	Jul-28	Aug-28	Sep-28	Oct-28	Nov-28	Dec-28	Jan-29	Feb-29	Mar-29	Apr-29	May-29	Jun-29	Jul-29
FIELD INVESTIGATIONS																																						
60% DESIGN																																						
90% DESIGN																																						
IFT																																						
TENDER																																						
EVALUATION + AWARD																																						
PRE-CON																																						
PIPE SUPPLY																																						
UTILITY LOCATES & RELOCATIONS																																						
STEEL PIPE INSTALL																																						
LV / APPURTENANT CHAMBERS & TIE-INS																																						
COMMISSIONING																																						

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3. Attachment B – Detailed LOE

			Price	Hours	Hours Per Person																							
					326	790	35	120	288	10	270	52	96	64	68	232	76	80	568	112	48	110	308	376	120	20	140	2708
		CRD Transmission Main Upgrade Program	CAD	Hr	PM	DM	Program Manager	Project Controls	Civil Lead	Technical Reviewer	Mechanical Lead	Enviro, Permit & Comm. Engage	Structural Lead	Electrical Lead	IC Lead	Enviro & Permit Support	Transient Hydraulics Lead	Civil Designer	Junior Civil Designer	Mechanical Designer	Lead Designer / Drafter	Cost Estimator	Engineering Support - Intermediate	Engineering Support - Junior	EIC Engineering Support	Tie-In & Commissioning Specialist	Construction Specialist	Resident Engineer
		CCO 019 - Project A2.1 (Main No. 4 in Langford) Detailed Design and Services During Construction	$1,454,738	7,049	Anita Le	Patrick Moore	Ken Madill	Akhil Abburu	Percy Yu	Roger Bieler	Mehrdad Panahi	Bree Milne	Henry Xiong	Wendell Thiessen	Ramachandran Natarajan	Diana Chomack	Andrew Long	Bernadeta Zajac-Zak	Elzbieta Whek	Bugra Unal	Kelly Perison	Rosemarie Gumba	Oliver South	Jelena Radovanovic	Davis Law	Eric Wildschut	Michael Terlaan	Craig Fourie
1		CCO019A	$ 36,380	54	$200	$158	$242	$68	$242	$315	$184	$183	$164	$232	####	####	####	####	###	####	####	####	####	####	###	####	####	####
1	1.1	**Utility Field Investigations**	**$ 36,380**	**54**																								
1	1.1	Topographic Survey (Polaris)	$ 16,500																									
1	1.1	Utility Field Investigations (inc. manhole surveys and pothole survey)	$ 9,096	54	2	12																						40
1	1.1	Utility Field Investigations for Manholes and Potholes (Polaris)	$ 9,896																									
1	1.1	CCO019A General Disbursements (2.5%)	$ 887																									
		CCO019B	$ 1,418,358	6,995																								
2		Detailed Design Project Management	$ 771,800	3,515																								
2	2.1	**Remaining Field Investigations**	**$ 178,094**	**40**																								
2	2.1	Utility Field Investigations (GeoScan)	$ 27,200																									
2	2.1	Utility Field Investigations (GeoScan Subcontractors for TMP, Traffic Control, Permit Fees)	$ 16,700																									
2	2.1	Geotechnical Investigation																										
2	2.1	Project and Subcontractor Coordination, Meetings, Prime Contractor Safety Docs (Thurber)	$ 2,500																									
2	2.1	Geotechnical Test Hole Investigation (Thurber)	$ 97,435																									
2	2.1	Geotechnical Test Hole Investigation (Jacobs HSE Review & Coordination, including for E&N Trail Impacts)	$ 3,156	20	2	8			2							8												
2	2.1	Geotechnical Data Report (Thurber)	$ 8,980																									
2	2.1	Environmental Soil Sample Collection and Soil Characterization Report (Thurber)	$ 8,560																									
2	2.1	Environmental Investigations	$ 2,748	20								4				16												
2	2.1	Tree Survey and Arborist Report (Bartlett)	$ 10,815																									
2	2.2	**Detailed Design Project Management**	**$ 55,624**	**408**																								
2	2.2	Progress Meetings (Bi-Weekly)	$ 12,384	72	24	48																						
2	2.2	Monthly Reporting and Invoicing (Monthly / All Stages)	$ 14,048	112	16	48		48																				
2	2.2	Project Schedule	$ 10,608	72	16	40		16																				
2	2.2	Subconsultant Coordination	$ 18,584	152	24	40		48																		40				
2	2.3	**60% Detailed Design**	**$ 204,628**	**1,096**																								
2	2.3	Site Walks	$ 10,588	58	8	8	2		8		8	8				8												8
2	2.3	Stakeholder Engagement	$ 18,768	108	40	40	4					8				16												
2	2.3	Steady State Hydraulic Analysis (GeoAdvice)	$ 7,612																									
2	2.3	Transient Hydraulic Analysis	$ 6,960	40													40											
2	2.3	Construction Staging and Tie-In Plan	$ 5,928	28		4			8																	4	4	8
2	2.3	Operations and Maintenance Plan	$ 3,384	24					4		4													16				
2	2.3	Material Procurement Strategy	$ 4,396	28	4	4			4		4													12				
2	2.3	Asset Life Cycle Assessment	$ 4,416	30	2	4			4		4													16				
2	2.3	60% Detailed Design Delivery																										
2	2.3	Permitting and Approvals	$ 3,756	28								4				24												
2	2.3	Traffic Management (Watt Consulting Group)	$ 5,000																									
2	2.3	Traffic Management Coordination	$ 2,000	10	2	4			4																			
2	2.3	Environmental and Geo-Environmental	$ 3,756	28								4				24												
2	2.3	Geotechnical Design (Thurber)	$ 10,702																									
2	2.3	Seismic Design (Doug Honegger)	$ 5,712																									
2	2.3	Civil Design	$ 12,760	90	2	8			16														24	40				
2	2.3	Mechanical Design	$ 9,456	64							24												40					
2	2.3	E, I&C Design	$ 5,792	38	2	4								8	8										16			
2	2.3	Structural Design	$ 5,600	34	2	8							24															
2	2.3	Corrosion Protection Design (Corrosion Services)	$ 6,450																									
2	2.3	60% Design Report	$ 19,572	114	4	40	2		12	2	12	4	2	2	2	12	8					4			8			
2	2.3	60% Design Drawings	$ 32,450	268	2	8			8	2	8		8	4	4			40	120	40	24							
2	2.3	60% Technical Specifications	$ 3,914	20	4	8	2			2	4																	
2	2.3	Class B Cost Estimate	$ 9,068	52	2	8	2															40						
2	2.3	60% Design Review Workshop	$ 6,588	34	4	12	2		8		8																	
2	2.4	**90% Detailed Design**	**$ 258,604**	**1,431**																								
2	2.4	Site Walks	$ 2,280	12		4			4																			4
2	2.4	Stakeholder Engagement	$ 18,036	104	40	40	4					4				16												
2	2.4	Transient Hydraulic Analysis	$ 4,176	24													24											
2	2.4	Construction Staging and Tie-In Plan	$ 16,440	92	4	16			16															24		8	8	16
2	2.4	Operations and Maintenance Plan	$ 5,068	32	2	6			4		4												16					
2	2.4	Material Procurement Strategy	$ 5,724	34	4	12	2		4		4													8				
2	2.4	Asset Life Cycle Assessment	$ 3,112	20		4					8												8					
2	2.4	90% Detailed Design Delivery																										
2	2.4	Permitting and Approvals	$ 5,772	44								4				40												
2	2.4	Traffic Management Strategy (Watt Consulting Group)	$ 5,000																									
2	2.4	Traffic Control Plans (Watt Consulting Group)	$ 14,400																									
2	2.4	Traffic Management Coordination	$ 2,000	10	2	4			4																			
2	2.4	Environmental & Geo-Environmental	$ 3,756	28								4				24												
2	2.4	Geotechnical Design (Thurber)	$ 10,702																									
2	2.4	Seismic Design (Doug Honegger)	$ 5,712																									
2	2.4	Civil Design	$ 9,104	62	2	4			16															40				
2	2.4	Mechanical Design	$ 7,984	56							16												40					
2	2.4	E, I&C Design	$ 10,236	68	2	2								16	16										32			
2	2.4	Structural Design	$ 5,600	34	2	8							24															
2	2.4	Corrosion Protection Design (Corrosion Services)	$ 6,450																									
2	2.4	Final Design Report	$ 21,292	148	4	16			8	2	8	4	4	4	4	12	4					2	24	40	12			
2	2.4	90% Design Drawings	$ 36,030	286		8			12	2	12		12	8	8			40	120	40	24							
2	2.4	90% Technical Specifications	$ 29,860	190	8	16	2		16		16	4	8	4	8	16							40	24	12	4	4	8
2	2.4	Class A Cost Estimate	$ 12,588	72	2	4	2															64						
2	2.4	Commissioning Plan	$ 8,698	63	2	4	1		4		4													40		4		4
2	2.4	Submittal and Shop Drawing List	$ 1,996	18		2																		16				
2	2.4	90% Design Review Workshop	$ 6,588	34	4	12	2		8		8																	
2	2.5	**Issued for Tender / RFP**	**$ 33,316**	**262**																								
2	2.5	Issue For Permits (e.g., Island Health Permit) & Permit Submissions	$ 7,812	62	2	8			2		2					16			8					24				
2	2.5	IFT Drawings	$ 15,560	128	4	12			8		8								80	16								
2	2.5	IFT Technical Specifications & Other Supporting Documents	$ 9,944	72	4	12			4		4												24	24				
2	2.6	**Construction Tendering Support**	**$ 41,534**	**278**																								
2	2.6	RFI and Addenda	$ 15,238	94	8	40			8		8		2	2	2								12	12				
2	2.6	Technical Bid Evaluation & Recommendation	$ 9,620	50	16	16	2		8		8																	
2	2.6	IFC Drawings and Specifications	$ 16,676	134	4	16	2		8		8								80	16								
3		Construction Stage	$ 560,577	3,128																								
3	3.1	**Construction Engineering Services**	**$ 560,577**	**3,128**																								
3	3.1	Construction Progress Meetings	$ 35,120	208	8	40																						160
3	3.1	Contract Administration	$ 28,320	168	8	40																						120
3	3.1	Resident Engineering	$ 391,000	2,300																								2300
3	3.1	Engineering Support Services	$ 90,712	452		40			64		64		12	16	16								80		40		120	
3	3.1	Inspection Services (Onsite and Offsite Materials, Thurber)	$ 10,300																									
3	3.1	Construction Services Engineering Support (Thurber)	$ 5,125																									
4		Post Construction Services	$ 51,387	352																								
4	4.1	**Post Construction Engineering Services**	**$ 51,387**	**352**																								
4	4.1	Post Construction Engineering Support	$ 39,032	292	16	40	4	4	12		12								160								4	40
4	4.1	Operational Handover Workshop	$ 10,080	60	16	16		4																				24
4	4.1	Cathodic Protection Record Drawings (Corrosion Services)	$ 2,275																									
5		Escalation, Disbursements, MR, Contingency	$ 34,594																									
5	5.1	General Disbursements (2.5%)	$ 34,594																									

4. Attachment C – GeoScan Utility Proposal

GeoScan

a T2ue company

WE REDUCE RISK AND ADD VALUE BY MAPPING THE PAST, PRESENT, AND FUTURE

Jacobs Consultancy Canada Inc.

Project Title: CRD Water Main Design
Quote Number: QG260505-14
Date: 5/6/2026
Name: Patrick Moore
Email: Patrick.Moore@jacobs.com
Phone: 236.971.6565

Estimating@GeoScan.ca
5279 Still Creek Ave, Unit A9,
Burnaby, BC
(604) 436-7226

GeoScan
a T2ue company

Project Understanding & Deliverables

Subsurface Utility Mapping

Project Understanding
We understand as part of the design of a proposed water main a Subsurface Utility Mapping survey is required to record the position of identified utilities and related surface features using electromagnetic locating, ground penetrating radar, and survey-grade equipment tied to local control. The project area spans across a number of locations - Goldstream Ave, Leigh Rd, Dunford Ave, Jacklin Rd, Peatt Rd and Highway 14th. Pricing assumes daytime work, and 8 hours of continuous access to the roadways is permitted.

Deliverables

- Georeferenced subsurface utility drawing in PDF and Civil 3D/AutoCAD
- Utilities shown with positions, depths, elevations, and associated surface features

Site / Scope Boundary

The site boundary is depicted on the attached plan. The extents of the utility survey are as follows;

- Goldstream Ave (PL-PL) approx 90 linear meters from 1115 Goldstream Ave to intersection with Leigh rd
- Goldstream Ave & Leigh Rd intersection - south lanes only
- Leigh Rd (PL-PL) approx 320 linear meters from intersection to 2903 Ted Nixon Trail
- Dunford Ave & Maurice Ln intersection (PL-PL) - from east PL of 2898 Dunford Ave to east PL of 2899
- Dunford Ave & Carlow Rd intersection (PL-PL) - from 1005 Dunford to 10 meters south of intersection
- Dunford Ave & henry Eng Pl intersection (PL-PL)
- 918 Dunford Ave (PL-PL)
- 904 Jacklin Rd (PL-PL) - 1 lane on Dunford + pedestrian areas on front of properties + crossing of Jacklin
- Peatt Rd (PL-PL) - from south side of abandoned rail line to 2005 south PL
- Highway 14 intersection - sotuh bound lanes of Hwy 14 + portion of abandoned rail line

Pricing is provided as a fixed lump sum costs, inclusive of travel, a desktop record review of available drawings, project management, and final deliverables. If unforeseen conditions extend the required effort, additional time will be billed hourly in accordance with our standard rates.

All quotes are valid for 90 days from the date of issuance. By signing below you agree to our terms and conditions of service.

Date:	05/06/2026
Name:	
Signature:	

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	Description of Service	Quantity	List Price (CA$)	Total (CA$)
	Utility Locate and Survey Daywork. Including site time to locate and survey utilities, and office time to draft final utility drawing in CAD format.	1.00	$ 27,200.00	$ 27,200.00
	Subcontractors Including TMP costs, permit fees and traffic control costs	1.00	$ 16,700.00	$ 16,700.00
Notes:			Total Quote (Ex. tax)	$ 43,900.00

Site Plans:

Fig 1. Site 1 - Goldstream Ave & Leigh Rd



Fig 2. Site 2 - Dunford & Maurice Ln



Fig 3. Site 3 - Dunford & Carlow

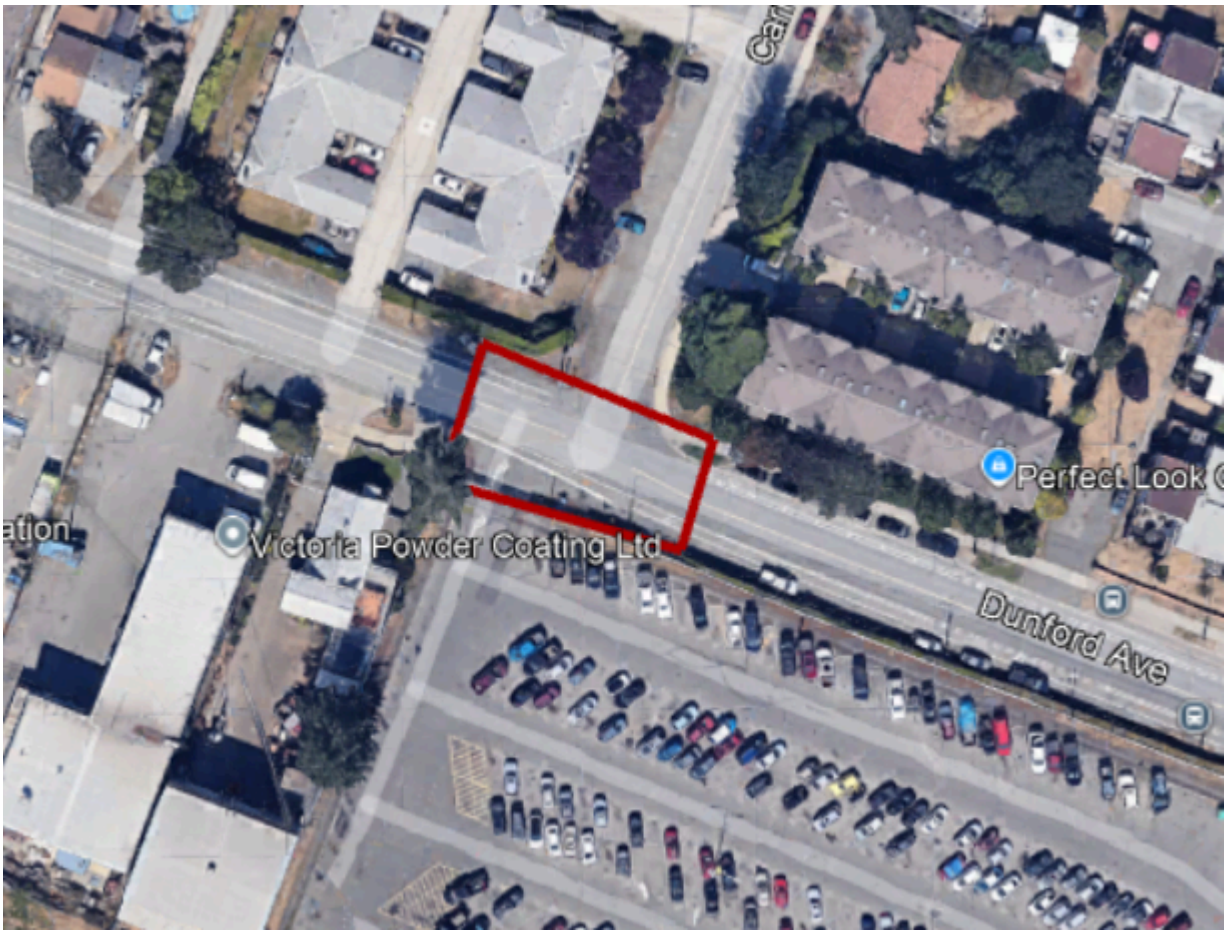


Fig 4. Site 4 - Dunford & Henry Eng Pl

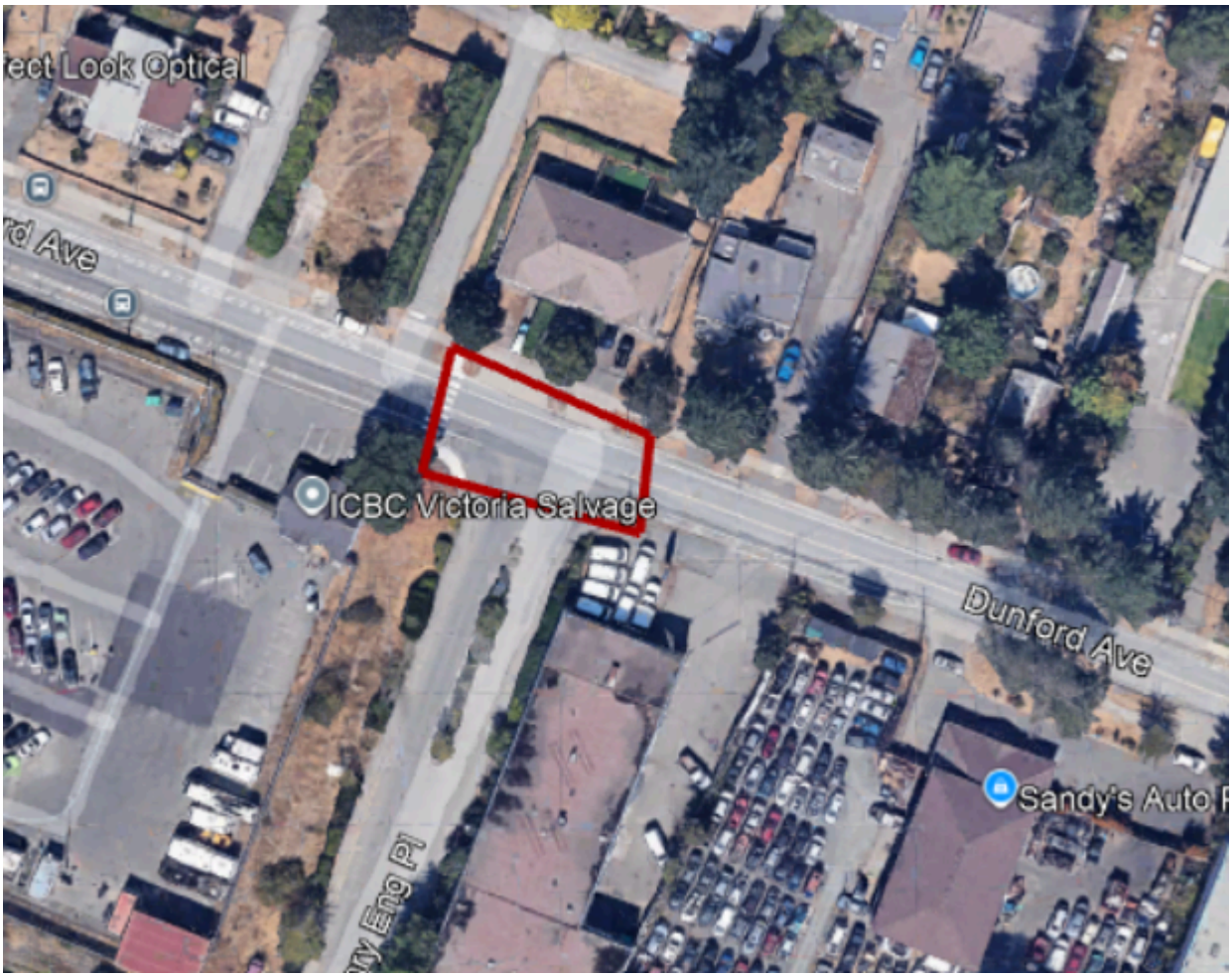


Fig 5. Site 5 - Dunford & Jacklin Rd



Fig 6. Site 6 - Peatt Rd



Fig 7. Site 7 - Hwy 14



General Assumptions for Client

Unless specifically quoted or addressed in the scope:

- The estimate is based on the provided scope. Any additional work outside the defined scope will require a change order and may result in additional costs.
- The estimate assumes uninterrupted access to the site. If access is restricted due to site conditions, client scheduling conflicts, or third-party delays, additional charges will apply.
- The estimate is based on standard crew availability. If additional crews, extended shifts, or overtime work is required to meet client timelines, additional charges will apply as per our standard rate sheet.
- Site conditions (such as heavy congestion, parked vehicles, or pedestrian access restrictions) may impact work efficiency and result in longer completion times.
- There are no lengthy delays for site orientation, security clearance. Any delays may be billed at our standard rates.
- The quote assumes favourable weather conditions. Inclement weather (heavy rain, snow, ice, or extreme temperatures) may cause delays or affect the efficiency of locating and excavation.
- Railway Proximity: If work is near active railways, coordination with CN Rail or CP Rail may be required, including permits and railway flaggers, which may add costs and scheduling constraints.
- Utility Locate Limitations: Locating services are performed using Ground Penetrating Radar (GPR) and Electromagnetic (EM) induction methods, which have inherent limitations:
    - Depth accuracy can be affected by soil composition (clay, wet soil, or rocky terrain).
    - Non-conductive utilities (asbestos cement, PVC, plastic pipes) may be difficult to locate using the above methods.
    - Ground disturbances or excessive surface obstructions may impact scan quality.

Traffic Control & Permitting Assumptions

- Work is assumed to occur during regular business hours unless otherwise stated.
- Traffic control is based on standard flagging and lane closure operations. If additional personnel, lane closures, or extended shifts are required, additional costs will apply.
- Night work or off-peak work may be required depending on the approved permitting or increased costs for traffic control, which are not included unless specified.

Additional Information

- We hereby confirm that GeoScan Subsurface Surveys Inc. carries Commercial General Liability Policy coverage of $5,000,000, Professional Liability Policy coverage of $5,000,000 as well as Workers Compensation Coverage.
- We have memberships at the following professional bodies including BC Common Ground Alliance, Underground Engineering Surveying Institute Environmental and are accredited by ASTTBC.
- Mobilization costs such as Flights, Accommodation and Vehicle rental are based on current rates at the time the quote was issued. If there are rate increases at the time of booking, these costs will be revised and reflected in your final invoice.
- Any related Traffic Control or Daylighting costs are a best estimate only. If final costs exceed the quoted amount, they will be invoiced at cost +10%.
- Please note that this is only an estimate and actual field and office hours will be used to calculate your final invoice.

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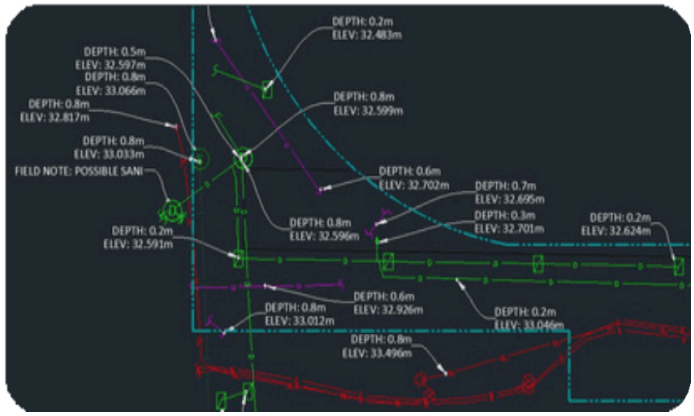
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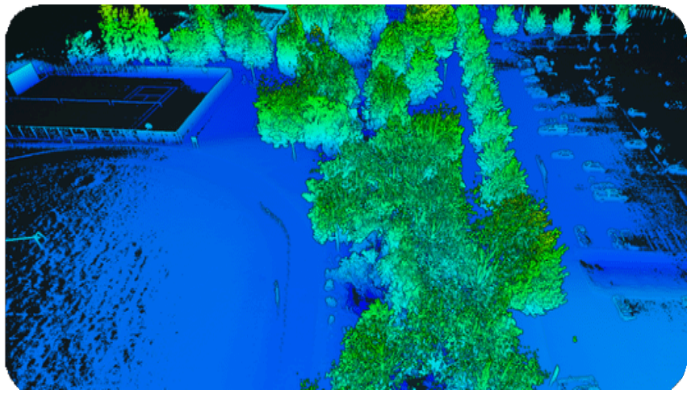
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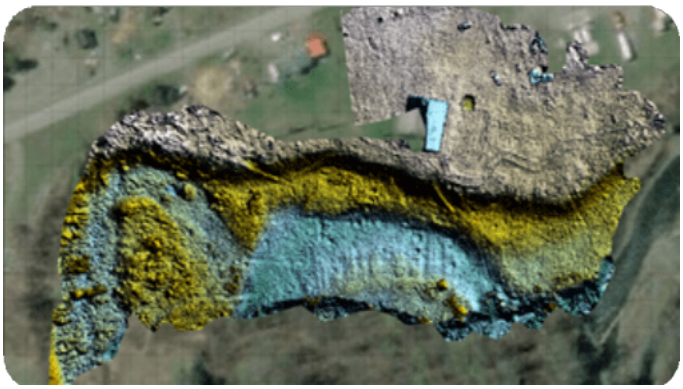
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LiDAR Services | Aerial UAV Mapping | 3D Laser Scanning



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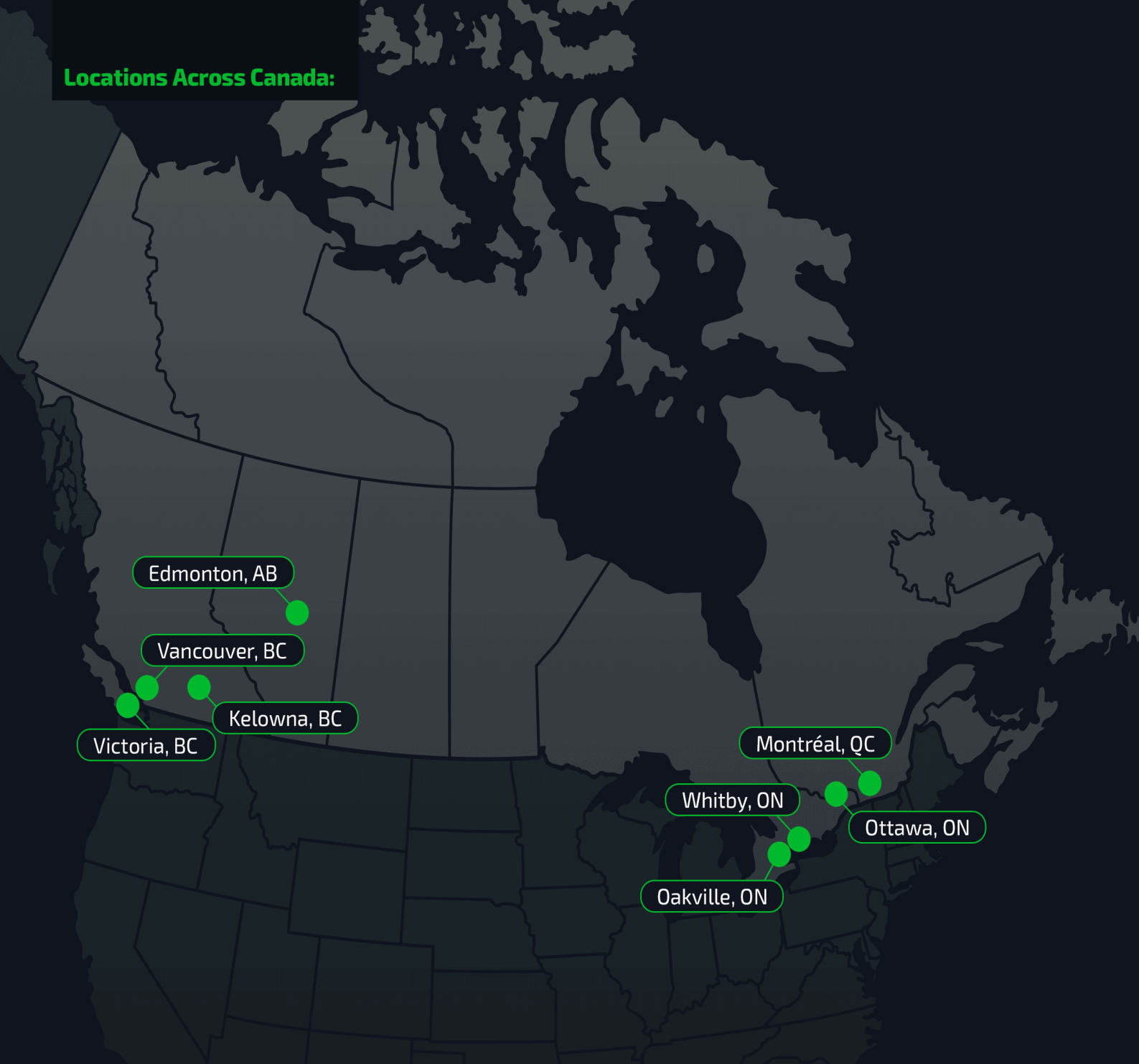
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5. Attachment D – Thurber Proposed Borehole Locations

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Plotted: December 12, 2024



LEGEND:

PROJECT A2.1 - MAIN NO. 4 UPGRADE, LEIGH ROAD & DUNFORD AVE

PROPOSED TEST HOLE LOCATION

NOTES:
1. 2023 ORTHO IMAGE FROM CRD OPEN DATA.
2. PROPOSED TEST HOLE LOCATIONS ARE APPROXIMATE.

THURBER

CAPITAL REGIONAL DISTRICT

PROPOSED TEST HOLE LOCATIONS
PROJECT A2.1

MAIN NO. 4 UPGRADE, LEIGH ROAD & DUNFORD AVE — VICTORIA, BC

DESIGNED	DRAWN	APPROVED	DATE	SCALE	PROJECT No.	FIGURE. NO.	REV.
DJE	DRB	KGG	DEC. 12, 2024	1:10,000	37959	**FIGURE 1**	-

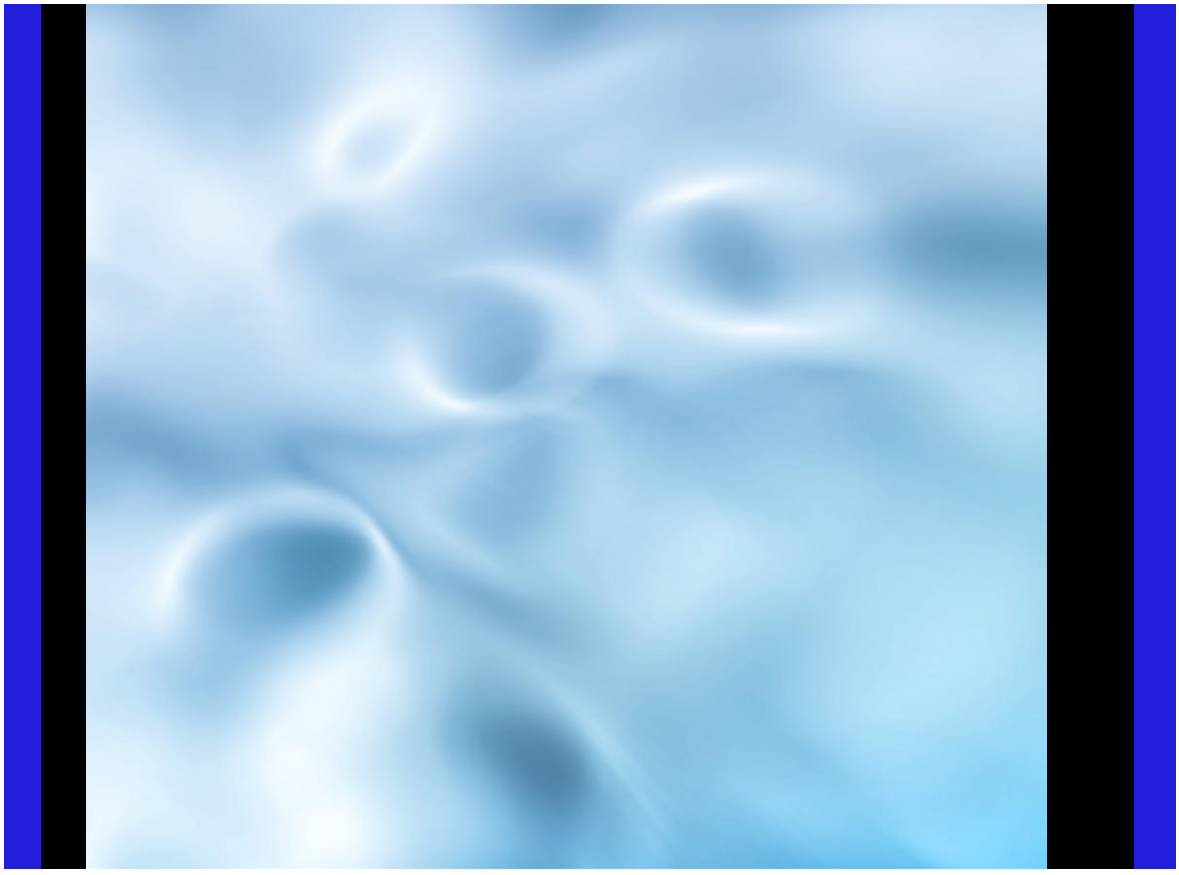
37959-CAD004.dwg

APPENDIX E

Main No. 4 (Leigh Road to Veterans Memorial Parkway) Preliminary Design Report

Document No: 260107151610_a137f060
Version: A

Capital Regional District
RWS/SPW - 2023-2026 Transmission Main Upgrade Program



Main No. 4 (Leigh Road to Veterans Memorial Parkway) Preliminary Design Report

Client Name:	Capital Regional District		
Project Name:	RWS/SPW - 2023-2026 Transmission Main Upgrade Program		
Project No.:	CE881400	**Project Manager:**	Anita Le
Document No.:	260107151610_a137f060	**Prepared By:**	Patrick Moore
Version:	A	**File Name:**	RWS Main No. 4 (Leigh Road to VMP) Preliminary Design Report
Date:	February 10, 2026		

Document history and status

Version	Date	Description	Author	Reviewed	Approved
A	10 Feb, 2026	Issued for Preliminary Design	D. Chomack, A. McLeod, P. Moore, O. South	M. Panahi, B. Milne, P. Yu	A. Le

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Corporate Authorization

Jacobs has prepared this Main No. 4 (Leigh Road to Veterans Memorial Parkway) Preliminary Design Report for the Capital Regional District's use. The information and data provided here represent Jacobs' professional judgment at the time of preparation. Jacobs denies any liability whatsoever to any other parties who may obtain this report and use it, or any of its contents.

Percy Yu, P.Eng.
Project Manager

Permit to Practice No.: 1003650

Executive Summary

The Capital Regional District (CRD) supplies potable water to approximately 400,000 people across the Greater Victoria area through their Regional Water Supply (RWS) and Saanich Peninsula Water (SPW) systems and are undertaking a program of capital projects with the aim to improve system capacity (CRD 2023).

This report documents the preliminary design for Main No. 4 (Leigh Road to Veterans Memorial Parkway) which consists of replacing approximately 1,815 m existing 1,372 mm concrete pressure pipe (CPP). The existing transmission main is situated on Goldstream Avenue.

Appendix A provides the design criteria adopted for the CRD 2023-2026 Transmission Upgrade Program.

The alignment selection for the Main No. 4 (Leigh Road to Veterans Memorial Parkway) upgrade was determined through the completion of a multi-criteria assessment of eight different alignment options between the two tie-in points. The assessment recommended the Main No. 4 upgrade use Leigh Road, Dunford Avenue, and the E&N Rail Trail on Station Avenue.

The alignment within the selected corridor is predominantly defined by the existing utilities and location of other important features (i.e., rail lines). The selected alignment is expected to allow Main No. 4 to be operational during construction, with the exception being for the tie-ins.

A minimum cover of 0.9 m has been adopted for the project, noting that in some locations, the cover is deeper to mitigate impact to existing utilities that cross the alignment. Air valves are proposed for high points, and flush valves are proposed for low points.

The hydraulic analysis indicated the minimum pipe sizing required to meet the project requirements, which adopts the same nominal sizing of 1,350 mm diameter as the existing Main No. 4. This size has been checked and is also suitable for low flows.

Following the input from the CRD's O&M team during the Preliminary Design Workshop for the Main No. 4 upgrade for Mt Newton Cross Road to Lochside Drive, and further investigation into the performance of different materials under seismic conditions or corrosion resistance as part of that project, both mains are proposed to be constructed using steel.

Appendix I contains the Class C cost estimate completed for the preliminary design for the Project.

An archaeological overview assessment and desktop environmental assessment have been conducted, with the findings detailed in Section 11 and Section 10.

A list of the required permits and the estimated lead time for obtaining has also been provided in Section 8.

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Acronyms and Abbreviations

AC	alternating current
ADC	alternating direct current
AOA	Archaeological Overview Assessment
AOP	Area of Potential
ASME	American Society of Mechanical Engineers
ASTM	ASTM International
AWWA	American Water Works Associate.
BC MoTI	British Columbia Ministry of Transportation and Infrastructure
BC	British Columbia
BCBC	BC Building Code
BTEX	benzene, toluene, ethylbenzene and xylenes
CAPEX	capital expenditure
CDF	controlled density backfill
City	City of Langford
CJP	complete joint penetration
CP	cathodic protection
CPP	concrete pressure pipe
CRD	Capital Regional District
CSA	CSA Group
DI	ductile iron
DP	distribution pressure
DP/PE	distribution pressure polyethylene
DR	dimension ratio
E&N Railway	Esquimalt and Nanaimo Railway
EIC	Electrical, Instrumentation and Control
EPH	extractable petroleum hydrocarbon
ESC	erosion and sediment control
GFCI	ground fault circuit interrupter

GIS	geographical information system
HCA	Heritage Conservation Act
HDSS	high-pressure restrained pipe with deflection
HEPH	high extractable petroleum hydrocarbon
HGL	hydraulic grade line
HSU	heavy single unit
Hwy	Highway
I/O	input and output
IP	intermediate pressure
ISA	International Society of Arboriculture
ICF	Island Corridor Foundation
Island Health	Vancouver Island Health Authority
km	kilometre(s)
KP	Kilometre Post
kPa	kilopascal(s)
kph	kilometre(s) per hour
LDP	local distribution panel
LEPH	low extractable petroleum hydrocarbon
m	metre(s)
m/s	metre(s) per second
MCA	multi-criteria analysis
mbgs	metre(s) below ground surface
MDD	maximum day demand
Millenia	Millenia Research Ltd.
MJ	mechanical joint
mm	millimetre(s)
MMCD	Master Municipal Construction Documents
MoF	BC Ministry of Forests
MPa/m	megapascal(s) per metre
mV	millivolt(s)

NBCC	National Building Code of Canada
No.	number
O&M	operations and maintenance
ohm-cm	ohm(s) centimetre
PAH	polycyclic aromatic hydrocarbon
PCN	Process Control Narrative
PCS	pressure control station
PFR	Preliminary Field Reconnaissance
PRV	pressure-reducing valve
psi	pound(s) per square inch
PSV	pressure-sustaining valve
PVC	polyvinyl chloride
QA	quality assurance
QEP	Qualified Environmental Professional
redox	oxidation reduction
ROW	right-of-way
RTU	remote terminal unit
RWS	Regional Water Supply
SCADA	supervisory control and data acquisition
SLS	serviceability limit state
SPT	standard penetration test
SPW	Saanich Peninsula Water
TM	technical memorandum
ULS	ultimate limit state
UPS	uninterruptible power supply
VDC	volt(s) direct current
VMP	Veterans Memorial Parkway
vpd	vehicles per day
VPH	volatile petroleum hydrocarbon

1. Introduction

The Capital Regional District (CRD) supplies potable water to approximately 400,000 people across the Greater Victoria area through their Regional Water Supply (RWS) and Saanich Peninsula Water (SPW) systems. This is the preliminary design report for the Main No. 4 upgrade between Leigh Road and Veterans Memorial Parkway.

1.1 Project Background

The Capital Regional District (CRD) are undertaking a program of capital projects on the RWS and SPW services from 2023-2026 with the aim to improve system capacity.

Main No. 4, part of the RWS system, is a high-pressure transmission main that delivers bulk drinking water to customers in the Greater Victoria area, including the Saanich Peninsula. Main No. 4 begins at the Kapoor Tunnel outlet within the Greater Victoria watershed area and terminates at the McTavish Tank in the District of North Saanich and is approximately 36.7 kilometers long. Main No. 4 consists of diameters ranging from 610 mm to 1,372 mm of welded steel and concrete pressure pipe (CPP).

The existing 1,815 m section of Main No. 4 along Goldstream Avenue, from Leigh Road to Veterans Memorial Parkway, consisting of 1,372 mm diameter bar-wrapped, steel-cylinder type concrete pressure pipe (CPP) material is due for replacement as it is at risk of failure in a seismic event due to the pipe material and lack of pipe restraint.

As Goldstream Avenue is a congested corridor in terms of existing utilities, traffic, and community use, alternate alignments for this section of Main No. 4 have been considered as part of the concept development and preliminary design process for the Project.

The proposed Main No. 4 (Leigh Road to Veterans Memorial Parkway) upgrade will replace the existing Main No. 4 between Leigh Road and Veterans Memorial Parkway with a seismically resilient 1,372 mm (54 inch) welded steel transmission main complete with an appropriate corrosion protection system on Leigh Road, Dunford Avenue, and the E&N Rail Trail on Station Avenue.

Figure 1-1 shows the overview map for the Project which contains the existing alignment, and the preferred alignment adopted following the recommendation from the multi-criteria assessment.

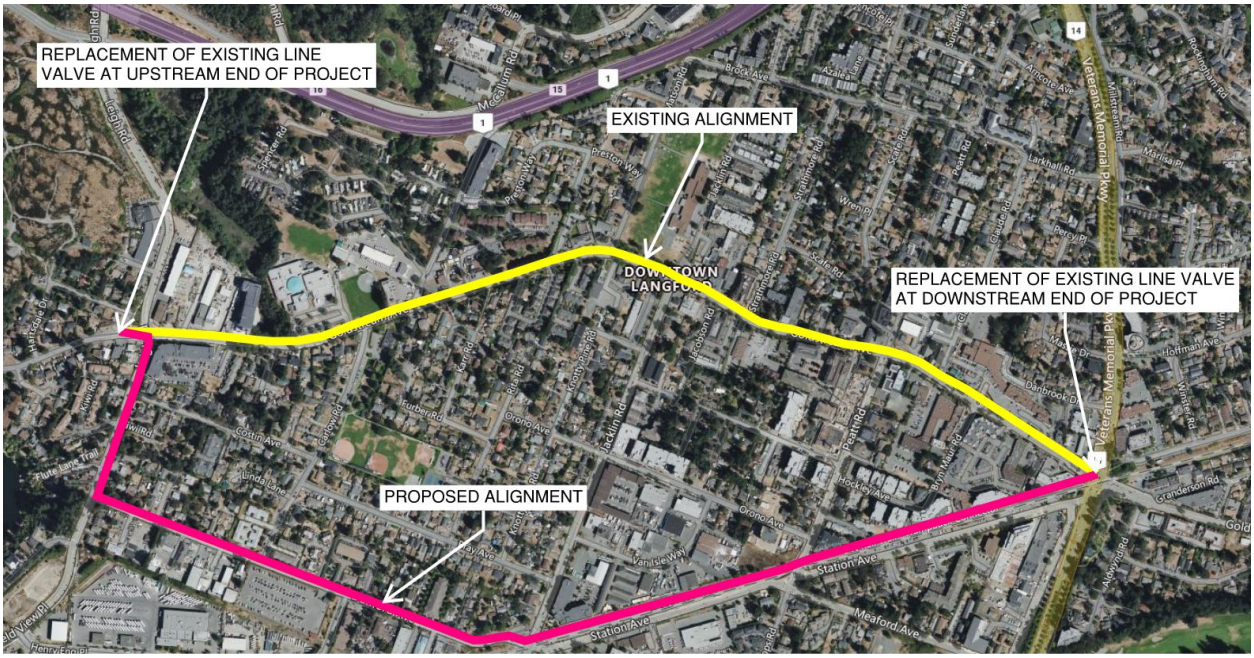


Figure 1-1. Main No. 4 (Leigh Road to Veterans Memorial Parkway) Alignment Overview Map

Sources: Esri, Maxar, Earthstar Geographics, and the GIS User Community

1.2 Objective

The objective of this report is to describe the preliminary design for the Main No. 4 (Leigh Road to Veterans Memorial Parkway) upgrade project. The preliminary design package serves to establish consensus and agreement among the Design Team, CRD, and other stakeholders on assumptions as well as critical decisions that will set the direction of the Project as they progress through the stages of design.

2. Design Criteria

The design criteria for the Project were established based on the following sources:

- CRD Engineer Specifications
- National and provincial standards, including:
  - *National Building Code of Canada* (NBCC)
  - *BC Building Code* (BCBC)
  - Standards from WorkSafe BC
- Local municipal standards
- Various industry standards including from the following organizations:
  - American Society of Mechanical Engineers (ASME)
  - ASTM International (ASTM)
  - American Water Works Association (AWWA)
  - CSA Group (CSA)
- Good practice
- Project assumptions

Appendix A provides the design criteria adopted for the CRD 2023-2026 Transmission Upgrade Program.

3. Alignment Selection

The current alignment of Main No. 4 along Goldstream avenue between Leigh Road and Veterans Memorial Parkway is a highly congested corridor with critical infrastructure, overhead and buried utilities, traffic volumes in the order of 15,000 vehicles per day (in addition to being a transit route), and many stakeholders in a mixed-use residential and commercial environment (CRD 2023).

To investigate the potential to alleviate concerns around construction and long-term maintenance and operation of one of the CRD's critical, large diameter watermains in the congested corridor, a detailed multi-criteria analysis (MCA) was conducted to consider several alternate routes for the main and determine which is most preferrable for the CRD.

3.1 Route Options Assessment and Multi-Criteria Analysis

This section summarizes the route options assessment and multi-criteria analysis completed, and the preferred route for Main No. 4. Appendix B contains the full analysis for this assessment.

Eight different route options were investigated as part of this MCA. This MCA used the following criteria to evaluate each option:

- Archaeological and Cultural Impacts
- Social Impacts (Residential, Business and Traffic)
- Environmental Impacts
- Resilience (Geotechnical, Seismic & Proximity to Other Mains)
- Constructability Impacts (including Third-Party Utilities)
- Property and Land Acquisition
- Capital Expenditure
- Operation and Maintenance
- Connectivity

Weightings for each criterion were reviewed and agreed with the CRD based on their assessment of the importance of each criterion and historical weighting ranges.

The preferred route from this assessment was to follow Leigh Road, Dunford Avenue, and the E&N Rail Trail on Station Avenue. This route scored the highest in the assessment as it is in more industrial areas than other routes, further from waterways and vegetation, is likely to be less disruptive during construction based on the potential to use the E&N Rail Trail, and is expected to have a relatively lower CAPEX than the other alignments considered.

Figure 3-1 shows the preferred route for the Project.

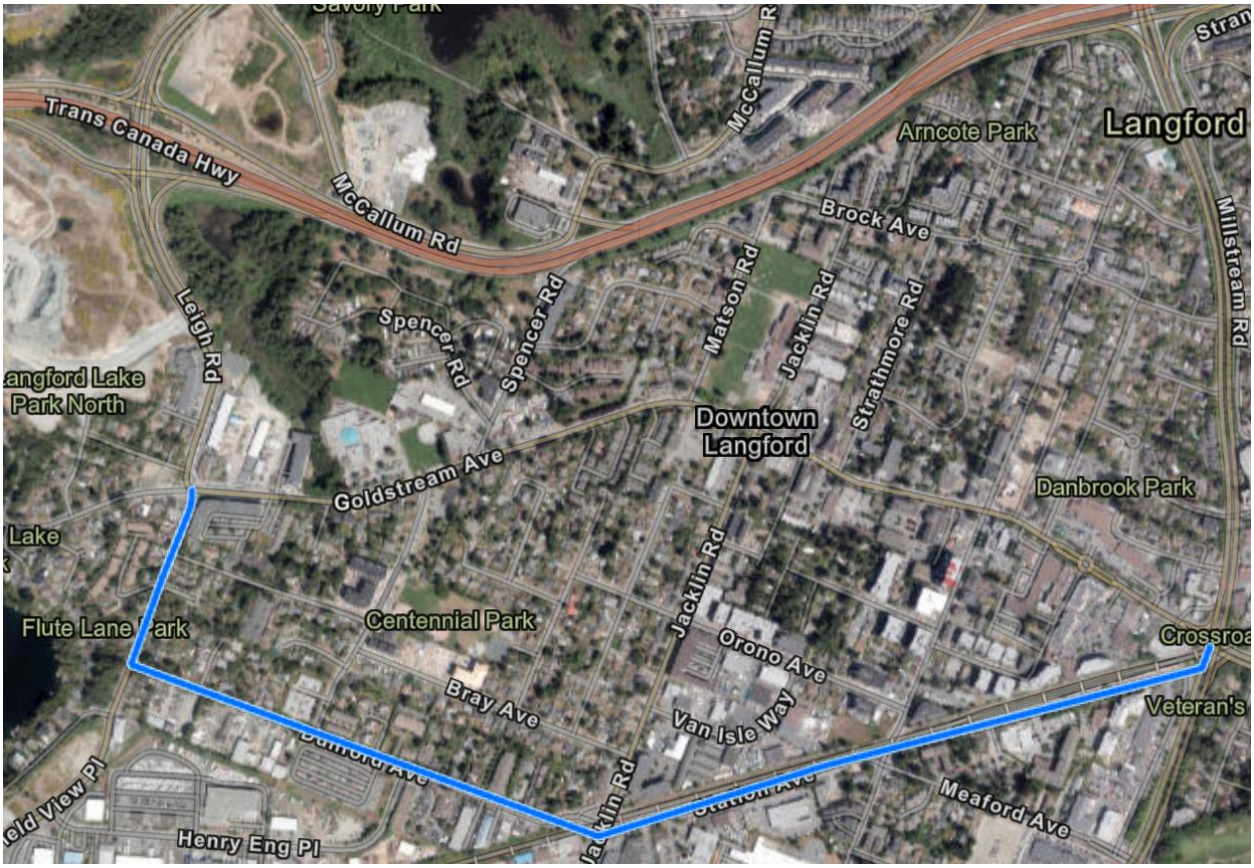


Figure 3-1. Main No. 4 (Leigh Road to Veterans Memorial Parkway) Preferred Route
Sources: Esri, Maxar, Earthstar Geographics, and the GIS User Community

3.2 Early Stakeholder Engagement

Jacobs and CRD have undertaken stakeholder engagement workshops with the City of Langford and the Island Corridor Foundation (ICF) during the alignment analysis phase. Appendix B includes feedback from these stakeholders and further investigations on their concerns.

3.3 Existing Utilities

The existing utilities along the alignment have been identified using the following information:

- Record drawings provided by CRD
- Municipal geographical information system (GIS) maps (CRD n.d; City of Langford n.d)
- BC1 Calls

Topographic survey and utility potholing will be undertaken as part of the field investigation program during subsequent design stages.

The existing utilities identified along the proposed route for the Project include the following:

- BC Hydro:
  - Goldstream Ave: Underground electrical on southern side of road. Overhead electrical on northern side of road.

  - Leigh Road: Underground electrical running down the middle of road. Overhead electrical on eastern side of road with overhead connections to properties on opposite side.
  - Dunford Avenue: Underground electrical running generally down the middle of road. Overhead electrical on northern side of road with overhead connections to properties on opposite side.
  - Jacklin Road, Peatt Road and Goldstream Avenue intersections: Underground electrical servicing the traffic lights, street lighting, and kiosks and disused rail infrastructure will need to be confirmed with onsite service location. Underground electrical crossings are anticipated at all three intersections.
- CRD – existing 1,372 mm (54 inch) transmission main and 300 mm distribution line along Goldstream Avenue. CRD own the 200 mm PVC distribution line (and branches coming off this line) along Leigh Road and Dunford Avenue. Existing Main No. 3 and Main No. 1 run along Station Avenue, however these are located under the road and do not intersect the proposed Main No. 4 alignment.
- City of Langford:
  - Sewer – 375 mm diameter sewer gravity main runs along Goldstream Avenue and Leigh Road. This line turns east along Dunford Avenue and increases to 450 mm diameter. There are numerous property connections to this line from the properties fronting these roads.
  - Stormwater: 300 mm diameter stormwater line on eastern side of Leigh Road. There are catch basins and stormwater pits along Dunford Avenue, however the size, location and drainage arrangement of these stormwater capture points it is not clear from the available data.
- Fortis – 42 mm gas line on the western side of Leigh Road, 168 mm gas line on the eastern side of Leigh Road, and an 88 mm gas line along the northern side of Dunford Avenue. The proposed alignment crosses a 168 mm gas line at Jacklin Road intersection.
- Telus – Underground Telus lines are located on the eastern side of Leigh Road north of Costin Avenue, and on the south side of Dunford Avenue, east of Carlow Road. Crossings underground Telus lines is expected at Jacklin Road and Goldstream Avenue intersections.
- (The E&N Rail Trail is free of existing utilities, except at intersection crossings at Jacklin Road, Peatt Road and Goldstream Avenue)

3.4 Optimization and Potential Utility Relocations

Route selection, optimization, and potential utility relocations are summaries below based on the streets the proposed alignment follows.

3.4.1 Goldstream Avenue

The alignment is generally under the middle of the road, located between the existing 1,372 mm Main No. 4 and the 300 mm PVC sewer line. The alignment is offset from existing Main No. 4 by 3 m (center-to-center) providing approx. 1m clearance between the anticipated edge of excavation for the new watermain and existing Main No. 4 to the north, and the sewer main to the south.

In this area, single lane alternating traffic is expected to be maintained through the construction zone.

The alignment cuts through the south-west corner of the Goldstream Avenue and Leigh Road Intersection to allow the line valve chamber to be located outside the road area. Section 7 provides further details on this line valve chamber.

No utility relocations are anticipated along Goldstream Avenue. However, interactions between stormwater pits, traffic signal poles, and the proposed line valve chamber need to be confirmed during detailed design.

3.4.2 Leigh Road

Leigh road is highly congested with utilities, with utility relocations are anticipated to allow sufficient space for the new water main.

The proposed alignment for the new water main along Leigh Road has is on the western side of the road, with the centreline of the pipe offset from the kerb line by approximately 1.4 m. The anticipated excavation width is 2.8 m, making the edge of excavation in line with the western kerb line for the road. This location in the road corridor has been chosen for the following reasons:

- Using this alignment allows the existing power / communication poles on the western side of the road, located in the sidewalk behind the kerb line, to be retained
- Single lane alternating traffic on the eastern side of the work zone is expected to be maintained
- From the desktop assessment, this alignment mitigates utility relocation works for this area, where relocation of the 42 mm gas line, a short section of the 200 mm water distribution main, and the underground electrical line is anticipated to be cheaper and take less time to complete than relocating the 375 mm sewer, 200 mm stormwater line and / or the 168 mm gas line on the eastern side of the road
- The overhead hydro lines on the eastern side of the road are not expected to be impacted

A summary of the proposed relocations is provided below:

- 42 mm gas line between Goldstream Avenue and Kiwi Road for an expected distance of 145 m. To achieve a horizontal clearance between the edge of the new transmission main and the relocated distribution gas line of 0.5 m it is expected the gas main will need to move by 0.7 m. This is less than the desirable 1 m to 1.5 m clearance, however, clearance in this location is limited by the adjacent sewer
- 200mm water line at Kiwi Road intersection for an expected distance of 32 m. The existing 200 mm water distribution main of Leigh Road moves from the east to the west side of the road just north of Kiwi Road intersection. The realignment keeps the existing water main on the east side of the road until the Kiwi Road intersection, where it shifts to the west and the new transmission main alignment shifts closer to the centre of the road
- Underground electrical south of Kiwi Road intersection for an expected distance of 106 m. As the transmission main alignment is designed in the middle of the road to avoid the gas and water distribution lines to the west, relocation of the electrical line is require to provide adequate space for construction. The proposed relocation achieves a 1 m clearance between the edge of the new transmission main and the relocated underground electrical lines

3.4.3 Dunford Avenue

This section details the utility impacts on Dunford Avenue. This section is split as the utilities on Dunford Avenue vary west and east of Carlow Road.

3.4.3.1 West of Carlow Road

There are a number of utilities within the Dunford Avenue corridor. The proposed alignment west of Carlow Road is on the southern side of Dunford Avenue, offset from the existing sewer line to maintain 1 m clearance from the edge of the sewer line to the expected edge of excavation for the transmission main. The centreline of the pipe is situated approximately under the existing edge of pavement for the southern edge of Dunford Avenue.

No major utility relocations are expected for this section. This is subject to confirmation of the existing stormwater infrastructure in this area, as there may be the need for some stormwater catch basins and pits to be removed and reinstated after construction.

This alignment is expected to maintain single lane alternating traffic through the construction zone during construction, with specific traffic management plans in place to allow for driveway access to the properties on the southern side of Dunford Avenue. It is expected there may be the need to construct temporary accesses to some properties to facilitate access during construction. This will be further refined in subsequent design stages.

Should subsequent stakeholder engagement find that it is preferrable to maintain traffic on the southern side of Dunford Avenue, the alignment is able to be shifted to the northern side of Dunford Avenue. However, this would require the existing underground electrical line to be relocated between Leigh Road and Carlow Road, a length of 320 m, to allow sufficient space for the new transmission main.

3.4.3.2 East of Carlow Road

At the intersection of Carlow Road and Dunford Avenue, the alignment crosses from the south side to the north side of the road as the south side of Dunford Avenue in this location contains a 150 mm / 200 mm water distribution line and underground Telus communications line.

The proposed alignment east of Carlow Road runs under the northern kerb line, with a 1.5 m offset from edge of pipe to the underground electrical line. The proposed location will require relocation of the 88 mm gas line from property 964 to 916 Dunford Avenue (a length of 205 m). This relocation would move the gas line under the sidewalk on the north side of Dunford Avenue.

The proposed alignment would require some of the street lighting close to the kerb line to also be relocated as part of these works. It is estimated that 7 streetlights would need to be relocated. The larger hydro poles on the north side of Dunford Avenue would not require relocation as part of these works but may require additional support during excavation works.

Relocation of some stormwater catch basins and pits may be required. The scope of this work will be determined once the location of all existing stormwater infrastructure is confirmed in subsequent design stages.

This alignment is expected to allow single lane alternative through the construction zone on the southern side of the road.

3.4.4 E&N Rail Trail

There are no existing utilities running along the E&N rail trail. An offset of 3 m from the edge of the property line to the center-line of the main is proposed, providing a 1.5 m offset from the edge of excavation to the edge of the property boundary.

The following assumptions have been made for the preliminary design of this project:

- The disused rail infrastructure (e.g., control sheds, signalling, etc.) that clashes with the proposed alignment is able to be removed to facilitate construction
- The design has assumed future reactivation of the corridor for transit usage will likely require construction of new rail tracks rather than maintaining of existing tracks and therefore the design of the transmission main has assumed maintenance of the footprint for the existing shared-use trail and 2 new tracks can be installed in the remaining width of the corridor without impacting the new transmission main
- The CRD / ICF will acquire the parcel of land where the corridor currently reduces in width at the intersection of Peatt Road and Station Avenue, Figure 3-2 shows the area expected to be acquired

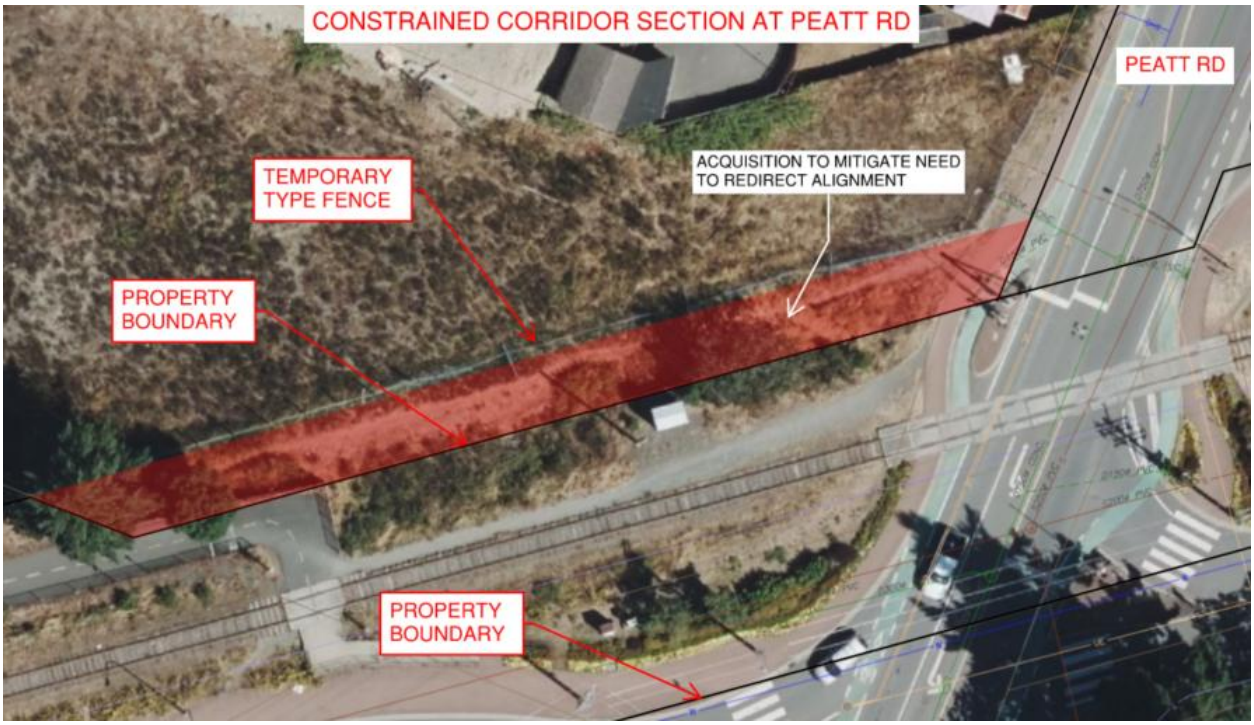


Figure 3-2. Corridor Area to be Acquired

Sources: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Jacobs are also aware that there is an underground carpark at 713 Goldstream Avenue (intersection of Goldstream Avenue and E&N Rail Trail). The location of this structure and potential impacts of the alignment past this property should be confirmed during subsequent design stages and design changes or construction monitoring implemented to mitigate impacts.

3.4.4.1 Intersection Crossings

The E&N Rail Trail crosses intersections at Jacklin Road, Peat Road and Goldstream Avenue. It is expected that the new main will cross under these utilities with open-cut construction at each intersection, with the Contractor managing traffic flows through attempting to maintain some lanes as open or with detour routes. Noteworthy is the 750 mm stormwater line at the Peat Road intersection. The depth of this stormwater, and potential to cross over rather than under this line will be confirmed during detailed design.

There are also multiple large utilities in the Goldstream Avenue / Veterans Memorial Parkway (VMP) intersection. Coordination with these and managing traffic impacts will be important considerations for the Goldstream Avenue works and tie-in to existing Main No. 4.

3.5 Traffic Impacts and Management Strategy

Development of a detailed traffic management strategy for the Project is recommended as part of subsequent design stages as construction of this transmission main will impact several traffic routes, multi-use paths, and access to businesses.

Where possible, the preliminary design has proposed construction of the relocated Main No. 4 in locations within the road and trail corridors which mitigate impacts to traffic and access to properties during construction.

It is expected that single lane alternating traffic will be able to be maintained on Leigh Road and Dunford Avenue through the construction zone. Following concerns raised by the City of Langford around access to businesses on the southern side of Dunford Avenue during stakeholder engagement workshops, some initial high-level cross-sections were developed to assess the potential impacts to businesses during construction. Appendix B shows these high-level sections which should be refined following subsurface utility investigations and design alignment refinements in subsequent design stages. East of Carlow Road, the preliminary design alignment is on the northern side of Dunford Avenue. West of Carlow Road, the preliminary design alignment is on the southern side of Dunford Avenue. It is expected that access to business will be maintained during construction, using either current or temporary access arrangement. However, further turn path analysis to assess the impact to heavy vehicles is recommended as part of the detailed design and any temporary access requirements included in the traffic management strategy.

Construction within the E&N Rail Trail is expected to result in closure of the trail through the construction zone. The CRD's Parks and Trails Department has indicated that a detour route will need to be provided during construction. This route and the requirements of this detour will be determined and incorporated in the detailed design as part of the traffic management strategy.

There is the potential for short-term closures at intersections and chamber construction locations, in particular replacement of the line valve chamber at Veterans Memorial Parkway. This will be refined in subsequent design stages.

4. Hydraulic Analysis

The Hydraulic Analysis for the Project utilizes the following scenarios:

- Year 2023 Maximum Day Demand (MDD) + Kapoor Tunnel in Service + Main No. 1 operating at HGL of 169m to Watkiss PCS and No. 3 operating at a HGL of 116m.
- Year 2100 MDD + Kapoor Tunnel in Service + Main No. 1 operating at HGL of 169m to Watkiss PCS and No. 3 operating at a HGL of 116m.

All hydraulic modelling undertaken has assumed steady state conditions. A summary of the hydraulic modelling results are presented in the subsequent sections of this report. Appendix C contains the hydraulic modelling memorandum.

4.1 Network Capacity Analysis, Operating Pressure and Flowrate

The analysis showed there are no deficiencies under the 2023 MDD and 2100 MDD scenarios when assuming a design pipe diameter of 1,350 mm.

Table 4-1 shows the expected MDD flows, velocities and headloss gradients for the realigned Main No. 4.

Table 4-1. Main No. 4 (Leigh Road to Veterans Memorial Parkway) Hydraulic Modelling Results

Modelling Results	2023 MDD SS	2100 MDD SS
Flow (L/s)	1,418	2,462
Velocity (m/s)	1.03	1.80
Headloss Gradient (m/km)	0.74	2.06

4.1.1 Export Nodes Impact Analysis

The HGL results of the export nodes under the 2023 and 2100 MDD scenarios do not show an impact to the export nodes from the Project.

4.1.2 Fire Flow Impact Analysis

No impact to fire flow modelling results was shown for either the 2023 or 2100 MDD scenarios because of the Project.

4.2 Transient Analysis

Transient analysis will conduct in subsequent design phases.

5. Material Options Assessment

At the proposed diameter for Main No. 4 in this section, carbon steel (AWWA C200/M11) is the preferred pipe material for the following reason:

- Failure mode through leaking (i.e., not catastrophic)
- The cathodic protection system matches the adjacent sections of Main No. 4 which are also steel
- Steel can accommodate high design pressures
- The material is durable, lightweight, and easy to modify during construction
- The material is easy to repair and CRD's RWS team have experience working with the existing steel mains on their network
- Using steel is expected to result in a seismically resilient main provided proper trench bedding, backfill and compaction is also applied. Subject to the chosen joint type (discussed further in Section 6.5), joint failure resulting from seismic ground displacement is less likely to occur in welded steel pipe, compared with piping systems with mechanically/integrally restrained system joints (such as ductile iron, which have a high probability of joint failure once joint displacement limits are reached).
- Cost competitive material at this pipe diameter

6. Pipe Design

This section provides details about the pipe design for the Main No. 4 (Leigh Road to Veterans Memorial Parkway) upgrade.

6.1 Sizing and Material

A pipe outside diameter of 1,372 mm (54 inch) has been adopted based on the following:

- This allows continuity with other sections of Main No. 4 in the area which are also 1,372 mm (54 inch) diameter, facilitating easier operation and maintenance (O&M) planning
- Hydraulic modelling has indicated this sizing is adequate for the design flows utilized in the hydraulic modelling

The steel grade adopted for the preliminary design of this 1,372 mm (54 inch) steel pipe is ASTM A1018 Grade 36 Structural Steel. This grade of steel is commonly available and meets the pressure requirements at typical pipe wall thickness. Pipe material options will be reviewed during detailed design based on:

- Design advancement and refinement of design pressures, including transient pressures
- Site investigation findings
- Review of pipe supply market behaviours
- Further coordination with cost estimators, pipe suppliers, and the CRD

6.2 Operating Pressures

Main No. 4 in this section is planned to operate at a HGL of 169 m. The maximum pressure in the pipeline under steady state operating conditions for this section of the main occurs at the lowest point in the alignment. Based on online mapping data, this low point occurs at the eastern tie-in, at the intersection of Goldstream Avenue and Station Avenue, where the surface elevation is approximately 75 m. The route is relatively flat, with an elevation variance of approximately 7 m across the length of the alignment. At this low point the design working pressure in the pipeline under steady state operation conditions is 95 m (135 psi). This working pressure has been adopted for the full length of the Project.

In accordance with AWWA M11 guidelines, a test pressure of 1.25x working pressure is proposed. Test pressure adopted is 120 m (170 psi).

6.3 Seismic

A seismic pipe design analysis will be completed for the Project as part of the detailed design once the field investigations are completed.

Based on the design criteria adopted for this project, this pipeline will be designed with an Annual Exceedance Probability (AEP) of 1 in 2,475. If the analysis indicates that large lateral spreading displacements will occur in the project area, consideration will be given to solutions such as ground improvements, thickening of the pipe wall, selecting joints seismic resilient joint systems and / or modifying the pipe geometry.

6.4 Pipe Lining and Coating

Steel pipe coating and lining are required as part of the corrosion management system to maximize the service life of the new pipe. The pipe lining and coating material are also a consideration in determining the allowable pipe deflection, and therefore must be factored into pipe wall thickness calculations. Selecting the most appropriate lining and coating requires consideration of the following factors:

- Anticipated deformation magnitude / type (elastic or plastic) due to seismic displacement
- Availability
- Compatibility with the cathodic protection systems
- Cost
- CRD's familiarity with the material and compliance with CRD specifications
- Ground conditions
- If there are already successful implementations (industry proving)
- Robustness

The various coating options, costs, and benefits should be discussed with the CRD in subsequent design workshops. For this preliminary design, polyurethane coated and cement mortar line is proposed. This may be adjusted during detail design once the factors listed above are better understood following further design development.

6.5 Jointing

As this project is intended to provide improved seismic resilience to Main No. 4, complete restraint of the pipeline is proposed. For steel pipes, this means welding pipe-to-pipe joints together. Various welded pipe joint options are available for steel pipe at this diameter (1,372 mm [54 inch]) including:

- Single fillet lap welds
- Double fillet lap welds
- Single welded complete joint penetration (CJP) groove welds
- Double welded CJP groove welds

Each joint system has pros and cons regarding the joint strength (i.e. joint efficiency), safety / access consideration, and installation complexity (impacting labour and resulting cost to complete welding), quality assurance (QA) opportunities/methods.

For this preliminary design, a double fillet lap weld is proposed. This weld type utilizes a welded bell and spigot arrangement which is easier to assembly in the field than a groove welding (also known as butt weld). However, this jointing system requires personnel access into the pipe to complete the internal fillet weld at each pipe joint, and the ability to NDT this type of joint is limited, compared to groove welds. The joint efficient for a double fillet lap weld is 0.55.

The preferred jointing method will be reviewed during detail design once ground conditions and permanent ground displacement risks resulting from seismic events are understood.

6.6 Steel Pipe Wall Thickness

A preliminary calculation of steel pipe wall thickness was completed for the transmission main using the methods outlined in AWWA M11 (AWWA 2004).

The following tolerances and parameters were applied for pipe wall thickness checks:

- Allowable deflections for rigid pipe lining (cement mortar): 3%

- Jointing type: double fillet lap weld
- Hoop stress: For working, test and surge pressures (surge pressure assumed to be working pressure +30m)
- Minimum thickness for handling: Jacobs' best practice is diameter to thickness (D/t) less than 240
- Minimum thickness for field welding: 4.76 mm
- External load analysis: Loading was checked for minimum (0.9 m cover) and maximum pipeline depth (assumed to be 3.0 m cover – this is a non-critical load case), with three checks:
  - Soil loads only
  - Soil loads + surface loading (highway semi-trailer [HS-20] loading [FHWA 2015])
  - Soil loads + construction loading (critical load case)
- Soil buckling analysis: Pipe buckling under vacuum with dead + live loading
- Equivalent stresses (hoop and longitudinal): Due to temperature variation under varied operating conditions

The proposed pipe wall thickness based on preliminary calculations is 12.7 mm (1/2 inch). This should be further reviewed following the geotechnical and seismic field investigations in subsequent design stages. The 3% pipe deflection limit is the parameter currently governing pipe wall thickness. This wall thickness can likely be reduced once the composite soil modulus around the pipeline is determined. A conservative soil modulus value of 6895 kPa (1000 psi) has been adopted for preliminary design.

6.7 Pipe Access

At the direction of CRD, and in line with the decisions made for the Main No. 4 (762 mm diameter steel pipe between Mt Newton Cross Road and Lochside Drive) and Bear Hill Trunk Main (600 mm diameter ductile iron pipe between Wallace Drive to Dean Park Lower Tank), Jacobs has not included access hatches in the pipeline design for the Project.

The requirement for pipe access hatches was raised with the CRD during the 60% and 90% design review workshops with the CRD in 2024 for the Main No. 4 (Mt Newton Cross Road to Lochside Drive) and Bear Hill Trunk Main (Wallace Drive to Dean Park Lower Tank) as access requirements are not stipulated in the CRD engineering specifications. Jacobs highlighted that access hatches with a 600 mm (24 inch) diameter are typically installed at a maximum spacing of 300 m. These access hatches provide access into the pipeline for inspection and repairs as part of ongoing pipeline O&M.

Jacobs proposed to adopt a similar approach for access hatches for these projects in 2024. However, CRD stated during these workshops that access hatches would not be incorporated into the design for the following reasons:

- Additional cost for installing these fittings
- Additional points of failure (leakage)
- They were not perceived to be of benefit to future main O&M

The decision to include access hatches in the Project should be considered further during detail design. Particularly as this main is significantly larger than the 762 mm Main No. 4 replacement from Mt Newton Cross Road to Lochside Drive. A larger main is typically considered a more critical asset, warranting a more comprehensive inspection and maintenance regime. At this pipe size (1,372 mm [54 inch]) both personnel and remote access options are available for pipeline inspections and maintenance. Undertaking such works would require access via hatches at regular intervals. Furthermore, it is anticipated that the

contractor will need to send in a crew to manually clean the new Main No. 4 prior to disinfection. Having some strategically located access hatches could provide practical benefits as well as enhancing safety.

6.8 Air Valves

Combination air valves are located at peaks in the pipeline profile and at high points between isolation valves to provide the following functions:

- Release trapped air under pressure during normal pipe operation
- Release air during pipe filling
- Admit air into the pipe during system draining

Air valves are located in belowground chambers outside of roadways. This matches the decisions made during the Main No. 4 (Mt Newton Cross Road to Lochside Drive) design in 2024. As the Project is predominantly road corridors, air valves (and their associated chambers) are offset from the main in the boulevard of the road corridors.

The Main No. 4 (Leigh Road to Veterans Memorial Parkway) air valve assemblies are summarized as follows:

- Riser pipes are proposed on the main line to improve the efficiency of air capture. This constitutes a welded riser piece (nominally 600 mm diameter and 200 mm high) on top of the pipeline
- An air valve branch pipe from the riser to the air valve will maintain a minimum 2% rising grade, with double isolation between the main and the air valve
- Air valves are housed in an AE Concrete's 1.5 m Tel Service Type precast pit, complete with a H-20 static load rated, double door lid, which opens to provide full width access to the chamber. These lids are suitable for use in roadway boulevards and can withstand incidental vehicle loading. They are not suitable for locating in the travelled roadway.
- Air valves will be sized as part of the detail design once the pipeline profile is confirmed and specific air valve calculations are conducted. It is anticipated that a 100 mm (4 inch) air valves would be used for this pipeline. Air valves will be a combination type air valve, suitable for the following operating scenarios; pipe filling, pipe draining, air release under pressure.
- Air valve / chamber venting and breather pipe requirements will be investigated further as part of detailed design.
- The aboveground breather pipes should be located in a stainless steel kiosk to protect them from vandalism

The arrangement of air valves should be explored further in the following design phase, with an important input being the CRD operating and maintenance regime.

6.9 Flush Valves

Flush valves are provided at low points along the transmission main to facilitate draining. Similar to air valves, flush valve discharge points are located outside of roadways to reduce structural loading requirements, reduce traffic impacts, and improve safety during flushing operations.

Two flush valve arrangements are provided as part of the design:

- In the boulevard, surfacing in a standard meter box, reflecting CRD Standard Drawing No. 1.6 (CRD 2023) as a basis.

- In the pavement or roadway, reflecting CRD Standard Drawing No. 1.6 (CRD 2023) as a basis.

The proposed flush valve assembly for the Project is summarized as follows:

- A tangential offtake from the bottom of the main.
- A 100 mm diameter flush line with two direct-buried isolation valves: a gate valve for primary isolation immediately after the offtake, and a butterfly valve near the flush point connection for flow control during flush.
- Discharge points located in boulevards are housed in a standard meter box.
- Discharge points located in pavement or roadways are housed in a 600 mm diameter concrete maintenance hole, complete with a traffic-rated lid.

6.10 Corrosion

A detailed cathodic protection (CP) design review will be completed during the latter stages of the design. The design considerations will include the following:

- Soil Corrosivity Testing
  - Soil corrosivity testing will be performed at regular intervals along the proposed alignment including direct testing (resistivity, moisture, pH, and sulphides) of soil samples from geotechnical test boreholes . The test results will be characterized according to the AWWA C-105 "10-point system."
  - Additional soil resistivity testing may be performed at prospective anode groundbed location(s) as required to facilitate groundbed design.
- Current Requirement
  - CP involves the application of a suitable level of DC current to the protected structure, which is generally dictated by the total structure surface area, isolation provisions, coating type and quality, and soil conditions.
  - Based on the proposed alignment and pipeline dimensions, a preliminary current requirement has been set at approximately 2 ADC.
- Location for Groundbed and Rectifier Installation
  - Based on the overall short length of the protected piping, a single groundbed location should be sufficient to provide adequate current distribution to protect the entire length of the new piping. It should be located at approximately the mid-point along the pipeline, at a location with accessible AC power. This frequently results in anode groundbeds being placed at powered valve or meter chambers.
  - Another consideration is the availability of land and the type of anode groundbed that will be installed (i.e., shallow distributed or deepwell). The preferred type of anode will be determined based on the soil strata, with preference to install the anodes in a relatively low-resistivity soil layer, with consideration of the land / rights-of-way into which the anodes and the rectifier can be permanently located. Groundbed type, location, and rectified size will be determined during the detailed design phase.
  - The rectifier shall be either pole-mounted or installed in a kiosk to facilitate routine inspections.
- Electrical Isolation

  - To help ensure the cathodic protection current requirement is mitigated the subject watermain facility must be electrically isolated from foreign structures such as the following:

    Other unprotected pipelines
    Electrical service grounds for valves
    Metering equipment
    Reinforcing or ancillary steel structures

  - Specific locations for flange isolation kits will be provided with the pipeline and chamber drawings during the detailed design phase.

- Electrical Continuity
  - Electrical continuity shall be maintained along the entire protected structure. On the basis that the subject pipeline will be made of welded steel, it will intrinsically be electrically continuous along its length, with isolation as required at chambers with electrical isolation provisions. Bonding will be included at such locations as required so the protected structure is electrical continuous.
- Test Stations
  - Test stations shall be installed at the following locations:

    All major chambers
    End points
    Tie-ins
    Foreign pipeline crossings (for foreign lines with CP)
    Casings
    Transitions to/from non-metallic or unprotected metallic piping (e.g. at service lines or municipal custody transfer points)
    As required to maintain nominal 300 m test point spacing
- Field Coating
  - All CP test leads' connection points shall be recoating with a product that is compatible with the parent coating.
- Other
  - Unusual conditions or factors relevant to corrosion risk or to cathodic protection systems based on a review of the pipeline alignment drawings

Soil Corrosivity Testing

Soil corrosivity testing for the Project will be completed in the subsequent design phase in line with geotechnical field investigations.

7. Chamber Design, Flow Control and Monitoring

This section provides details about the chamber design and flow control for the transmission main.

7.1 Overview

No new specialized flow control arrangements (such as pressure reducing or pressure sustaining valves) are proposed as part of this project.

Line valves for pipeline isolation are proposed at the upstream and downstream extents of the project (i.e., Leigh Road / Goldstream Avenue intersection, and Veterans Memorial Parkway / Goldstream Avenue intersection) to replace the existing line valves at these locations.

The line valves proposed as part of the preliminary design are 1,200 mm (48 inch) butterfly fly valves. These valves are smaller (150 mm, 6 inch) than the main line to reduce the direct cost of the valve, and the size and cost of the components associated with each line valve including dismantling joints, pipe flanges/fitting, and the valve chamber structure. This is common practice on large diameter mains and this short length of reduced pipe diameter has negligible impact on the overall hydraulic performance of the main.

Both line valves and their respective flush arrangements will be fully operable from the surface, meaning that access to the chamber will only be required for maintenance of components within the chamber.

7.2 Chamber and Flow Control Location

At the request of CRD, and to improve accessibility and safety for CRD O&M personnel when working in and around the line valve chambers, both chambers are located out of the travelled roadway.

The line valve chamber near the western tie-in is located on the southwest corner of the intersection of Goldstream Avenue and Leigh Road. This chamber is located in the road right-of-way behind the kerb line, meaning road / lane closures are not expected to be required for regular chamber access.

The line valve chamber at the eastern tie-in is located in the E&N Rail Trail corridor, on the southwest corner of the intersection of Goldstream Avenue and VMP. This chamber is not located within the road, meaning road / lane closures are not expected to be required for staff to access the chamber. However, there may be temporary impacts to E&N Rail Trail users when the CRD is undertaking valve chamber O&M works.

Valve chamber locations will be confirmed once site survey, utility and geotechnical data are available in subsequent design stages.

7.2.1 Operating Pressure

The operating pressure for chambers is as noted in Section 6.2.

7.2.2 Structural

Pre-cast chambers are proposed for the Project. These have been provisionally sized at 4.7m x 3.05m x 3m (internal) based on AE Concrete standard sizing. Customized penetrations and access hatches will be designed in the following design phase and incorporated into the chambers prior to casting.

Further structural analysis for the chambers will be conducted during the following design phase.

No structural or seismic analysis has been conducted on, or proposed to be conducted on, existing nearby structures.

7.2.3 Differential Settlement

Differential settlement between the chambers and connecting pipework must be considered. Differential settlement can occur due to settlement of the chamber or the pipeline post construction or during a seismic event. If incorrectly managed, differential settlement can induce large stresses in the connecting pipework, potentially resulting in pipe deformation or failure.

To accommodate differential settlement, flexible couplings are proposed at all connections to chambers.

Selection of the preferred coupling arrangement and locations will be confirmed with the CRD and suppliers in the following design phase.

7.3 Electrical, Instrumentation and Communications (EIC)

To reduce cost and scope EIC is not proposed within the line valve chambers. If needed, portable sump pumps can be used to drain the chamber, and lighting can be provided by opening roof hatches or with portable lighting.

7.4 Mechanical

Equipment and mechanical components for the Project are detailed in Table 7-1.

Table 7-1. Main No. 4 (Leigh Road to Veterans Memorial Parkway) Chamber Components

Component	Location/Function	Type/Class	Sizes (Nominal)
Butterfly valves	▪ Goldstream Avenue / Leigh Road Intersection – main line isolation ▪ Goldstream Avenue / VMP Intersection – main line isolation ▪ Goldstream Avenue/VMP Intersection – Main No. 1 / Main No. 4 interconnection isolation ▪ Flush point flow control	Rubber-seated AWWA Class 250B	1200 mm (line valves) 600 mm (Main No. 1 / No. 4 connection) 150 mm (flush points)
Gate valves	▪ Air valve isolation ▪ Flush point isolation ▪ Line valve bypass and flush isolation	Metal-seated, non-rising	100 mm (air valves) 150 mm (flush points) 200 mm (bypass and flush within chambers) Note: sizes are preliminary and should be confirmed in subsequent design stages

Component	Location/Function	Type/Class	Sizes (Nominal)
Air valves[1]	Adjacent to line valves (where required) and at pipeline high points to facilitate air exchange during operation, pipe filling and draining.	Combination air release and vacuum break	100 mm. Size TBC in detailed design.
Rigid couplings	Adjacent valves on the main line and bypass lines. On pipe branches for interconnections, flush point and air valves. Used to facilitate installation and dismantling.	Flanged dismantling joints such as Romac DJ400 or approved equivalent. AWWA M-11 harness with flexible coupling.	1200 mm (valve chambers) 200 mm (valve chambers) 600 mm (Main No. 1 / No. 4 connection) 150 mm (flush points) 100 mm (air valves) Note: sizes are preliminary, TBC in detailed design.
Flexible coupling	Buried adjacent chambers to accommodate differential settlement	Victaulic Style 257 or W257 Dynamic Movement Joint (groove coupling) compliant with M11, or approved equivalent. Or AWWA M-11 harness with multiple flexible coupling, specifically design to accommodate vertical differential settlement.	1200 mm (adjacent to chambers)
Flanges	Valves, flange adaptors	AWWA C207 Class E	Various

[1] For air valves outside of valve chambers, refer to Section 6.86.8.

7.4.1 Pipe Access and Draining

Each underground chamber has pipe access hatches and features a 200 mm bypass line controlled by surface operated gate valves. There is a camlock port accessed from the surface for draining, with final draining via an integrated sump arrangement.

7.4.2 Sump and Sump Pumps

Both line valve chambers are planned to feature integrated sumps with a passive drainage arrangement. Feasibility of this arrangement will be confirmed after obtaining geotechnical information from subsurface investigations.

7.4.3 Branch Outlets and Flanges

The pipe and valve flange design and patterns will be AWWA C207, Class E. At water service temperature, Class E flanges have working pressure rating of 275 psi with maximum pressure (test or transient) allowed up to 412.5 psi.

7.4.4 Mechanical Couplings and Harness Joint Assemblies

Compression type mechanical couplings restrained with tie-rods and lug-to-lug or lug-to-flange backing plates are proposed per AWWA M-11.

8. Permits and Approvals

This section outlines the anticipated critical path permits and approvals required for Main No. 4 (Leigh Road to Veterans Memorial Parkway). Table 8-1 lists anticipated critical path federal, provincial, regional/municipal, and other permits and approvals that may apply to the Project. Information to mitigate the risk to the proposed Project is also provided. These lists are subject to change as Project designs progress. Appendix D contains the full list of potential permits identified for the preliminary design.

Table 8-1. Main No. 4 (Leigh Road to Veterans Memorial Parkway) Potential Critical Path Permits and Approvals

Issuing Authority or Regulator	Legislation	Permit/ Approval Type or Name	Approximate Application Review Timeline	Relevance to Project	Risk Mitigation
BC Ministry of Forests (MoF)	*Heritage Conservation Act*	AOA	60 days	Millenia has undertaken an AOA for the project	N/A – permit obtained
		Multi Assessment Permit (MAP)	122 - 183 days	It is understood a MAP has been obtained by WSP	
BC Ministry of Transportation and Infrastructure (MOTI)	*Transportation Act*	Work Notification / Lane Closure Request and Approval Form (H1080)	28 days	Select project segments on land regulated by BC MOTI. In order to close a lane or work on the highway a form H1080 needs to be submitted to MOTI	Engage with MOTI early
		Highway Use Permit - Utilities	122 days	Required to trench or bore and jack to install or construct a water main on provincial highway rights-of-way	
City of Langford	*Traffic Bylaw No. 33*	Application to Construct, Use and Maintain Works within a Roadway or Lane	14-30 days	This is required for works within municipal road allowances	Engagement with the City of Langford is ongoing
Vancouver Island Health Authority	*Drinking Water Protection Regulation*	Water Works Construction Permit	30 days	This is required for the construction of a water supply system	Engage with the Public Health Engineer early to ensure application requirements are met

Issuing Authority or Regulator	Legislation	Permit/ Approval Type or Name	Approximate Application Review Timeline	Relevance to Project	Risk Mitigation
Telus Communications	--	Third Party Agreement	60 days	Telus communications is to approve of any work near their infrastructure	Engage with Telus early
FortisBC	--	Pipeline and/or right of way works application (working adjacent)	122 - 183 days	Fortis BC is to approve of any work near their infrastructure The proximity to infrastructure is TBD	Engage with FortisBC early
BC Hydro	--	30m Ground Disturbance Permit	30 days	BC Hydro is to approve of any work near their infrastructure	Engage with BC Hydro early

Note:

AOA = Archaeological Overview Assessment

9. Constructability and Operations

This section discusses the potential project schedule, potential constructability and operational challenges, and potential considerations for subsequent design stages to mitigate their potential impact on the project.

9.1 High-Level Project Schedule

The subsequent design stages and construction of the Project are currently pending.

Based on the preliminary design, the construction duration for the Project is expected to be in the order of 18 to 24 months including mobilisation and demobilisation. This is based on the preliminary design which proposes open cut construction. If there are trenchless crossings required or adverse ground conditions encountered, then this duration is likely to increase.

9.2 Constructability Challenges

Some of the challenges associated with constructability of the Project include:

- Management of traffic during construction at high traffic volume intersections in the City of Langford (i.e., Goldstream Avenue / Leigh Road, Dunford Avenue / Station Avenue / Jacklin Road, Station Avenue / Peatt Road and Goldstream Avenue / Veterans Memorial Parkway)
- Maintaining of access to residential and business properties in road rights of way
- Construction of large diameter steel pipeline in an historical rail corridor while mitigating potential impacts to the rails and adjacent infrastructure
- Deep excavation underneath existing utilities in areas of potential groundwater
- Trench width and backfill design, in some locations, is in proximity to existing utilities. The trench size will be designed as narrow as practical to reduce the likelihood of impacting adjacent utilities and traffic

9.3 Constructability

Table 9-1 outlines some important considerations for constructability to be incorporated into subsequent design stages.

Table 9-1. Main No. 4 (Leigh Road to Veterans Memorial Parkway) Constructability Considerations

Constructability Aspect	Details
BC Transit Operations	▪ Contract specifications and traffic management strategy to include requiring access to BC Transit bus stops or alternate access arrangements to be put in place
Construction Schedule Impacts	▪ Construction in a separate corridor to the existing transmission main to streamline the construction schedule and mitigate impacts to the existing system and the construction schedule which would occur if a shutdown and temporary bypass were required ▪ Maintain minimum clearances from existing utilities, where possible, to mitigate relocations or protection measures which will increase the construction schedule ▪ Minimize depth of cover, where possible, and mitigate the need for specials, fittings, and closure pieces

Constructability Aspect	Details
Excavation and Pipe Installation	▪ The Contractor will be expected to minimize the extent of open trench throughout the alignment to mitigate potential issues, such as: - Trench instability - Unnecessary traffic impacts - Blocked driveways - Excess dewatering
Pipe Access	▪ It is understood CRD's preference is to not use access hatches at regular intervals due to potential for leakage. There will be air valve connections at larger intervals which can be used for access. ▪ Access into the pipe during construction will be required for lining repairs, ovality checks, and cleaning. These activities will likely need to be completed as the pipe is installed instead of at 300 m intervals, the common spacing for pipe access hatches on transmission mains, due to potential challenges with confined space access ▪ Completing these activities gradually may result in decreased installation productivity while trenches are open but will result in fewer activities to complete once the pipe is installed
Staging	▪ Further consideration in the traffic management strategy for the interaction of construction with access to property, particularly the businesses on Dunford Avenue ▪ Offline alignment of the new main will allow for the existing main to remain operational during construction ▪ The construction zone width within the road right-of-way will be validated, aiming to maintain at least one traffic lane for local traffic only or controlled traffic activity
Temporary Support of Utilities	▪ Support utilities at crossings by requiring the Contractor to provide support drawings for permitting. These requirements and lead times are to be included in the contract documents to reduce the potential for construction schedule impacts
Testing	▪ Provision of air and flush valves to allow for filling and draining, where required ▪ Provision of ellipsoidal test heads and bypass piping to facilitate testing and commissioning
Tie-Ins	▪ Tie ins propose to remove existing valve chambers and relocate to a new location so that construction can occur in parallel to the operation of the existing chamber ▪ Proposed main to be constructed using steel be tied into the existing main without a need for a pipe material change and potential complex transitions and coupling arrangements ▪ It is recommended that isolation plans for tie-ins and associated outages be reviewed by CRD and affected municipalities before completing the work. ▪ The physical tie-in work is planned to be completed by the Contractor but will require support by CRD operations resources during the following activities: - Isolation - Tie-ins - Disinfection - Flushing - Commissioning - Reinstating service
Traffic Impacts	▪ While there are several routes which could serve as detour routes within Langford, if construction is occurring at multiple sites at once (e.g., lane closures for crossing both Jacklin Road and Peatt Road concurrently) then traffic may not be manageable so compounding lane closures should be limited in the specifications

Constructability Aspect	Details
	▪ Further traffic impacts and management strategies should be developed in the subsequent stage of design

9.4 Operational Considerations

Table 9-2 highlights operations and maintenance considerations identified and incorporated into the design.

Table 9-2. Main No. 4 (Leigh Road to Veterans Memorial Parkway) Operations and Maintenance Considerations

Operations & Maintenance Aspect	Details
Corrosion Protection	▪ Preliminary corrosion protection included in preliminary design, to be developed further following the field investigations ▪ Recommendation to include cathodic protection design as part of the contract documents to facilitate coordination with the Contractor during construction
Segment Isolation	▪ Provision of air and blowdown valves to allow for filling and draining, where required
Maintenance Accessibility	▪ Valve chambers provided with surface operation functionality to mitigate the personnel working in confined spaces ▪ Where possible, valve chambers have been proposed away from live traffic or within existing chambers/buildings

10. Environmental Setting

The biophysical and geo-environmental settings for the Project is discussed in this section.

10.1 Biophysical

This subsection summarizes the biophysical settings for the Project, with a focus on species and ecosystems of conservation concern; wildlife and wildlife habitat; vegetation and ecological communities; and aquatic habitat including watercourses, wetlands, and associated riparian areas. This information was incorporated into the preliminary design and has informed the design of the biophysical field investigations. Further detail on biophysical interactions, including the results of field investigations, will be provided in detailed design reports.

10.1.1 Methods

A detailed environmental desktop and literature review was conducted to obtain information about the existing conditions within 1 km of the proposed Project footprint (Study Area). Primary sources of information that were used include the following:

- Project imagery and drawings (Figures list their own references)
- City of Langford mapping (City of Langford 2024)
- City of Colwood webmap (City of Colwood 2024)
- BC Freshwater Atlas (BC MOF 2024a,b)
- BC Species and Ecosystems Explorer (BC Conservation Data Centre [CDC] 2024)
- Fisheries and Oceans Canada (DFO) Aquatics Species at Risk Map (DFO 2023)
- Sensitive Ecosystems Inventory (SEI): East Vancouver Island and Gulf Islands 1993-1997 (Ward et al. 1998)
- Invasive Alien Plant Sites (IAPP 2024)
- iMapBC 2.0 (Government of BC 2024a):
    - Federally identified Critical Habitat for Species at Risk (Environment and Climate Change Canada [ECCC] 2024a)
    - BC CDC publicly available element occurrence database (BC Ministry of Environment and Climate Change Strategy [BC MECCS] 2024b), masked secured occurrences (BC MECCS 2024c), and communication with the BC CDC (Renton, pers. comm. 2024)
    - Old Growth Management Areas (OGMAs) (BC Ministry of Forests, Lands, Natural Resources Operations and Rural Development [BC MOF] 2024c,d)
    - Provincial Parks and Protected Areas (BC MECCS 2024a)
    - Provincially identified wildlife areas (proposed and approved Ungulate Winter Ranges [UWRs], Wildlife Management Areas [WMAs], and Wildlife Habitat Areas [WHAs]) (BC MOF 2024e - i)
- HabitatWizard (Government of BC 2024b)
- Provincial Red and Blue designations (Government of BC 2024c)
- InvasivesBC Database and mobile application (Government of BC 2024d)

- Species at Risk public registry (Government of Canada 2024a)
- Committee on the Status of Endangered Wildlife in Canada status reports (COSEWIC 2024)
- National Wildlife Areas (Government of Canada 2024b)
- Important Bird Areas (Bird Studies Canada et al. 2024)
- Migratory Bird Sanctuaries (ECCC 2024b)
- Ramsar Wetlands (Ramsar 2024)
- Great Blue Heron Atlas (Community Mapping Network 2024a)
- Wildlife Tree Stewardship Atlas (Community Mapping Network 2024b)
- Western Hemisphere Shorebird Reserves (WHSRN) (WHSRN 2024)
- E-Fauna BC: Electronic Atlas of the Wildlife of British Columbia (Klinkenberg 2021)

10.1.2 Results

Conditions within the Study Area been heavily modified by urban development within the Cities of Langford and Colwood. Areas of native land cover are primarily associated with riparian areas near lakes and watercourses such as Langford Lake and Florence Lake and in parks such as Mill Hill Regional Park on the eastern edge of the Study Area. Hydrology within the Study Area has been altered by developments and extensive paving causing impacts to watercourses, lakes, and wetlands. These changes to the landscape have limited the quality and quantity of vegetation and wildlife habitat in the Study Area.

The Study Area is within the moist maritime Coastal Douglas-fir (CDFmm) Biogeoclimatic subzone (DeLong et al. 1991). This subzone has warm, dry summers and mild, wet winters (DeLong et al. 1991). Dominant species in this subzone include coast Douglas-fir (*Pseudotsuga menziesii* var. *menziesii*), Western redcedar (*Thuja plicata*), grand fir (*Abies grandis*), arbutus (*Arbutus menziesii*), Garry oak (*Quercus garryana*), and red alder (*Alnus rubra*) (DeLong et al. 1991).

Appendix E provides a list of species and ecological communities of conservation concern (Government of BC 2024c) that have the potential to occur within the CDFmm Biogeoclimatic zone. The resulting list includes 69 plant species, 140 fish and wildlife species, and 43 ecological communities (BC CDC 2024). After the biophysical field investigation is completed, this list will be refined based on the availability and suitability of habitat within and adjacent to the proposed Project footprint and potential for the species and ecological communities to interact with Project activities.

The Study Area does not interact with the following features:

- National Wildlife Areas (Government of Canada 2024b)
- Provincially identified wildlife areas (BC MOF 2024e - i)
- Western Hemisphere Shorebird Reserves (WHSRN 2024)
- Important Bird Areas (Bird Studies Canada 2024)
- RAMSAR sites (Ramsar 2024)
- Critical habitat for fish species (DFO 2023)
- Old Growth Management Areas (BC MOF 2024c,d)
- Provincial Parks or Protected Areas (BC MECCS 2024a)
- Migratory Bird Sanctuaries (ECCC 2024b)

The following subsections summarize the results of the environmental desktop and literature review specific to each proposed Project.

The Project is located within an urbanized area of the City of Langford among residential and commercial zones. The proposed Project footprint is sited within existing paved road surfaces.

There are watercourses present within the Study Area; however, there are no watercourse crossings or direct interactions with the proposed Project footprint. Watercourses or wetlands present within the Study Area include Langford Lake west of the proposed Project footprint within the Goldstream watershed, a 0.6 hectare (Ha) marsh wetland north of the proposed Project footprint behind Spencer School associated with Florence Lake, and Colwood Creek which is south of the proposed Project footprint (BC MOF 2024a,b). Direct impacts to watercourses and wetlands (including fish and fish habitat) are not anticipated, and mitigation measures will be needed to avoid potential indirect effects (such as, from sediment run-off into ditches or stormwater infrastructure).

Public observations of wildlife species of conservation concern are documented within the Study Area for western painted turtle – Pacific Coast population, common ringlet, *insulana* subspecies (*Coenonympha california insulana*) and northern red-legged frog (*Rana aurora*) (BC MECCS 2024b). Because the proposed Project footprint is routed entirely within paved roads, there is limited potential for Project activities to interact with any of these species. The documented turtle occurrences are within Langford Lake and Glen Lake (Engelstoft and Ovaska. 2008, 2011), which are 120 m and 840 m respectively from the proposed Project footprint and will not be impacted by Project activities. The proposed Project footprint does not provide suitable habitat for common ringlet, *insulana* subspecies, which has been found in association with shrub dominated areas near wetlands (Ansell, pers. Comm. 1995, Lilley et al. 2009). The northern red-legged frog occurrences were recorded in a wetland to the north of Spencer School, which is approximately 800 m to the north of the proposed Project footprint. The Project does not directly affect this wetland and there is no suitable habitat for the northern red-legged frog along the proposed Project footprint, so the Project is not expected to affect this species.

The Project overlaps with a masked secured occurrence of a species or ecosystem at risk (BC MECCS 2024c). Communication with BC CDC confirmed that no interactions were anticipated with the Project activities (Renton, pers. Comm. 2024).

A small portion of the proposed Project footprint along Leigh Road overlaps Critical Habitat for western painted turtle, Pacific coast population (ECCC 2024a). However, the proposed Project footprint is over 115 m from the nearest waterbody where the turtles were observed (Langford Lake), is sited entirely within an existing paved roadway, and is surrounded by commercial and residential land uses.
The biophysical attributes of critical habitat (including foraging, breeding, nesting, overwintering, basking, daily movements, and dispersal) (ECCC 2021, Western Painted Turtle Recovery Team 2017) are not present within the mapped Critical Habitat overlapping the proposed Project footprint, and there are no anticipated Project interactions with western painted turtles.

No osprey or great blue heron nests are documented within the Study Area by the Community Mapping Network (2024a,b). There are two bald eagle (*Haliaeetus leucocephalus*) nests recorded within the Study Area (Community Mapping Network 2024b). One nest is located approximately 600 m from the proposed Project footprint and the City of Colwood reports that the nest came down in 2007. The other is located approximately 580 m from the proposed Project footprint and was recorded as still standing in 2020 with a bald eagle nest present. While bald eagles and their nests are protected year-round under the BC *Wildlife Act*, the nests are located further than the recommended buffered distance even during sensitive periods for bald eagles (that is, 1.5 tree length, plus a 100 m quiet buffer from January to September (BC MOE 2013). There are no anticipated Project-related interactions with known bald eagle nests.

Two occurrences of a Red-listed Garry oak / California brome (*Quercus garryana / Bromus carinatus*) ecological community are within the Study Area, north of the Trans Canada Highway (BC MECCS 2024b,

Government of BC 2024c). Because of the distance from the proposed Project footprint (which is sited within paved roads) Project interactions with these occurrences are not expected.

SEI polygons are mapped within the Study Area for woodland, cleared/logged second growth forest, marsh and lake (Ward et al. 1998). Because the PCS is sited within a paved area, and does not overlap with SEI polygons, interactions with sensitive ecosystems are not anticipated.

Public observations of plant species of conservation concern are documented within the Study Area (but not on the proposed Project footprint) for Vancouver Island beggarticks (*Bidens amplissima*), fern-leaved desert-parsley (*Lomatium dissectum*), near navarretia (*Navarretia propinqua*), prairie lupine (*Lupinus lepidus var. lepidus*) and twisted oak moss (*Syntrichia laevipila*) (BC MECCS 2024b). Because the proposed Project footprint is sited on paved roads, interactions with vegetation, including plant species of conservation concern, are not anticipated.

Fifty-eight invasive plant occurrences are documented within the Study Area (IAPP 2024). However, only one occurrence has potential to interact with the Project: a 2016 occurrence of Japanese knotweed (*Reynoutria japonica var. japonica)* at the corner of Leigh Road and Dunford Avenue. Japanese knotweed is a Noxious weed in BC, is listed on the Eradicate list in the CRD, is on the Regional Containment/Control list for Provincial Priority Invasive Species and is on the "Contain" list for the Coast Region of BC (CRD 2019, IMISWG 2023, CISC 2024). Mitigation measures will be needed to reduce the introduction and facilitated spread of invasive plant species on the Project.

10.1.3 Conclusions and Recommendations

Construction of the portions of the proposed Project within paved roads is not expected to disturb habitat for potentially occurring species or ecological communities of conservation concern, or impact fish or fish habitat with the implementation of appropriate mitigation measures.

Biophysical field investigations need to be conducted to further inform design and mitigation.
The following is a preliminary list of recommendations and mitigation that are recommended to be implemented to avoid or mitigate potential effects from Project activities on the environment. These will be further refined following field investigations and inform the development of the Environmental Management Plan (EMP) which will be implemented during construction to avoid or mitigate potential environmental impacts from the Project, such as impacts to fish habitat, human-wildlife conflict, invasive species management, erosion sediment control, waste management, and spill prevention.

- Develop a sediment and erosion control strategy for inclusion in the EMP to control worksite mobilization of sediment or other deleterious substances into watercourses, drainages, and stormwater infrastructure and ditches.
- Implement an invasive species management strategy for inclusion in the EMP to manage the risk of introduction or facilitated spread of invasive plant species during construction including cleaning of equipment and vehicles prior to leaving site.
- Conduct a pre-construction non-intrusive migratory bird nest search if Project activities commence during the Develop with Care nesting period for passerines, March 1 to August 31 (BC MOE 2014) or recommended by a Qualified Environmental Professional.

10.2 Arboricultural

A tree survey is being completed by an ISA Certified Arborist to aid in the creation of Project-specific Tree Protection Plans, which will be included in the detailed design report (DDR). The plans will inform

municipal permitting and be incorporated into other sections of the DDR (such as biophysical setting) if applicable.

10.3 Geo-Environmental

This subsection summarizes the geo-environmental setting for the Project, with a focus on erosion and sediment control (ESC) and contaminated soils and groundwater.

The Project is completely sited within paved roads and existing cleared areas. However, Langford Lake is in proximity to the western section of the alignment. ESC measures will be implemented during and post-construction to prevent sediment from entering watercourses and drainage systems.

As the alignment is within or adjacent to roadways, there is the potential for fill of unknown quality to be present and for road salt runoff. Soil quality should be assessed prior to offsite disposal. A procedure for management of suspect contaminated soil should be included in the EMP.

Review of aerial photography of the alignment (CRD 2024) indicates that the alignment is in primarily commercial areas.

The BC Site Registry was reviewed for registered sites within 500 m of the Main No. 4 (Leigh Road to Veterans Memorial Parkway) alignment (BC MECCS 2024d). Thirty-seven registered sites were identified within 500 m, nine of which were adjacent to the Dunford Avenue and Station Avenue sections of the alignment. Aerial photography (CRD 2024) indicates that the nine adjacent registered sites are used for commercial purposes. There is a moderate potential for contamination to be present at or near Dunford Avenue and Station Avenue sections of the Main No. 4 (Leigh Road to Veterans Memorial Parkway) alignment.

A search for registered water wells within 500 m of the alignment was completed (BC MECCS 2024e). The search identified 17 registered wells for irrigation (4), private domestic (8), unknown (2), commercial and industrial (2), and not applicable (1) uses. None of the wells were noted to have artesian flow. Static water depths were reported for four wells, ranging from 3 m to 12 m.

The BC Soil Relocation database (BC MECCS 2024f,g,h) was reviewed for source and receiving sites within 500 m of the alignment. Two source sites were identified within 500 m, no receiving sites were identified. One site, 771 Station Avenue, is located adjacent to the alignment. Soil relocation at this site was for the purpose of site redevelopment. This site was listed in the BC Site Registry under 28099 (BC MECCS 2024d). As soil was not deposited, the relocation activity does not present an elevated risk to the Project. The second site was approximately 300 m from the alignment and is not considered to present a risk to the Project.

The Federal Contaminated Sites Inventory database (TBCS 2024) was reviewed for federal contaminated sites within 500 m of the alignment. No federal contaminated sites were identified.

11. Archaeological

This section was prepared with information presented in the AOA and Preliminary Field Reconnaissance (PFR) completed by Millenia Research Ltd. (Millenia).

The AOA and PFR are designed to assess the potential for archaeological sites in order to comply with the *Heritage Conservation Act* (HCA). The results and recommendations from the AOAs are summarized in the subsections below. Appendix F contains the full AOA for this Project.

12. Geotechnical

A geotechnical desktop assessment and visual on-site assessments of the alignments were undertaken during the preliminary design phase for the Main No. 4 (Leigh Road to Veterans Memorial Parkway) upgrade.

12.1 Desktop Assessment

The following sections detail the geotechnical information and challenges anticipated as part of the project. Appendix G contains the full preliminary geotechnical assessment memorandum.

12.1.1 Anticipated Ground Conditions

The surface geology for the area of the proposed transmission main is mapped as interbedded sands and gravels of the Colwood delta and outwash plain. This deposit is known to extend to depths around 30 m or deeper.

Thin organic layers, generally less than 4 m thick, may also be encountered around Leigh Road and Carlow Road. There is also the possibility of encountering shallow rock less than 2 m from the ground surface around the upstream tie-in point on Goldstream Avenue at Leigh Road.

12.1.2 Settlement Risk

Based on the anticipated ground conditions, settlement is not anticipated to be a significant concern. However, the potential for settlement should be considered in more detail once the geotechnical field investigation is completed.

12.1.3 Seismic Performance

Based on the anticipated relatively shallow depth of the pipe, lack of topographic relief, anticipated groundwater depth, and experience in Colwood sand and gravel, liquefaction or lateral spreading are not expected to be a significant concern along the proposed alignment.

12.1.4 Soil Corrosion Potential

The planned geotechnical investigation will collect soil samples for corrosivity testing as required, and the results of testing will be provided to others for interpretation.

12.1.5 Construction Considerations

Given the anticipated geotechnical conditions, it is expected that the pipe will be able to be installed following conventional open trench and backfilling methods. Where the subsurface trench conditions comprise stiff clay, it's likely that excavation can be completed using a standard trench box to mitigate soil removal and relocation.

Construction using trenchless technologies may still be required to mitigate impacts during construction.

12.2 Geotechnical Site Investigations

The proposed geotechnical site investigation plan in Appendix H proposes nine boreholes for the investigation. These holes would be drilled to a maximum depth of 5 m.

If trenchless sections of construction are required, then additional test holes may also be required.

13. Public and Stakeholder Considerations

For Project, the predominant social considerations have been broken down into sub-sections of the alignment.

The length of the rolling construction zone in the public road allowance will be confirmed in the later design stages and be factored into the development of the traffic management strategy for the project.

Table 13-1. Main No. 4 (Leigh Road to Veterans Memorial Parkway) Preliminary Public and Stakeholder Considerations

Alignment Sub Section	Public and Stakeholder Consideration/s
Goldstream Avenue	Works on Goldstream Avenue for the construction of the new line valve chamber and pipe installation works are likely to impact traffic flow on the section of Goldstream Avenue to the west of the Leigh Road intersection. The pipe alignment will be refined to mitigate impacts to traffic where possible, and the Contractor's traffic management should provide advanced warning of the works and potential detour routes to avoid delays. However, due to the size of the transmission main there are likely to be lane closures during construction.
Leigh Road	Similar to Goldstream Avenue, pipe alignment will be refined to mitigate impacts to traffic where possible. However, due to the size of the transmission main there are likely to be lane closures during construction.
Dunford Avenue	There are several businesses fronting Dunford Avenue. To mitigate impacts to access during construction, the preliminary design alignment is on the northern side of Dunford Avenue (i.e., the opposite side of the road to the businesses). This should allow for a minimum single lane alternating traffic on the southern side of Dunford Avenue to be maintained during construction which will allow for light vehicles to enter and exit businesses. However, further consultation with businesses should be completed to better understand the heavy vehicles which may use these businesses and how construction will impact heavy vehicle access.
Major Intersections ▪ Goldstream Avenue and Leigh Road ▪ Dunford Avenue, Jacklin Road and the E&N Rail Trail ▪ Peatt Road and the E&N Rail Trail ▪ E&N Rail Trail and Veterans Memorial Parkway	Mitigating impacts to traffic during construction across intersections will be addressed in the traffic management strategy. Where feasible, construction during night works for this sections may be considered in consultation with the City of Langford.

Alignment Sub Section	Public and Stakeholder Consideration/s
E&N Rail Trail	Consultation with the CRD's Parks and Trails branch indicated that detouring of the E&N Rail Trail will be required during construction. Detour routes and standards should be determined during the detailed design stage to propose adequate detour requirements in the contract documents. As the E&N Rail Trail is fenced, it is expected that a detour will be required for the full section that construction is occurring within – Jacklin Road to Peatt Road or Peatt Road to Veterans Memorial Parkway.
Full Alignment	Local First Nations
Full Alignment	The City of Langford will be a stakeholder for traffic impacts throughout the project and for interactions with any City of Langford infrastructure. The City should be engaged throughout the design process.

14. Cost Estimate

A Class D cost estimate was prepared during the preliminary design stage for the Project in August 2025. This indicated and overall opinion of probably construction costs, including contingency, provisional items, and escalation, of $37.9M to $61.2M.

Appendix I details the full cost estimate for the Project.

15. Recommendations & Activities for the Next Stage

This section summarizes the recommendations and activities for the next stage of the Project.

15.1 Field Investigations

The following are activities relating to field investigations which should be completed during the subsequent design stage of the Project:

- Biophysical field investigation
- Utility field investigation
- Topographic survey
- Geotechnical and groundwater field investigations
- Arborist review to survey the trees within the project area and identify removal and preservation requirements

15.2 Detailed Design

The following activities relating to detailed design advanced should be completed at the next stage of the Project:

- Incorporate the results of the field investigations (geotechnical, archaeological, survey, utility locates)
- Alignment refinement and detailed steel pipe design calculations

16. References

16.1 Personal Communications

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Appendix A.
Design Criteria

Project CRD Transmission Main Upgrade Program
Doc Name: A2.1 Design Criteria

Today's Date: 2/10/2026

No.	Discipline	Criteria Description	Origin (Owner, Good Practice, Code, Regulation)	Reference Document	Comments	Responsible
1	**General**					**Jacobs**
1.1	**Site Coordinate System**					Jacobs
1.1.1	Units	Civil plan and profiles, and site plans shall be in metres Mechanical, structural, and architectural details shall be in millimetres.	Owner	2020 CRD CAD Standards Guidelines		
1.1.2	Site Survey	Site survey shall be completed in accordance with the CRD CAD Standards Guidelines	Owner	2020 CRD CAD Standards Guidelines		
1.1.3	Site Horizontal Datum	North America Datum NAD 83 UTM	Owner	2020 CRD CAD Standards Guidelines		
1.1.4	Site Horizontal Coordinate System	North America Datum NAD 83 UTM	Owner	2020 CRD CAD Standards Guidelines		
1.1.5	Site Vertical Datum	CGVD2013 (HTv2.0) Victoria Datum (mean sea level = 0)	Owner	2020 CRD CAD Standards Guidelines		
1.1.6	Scale Factor	Site specific.	N/A	N/A		
1.2	**Design Life**					Jacobs
1.2.1	Chambers	The minimum design life of the chambers shall be 100 years.	Good Practice			
1.2.2	Pipe	The expected design life for the pipe will be 100 years.	Good Practice	-	Factor of safety 2:1	
1.2.3	Valves	The expected design life for the valves will be 50 years.	Good Practice	-		
1.2.4	Electrical and instrumentation	The expected design life for electrical and instrumentation will be 20 years.	Good Practice	-		
1.3	**Safety**					Jacobs
1.3.1	General	Design must meet: 1) WorkSafe BC Occupational Health and Safety regulations as well as applicable CRD standards. 2) British Columbia's Ministry of Environment and Climate Change Strategy Water Quality Guidelines 3) Chambers to consider removal of confined spaces	Owner, Regulation			
1.3.2	Safety in Design	Safety in design is to be considered and implemented prior to and during the design phase.	Regulation	WorkSafe BC		
1.4	**Standards / Guidelines**					Jacobs
1.4.1	CRD Standards	Design shall be in accordance with the latest CRD Standards , except where variances have been agreed with CRD and documented within this document.	Owner			
2	**Permits / Approvals**					**Jacobs**
2.1	**Permits / Approvals**					
2.1.1	Sewer Use Bylaw	If non-sanitary waste needs to be discharged into the sanitary sewer, a permit is required to discharge.	Regulation	CRD Sewer Use Bylaw No. 2922		Construction Contractor
2.1.2	CRD Water and Liquid Waste System Facilities Proximal Work Requirements	Work near existing CRD Sanitary and Water Lines will need to be discussed with the Water and Sanitary department to ensure proper distance from infrastructure.	Good Practice	CRD Water and Liquid Waste System Facilities Proximal Work Requirements		Construction Contractor
2.1.3	Water Distribution Local Service Conditions, Fees, and Charges Bylaw	If water from fire hydrants and standpipes is required during construction, authorization from the General Manager is required.	Regulation	Water Distribution Local Service Conditions, Fees, and Charges CRD Bylaw No. 3889		Construction Contractor
2.1.4	BC 1Call	A BC 1 Call will be conducted before ground disturbance to locate underground services.	Good Practice		Excavation must start within 14 calendar days from the request date of the ticket. If excavation has commenced within the 14 calendar days, only then is the ticket valid for 30 calendar days from the request date of the ticket.	Jacobs/Construction Contractor
2.1.5	Proximal Works - BC Hydro	Design the Project to consider location of BC Hydro infrastructure. If avoidance is not possible, design shall be in accordance with the latest BC Hydro Standards and WorkSafe BC Regulations.	Good Practice		Construction Contractor may need third-party agreement for proximal works	Jacobs/Construction Contractor
2.1.6	Proximal Works - Fortis BC	Design to consider location of FortisBC infrastructure. If avoidance is not possible, design shall be in accordance with the latest FortisBC Standards and WorkSafe BC Regulations	Good Practice		Construction Contractor may need third-party agreement for proximal works	Jacobs/Construction Contractor
2.1.7	Proximal Works - Telus	Design to consider location of Telus infrastructure. If avoidance is not possible, design shall be in accordance with the latest Telus Standards and WorkSafe BC Regulations	Good Practice		Construction Contractor may need third-party agreement for proximal works	Jacobs/Construction Contractor
2.1.8	Proximal Works - Rogers	Design to consider location of Rogers infrastructure. If avoidance is not possible, design shall be in accordance with the latest Rogers Standards and WorkSafe BC Regulations	Good Practice		Construction Contractor may need third-party agreement for proximal works	Jacobs/Construction Contractor
2.1.9	Bus Service Interruptions	If disruption to BC Transit bus stops is required, BC Transit needs to be notified.	Good Practice			Construction Contractor
2.1.10	Drinking Water Construction Permit	Comply with the Act and Regulation and obtain a construction permit or construction permit waiver prior to constructing or modifying a water system	Regulation, Good Practice	Drinking Water Protection Act and Regulation	Permit through Island Health	Construction Contractor
2.1.11	Private Property Landowners	Design optimized to avoid private properties encroachment during construction. When encroachment is inevitable, a temporary encroachment permit is required.	Good Practice, Regulation	Municipal Bylaws		Construction Contractor
2.1.12	MOTI rights-of-ways (highways)	The Transportation Act requires a permit for works within a highway right-of-way (including for trenchless crossings). Work Notification/Lane closure request and approval form H1080 required for works on highway needing lane closures.	Regulation	Transportation Act		Jacobs/Construction Contractor
2.1.13	Municipal Requirements	Design to consider existing municipal infrastructure as well as traffic impacts, future installations, and future development.	Regulation	Municipal Bylaws		Jacobs
2.1.14	Municipal Development Permits	Design to avoid development permit areas (such as riparian areas and sensitive environmental areas). If these areas cannot be avoided, development permits may or may not be required depending on exemptions and consultation with municipalities.	Regulation	Official Community Plan Bylaws for each municipality		Jacobs
2.1.15	Municipal Noise Bylaws	Adhere to noise bylaws in each municipality unless exempt.	Regulation	City of Langford Noise Regulation Bylaw 2056		Construction Contractor
2.1.16	Municipal Traffic Bylaws	Adhere to traffic bylaws in each municipality unless exempt.	Regulation	City of Langford Traffic Bylaw No. 33		Construction Contractor
2.1.17	Municipal Soils Bylaws	Adhere to municipal soils bylaws and obtain necessary permits	Regulation	City of Langford Soil Removal and Deposit Bylaw No. 1800,		Construction Contractor
2.1.18	Island Corridor Foundation (ICF)	Consultation and agreements may be needed for works occurring within ICF corridor	Regulation/Good Practice	Land Use Plan and Permitted Uses, Land Use Guidelines,	The land use guidelines allow for utilities, but consultation with the ICF is recommended to confirm requirements and process.	Jacobs/Construction Contractor
3	**Environmental**					**Jacobs**
3.1	**Environmental**					
3.1.1	Watercourses/Drainages	Design to avoid works within bed or banks of watercourses. If any works occur within the bed or banks of watercourses as defined by the Water Sustainability Act, a Section 11 permit may be required (or potentially a Section 39). These permits have long lead times.	Regulation	Fisheries Act, BC Water Sustainability Act		Jacobs
3.1.2	Riparian Buffers	Design to avoid riparian buffers.	Good Practice	Fisheries Act		Jacobs
3.1.3	Water Discharge	Excavations may produce groundwater depending on the depth. If this water needs to be removed, a Section 10 permit is required.	Regulation	BC Water Sustainability Act		Jacobs
3.1.4	Hydrotesting Discharge	Water exiting site will need to be treated to CCME standards, including highly chlorinated water used for testing	Good Practice	CCME standards		Jacobs
3.1.5	Tree Protection and Removal	Design to consider avoidance of Protected Trees as designated under municipal bylaws. Protected trees that cannot be avoided will require a Tree Removal Permit.	Good Practice, Regulation	City of Langford Bylaw No. 2136, 2023.		Jacobs/Bartlett
3.1.6	Bird Nesting Windows	Design to avoid trees with potential to provide raptor habitat, and plan construction activities to avoid raptor breeding periods when possible. Vegetation clearing (not just tree removal) during the nesting period for migratory birds will require nest surveys by QEPs prior to disturbance.	Good Practice, Regulation	Migratory Birds Convention Act, BC Wildlife Act		Construction Contractor
3.1.7	Amphibian and Reptile Salvages	Recommend obtaining a General Wildlife Permit for works in areas with potential for amphibians and/or reptiles (conducted during the active season) in order to conduct salvages	Regulation, Good Practice	BC Wildlife Act, Best Management Practices for Amphibian and Reptile Salvages in BC		Jacobs
4	**Geo-Environmental**					**Jacobs**
4.1	**Geo-Environmental**					
4.1.2	Erosion and Sediment Control	Design to consider municipal bylaws and applicable regulatory BMPs. Water exiting site will need to be treated to CCME standards	Good Practice, Regulation	Municipal Bylaws		Construction Contractor
4.1.3	Permanent Excavated Material Disposal	If source sites of material have been used for BC CSR Schedule 2 activities and the receiving site is not a landfill, permitting is required through the - regulated by BC Ministry of Environment and Climate Change Strategy.	Regulation	Environmental Management Act (Contaminated Sites Regulation)		Construction Contractor
5	**Archaeological**					**Jacobs**
5.1	**Archaeological**					
5.1.1	Areas of archaeological potential	Areas of archaeological potential will be determined during the development of Millenia's AOA. These areas will require an archaeological impact assessment (AIA) under the HCA and relevant First Nation heritage permits (additional areas may require AIAs and First Nation permits upon consultation with First Nations) . AIA may be conducted prior to construction (if feasible) or concurrent with construction activities.	Good Practice, Regulation (HCA Permit)	Heritage Conservation Act		Jacobs/Millenia/WSP

Project CRD Transmission Main Upgrade Program
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No.	Discipline	Criteria Description	Origin (Owner, Good Practice, Code, Regulation)	Reference Document	Comments	Responsible
5.1.2	Areas of low archaeological potential	Areas of low archaeological potential will be determined during the review of Millenia's AOA. A project-specific Archaeological Chance Find Management Plan should be also developed and implemented prior to construction in these areas, which will provide the Contractor(s) with guidelines in response to unanticipated and/or suspected archaeological materials encountered during construction while an archaeologist is not on site.	Good Practice	Review of the AOA by Millenia Project-specific Archaeological Chance Find Management Plan		Jacobs/Millenia
6	**Traffic and Noise**					**Jacobs**
6.1	**Traffic Impacts**					
6.1.1	MOTI Project Category	Project category will be determined for each individual project based on the preliminary alignment. Depending on the alignments chosen, this is likely to be predominantly Category 1 and 2. - Cat 1: minimal impact on the travelling public, typically located on simple terrain, and involve two-lane highways or roads, often with lower speeds and traffic volumes. - Cat 2: may be located on higher-speed or higher-volume corridors and involve some complexity. Impacts on the travelling public may be moderate becuase of the roadway characteristics or the type of work. - Cat 3: complex and have a significant impact on the travelling public because of factors such as higher volumes and speeds, project duration, active night work, mountainous terrain, and/or a requirement for lane closures and/or detours.	Regulation	Section 3.3 of 2020 Interim MOTI Traffic Management Guidelines for Work on Roadway.		
6.2	**Noise**					
6.2.1	Noise	Site specific based on location of project - will adhere to local by-laws. See item no. 2.1.15 above.	Regulation	Varies		
7	**Geotechnical**					**Jacobs**
7.1	**Geotechnical Design Parameters**					
7.1.1	Liquefaction	Determination of soil susceptibility to liquefaction based on information collected during the field investigation	Good Practice	2019 CHBDC or 2023 CFEM.		
7.1.2	Construction Loadings	To be determined by owner.	Owner	2023 CFEM		
7.1.3	Maximum Allowable Settlement	To be determined by owner.	Owner	None		
7.1.4	Design Analysis Factors of Safety	Temporary slope static FoS of at least 1.3. Seismic FoS not typically considered due to short exposure period. Quantitative Risk Assessment typically not required.	Regulation	2019 CFEM / 2019 CHDBC / EGBC V4.1 Landslide Assessments in BC, Table B-6.		
7.1.5	Backfill Material	Per the CRD standard trench detail.	Regulation	CRD Standard Trench Detail - Standard Drawing No. 1.12 / MMCD		
7.1.6	Bedding Requirements	Per the CRD standard trench detail.	Regulation	CRD Standard Trench Detail - Standard Drawing No. 1.12 / MMCD		
7.1.7	Maximum Excavation Slope	Site Specific based on subsurface conditions, and excavation depth requirements.	Good Practice, Regulation	Worksafe BC		
8	**Civil (General)**					**Jacobs**
8.1	**Trench**					
8.1.1	Trench Details	Per the CRD standard trench detail.. **Bedding depth below pipe**:100mm for <DN600mm pipe, 150mm for =>DN600mm pipe. (450mm minimum at pipe bells where welding is required.) **Trench bedding width at springline (pipe wall to trench wall)**: 300mm for pipes <DN600mm, 450mm for pipes =>DN600mm to DN1050mm, 600mm for pipes >DN1050mm. (600mm minimum at pipe bells where welding is required.) CDF may be used where working spacing is limited and adequate compaction of bedding cannot be achieved.	Regulation, Good Practice	CRD Standard Trench Detail - Standard Drawing No. 1.12		
8.1.2	Depth of Pipe Cover	Minimum cover to pipe crown = 0.9m. Where minimum cover is not achieved, additional protection required as per the CRD standard drawing.	Regulation, Good Practice	CRD Standard Trench Detail - Standard Drawing No. 1.12 CRD Engineering Specifications and Standard Drawings		
8.1.3	Utility Crossings and Offset - Vertical Clearance/Separation	Maintain a minimum of 3m horizontal and 450mm clear vertical separation between water mains and all sanitary sewer, storm sewer and stormwater services. Where minimum horizontal or vertical seperation is not achieved, pipe joints within 3m of crossing to be wrapped in accordance with CRD engineering specification. Maintain a minimum of 1.5m horizontal and 150mm clear vertical separation between water mains and electrical, gas, and telephone conduits. Maintain a minimum of 1m horizontal and 150mm clear vertical separation between water services and electrical, gas, and telephone conduits.	Regulation, Good Practice	CRD Engineering Specifications and Standard Drawings		
8.2	**Laydown / Parking**					
8.2.1	Construction Zone	Site specific based on location of project - will adhere to local by-laws.	Good Practice	Varies		
8.2.2	Offsite Storage	TBD - site specific. To be provided by the Contractor.	Good Practice	Varies		
8.4	**Trails / Pathways**					
8.4.1	Maintaining Existing Trails / Pathways	Site specific. This will be discussed with the key stakeholder/s as the projects progress and access requirements are understood.	Good Practice	Varies		
8.5	**Restoration**					
8.5.1	General	Surfaces will be restored to their as-found condition unless specified otherwise.	Good Practice			
9	**Alignment Selection**					**Jacobs**
9.1	**General**					
9.1.1	Isolation Blowdown/Drain Spacing	Each drain segment of the pipe should allow drain time not more than 8-hr operation.	Good Practice			
9.1.2	Pipe Alignment	Where possible: - Located within a road allowance as approved by the authority having jurisdiction. Design with a minimum distance of 1.5m from edge of road allowance or statutory right of way. - Mains shall not be located under sidewalks or where sidewalks may be constructed in future. - Pipe alignment to allow for single lane alternating traffic past work zone during construction (typically as a minimum), noting that total road closure maybe in unavoidable in some areas for large pipe road crossings or large valve installation. - Minimum/rationalise the number of bends to simplify pipeline set-out and the number of welded joints for steel pipe.				
9.2	**Air Valves & Isolation Valves**					
9.2.1	Air Valve Location and Design	Combination air valves will be located at high points along the pipeline profile, at a high points of main lengths between line valve isolated sections, to facilitate the followings: - Release trapped air under pressure during normal pipe operation, - Release air during pipe filling, - Vacuum relief during pipe draining. Air valves assembly to be: - Offset where required so that air valves are located out of road travel lanes and pavement extents. - Below grade, with chamber finishing level with the ground surface. - Have a dedicated breather pipe for the valve chamber, (assuming valve venting through gaps in the chamber lid is not acceptable). Air valve may directly connected to breather pipe to mitigate operation issues if chamber flooding is a risk. - Chamber to be AE Concrete 1.5m Tel Service Vault type with H-20 static load rated lid. - Design pressure to contain 50% surge allowance.	Owner, Regulation, Good Practice	AWWA M-51_Air Valves		
9.3	**Flush Valves**					
9.3.1	Flush Valve Location and Design	Flush Valve design will be per CRD Standard Drawing and Engineering Good Practice. Flush valves to belocated at low points along the watermain profile, and at low points along the main between line valve isolated sections. Flush valve intervals selected such that drain time does not exceed 8-hours. Blowdown valves at other points on the alignment, other than low points, or installating multiple blowdowns at the low point could be considered. Drain pipe diameter set to minimum 100mm.	Owner, Regulation, Good Practice	CRD Standard 100mm Flush Assembly Detail - Standard Drawing No. 6 CRD Standard 100mm Flush Assembly With Pavement Detail - Standard Drawing No. 16		
10	**Pipe**					**Jacobs**
10.1	**Pipe Design - Non Seismic**					Jacobs

Project CRD Transmission Main Upgrade Program
Doc Name: A2.1 Design Criteria

Today's Date: 2/10/2026

Jacobs

No.	Discipline	Criteria Description	Origin (Owner, Good Practice, Code, Regulation)	Reference Document	Comments	Responsible
10.1.1	Pipe Pressures	1372mm O.D. (54") Steel Pipe Design HGL: 169m (Current operating pressure is XXXm. Allowance for future HGL of 169m). Test Pressure: TBC in detailed design, typically 1.25x Design Pressure Surge Pressure: TBC in detailed design. Preliminary design value of working pressure +30m.	Code, Good Practice	Geoadvice report XXXX AWWA M11 Steel Pipe Manual and Best Practice		
10.1.2	Steel Pipe Design Factor of Safety (FOS)	Steel pipe wall thicknesses designed based on: 1) 50% of specified minimum yield strength for the working pressure yielding a FOS of 2.0. 2) 75% of specified minimum yield strength for the static plus surge pressure yielding a FOS of 1.33. 3) 80% of specified minimum yield strength for the static plus surge plus settlement allowance pressure yielding a FOS of 1.25.	Code, Good Practice	AWWA M11 Steel Pipe Manual		
10.1.3	Steel Material	**TBC during detailed design based on; Market behaviour and discussions with CRD, cost estimators and pipe suppliers.** Steel pipe material adopted for preliminary design: For straight pipe: ASTM A1018 Grade 40, 276MPa (40,000 psi) minimum yield strength. Steel pipe for pipe fabrications and fittings: ASTM A516 Grade 70, 262 MPa (38,000 psi) minimum yield strength.	Code	AWWA M11 Steel Pipe Manual		
10.1.4	Steel Pipe and Fitting Design / Pipe Wall Thickness	AWWA Standards; Based on internal pressure, handling, collapse pressure, pipe deflection, external loading, buoyancy, longitudinal stress, allowable strains for pipe lining and coating, based on AWWA Standards and considerations for Good Engineering Practice.	Code, Good Practice	AWWA-M11; AWWA C200 MV Standards: DA-CIV-00101 Rev B		
10.1.6	Pipe Connections	Steel Pipe: Welding Joints per AWWA Standards; Flanges for Valve Connections. Field welding of pipe-pipe joints to be Double Fillet Lap Welds.	Owner, Regulation, Code	AWWA- M11 Steel Pipe, AWWA C207; CRD Water Services Engineering Specifications,		
10.1.7	Lining and Coating	Steel yard and chamber pipes: Cement mortar lining and Polyurethane coating;	Code, Good Practice	NSF-61, AWWA C205, AWWA C222; CRD Water Services Engineering Specifications,		
10.2	**Pipe Design - Seismic**					D.Honegger
10.2.1	Buried Pipelines	Pipeline seismic design criteria for buried CRD pipelines are closely related to the Metro Vancouver standard seismic design criteria[1] for Class III and IV pipelines. Seismic demand is similar to what is defined for Class IV pipelines. Acceptance criteria are similar to Class III pipelines. Only earthquake-generated permanent ground displacement needs to be considered for the design of buried CRD pipelines. The level of earthquake ground shaking shall be that corresponding to an annual probability of being exceeded (AEP) of 0.0004 (equivalent to 2% in 50 years or and mean return period of 2,475 years). Pipeline response to seismic ground displacements can be based upon any rational calculation method that accounts for the interaction between the pipeline and surrounding soil. The minimum pipeline response shall be consistent with the acceptance criteria listed in the table below. [1] Metro Vancouver, 2015, "Seismic Design Criteria," DS-GEN-00100-Rev. D, April 10, 15 pgs. [2] Canadian Standards Association, 2019, "Oil and Gas Pipeline Systems," Z662:19, Standards Council of Canada. [3] Honegger, D.G. and Nyman, D.J., 2017, "Pipeline Seismic Design and Assessment Guideline," Catalog No. PR-268-134501-R01, report prepared for Pipeline Research Council, International, June 17, 198 pgs.	Regulation, Code, Good Practice	DS-GEN-00100 Pipeline Seismic Design and Assessment Guideline Canada Standards Association - Oil and Gas Pipeline Systems		D.Honegger
10.3	**Corrosion Control**					Corrosion Services
10.3.1	Protective Coating	See 10.1.7 All CP negative / test lead connections to pipe to be recoated	Owner, Good Practice	CRD Water Engineering Specifications		
10.3.2	Anode Groundbed	Size, configuration, materials type to be confirmed	Owner, Good Practice	CRD Water Engineering Specifications		
10.3.3	Rectifier	Rating to be confirmed	Owner, Good Practice	CRD Water Engineering Specifications		
10.3.4	Test Stations	Test stations installed at all major chambers, end points, tie-ins (CRD and municipal), foreign pipeline crossings (for foreign lines with CP), casings, transitions to/from concrete cylinder piping, and as required to maintain nominal 300 m test point spacing.	Owner, Good Practice	CRD Water Engineering Specifications		

Pipe Joint Type	Failure Mode	Acceptance Criteria
Mechanically Restrained[1]	Restraint Failure Load[2], [3] Restraint Failure Deformation[2], [3]	0.5 F_M, 0.5 M_M D_M, R_M
Single Lap-Welded Steel Pipe	Longitudinal Tension Stress[4] Longitudinal Compression Stress[4]	0.4 s_y 0.4 s_y
Double Lap-Welded Steel Pipe	Longitudinal Tension Strain[5] Longitudinal Compression Strain	2% See note 6
Complete Groove Weld with Backing Bar	Longitudinal Tension Strain[5], [7] Longitudinal Compression Strain	2% 1.76(t/D)
Butt-Welded Steel Pipe	Longitudinal Tension Strain[5] Longitudinal Compression Strain	4% 1.76(t/D)
*Notes for Table X are provided in Table Y.		

1. Segmented pipelines with unrestrained joints are not permitted.
2. F_M, M_M, D_M, and R_M are the is the pipe restraint manufacturer's recommended capacities for axial force ,bending moment, axial expansion or contraction, and rotation at a joint.
3. The determination of forces and displacements acting on a restrained joint shall be based upon the following assumptions:
   a. The axial force from permanent ground displacement shall be based up on the maximum axial soil restraint that could be present considering ground water conditions and soil compaction during installation.
   b. The bending force and rotation from abrupt permanent ground displacement shall be based upon accommodating the displacement by the rotation/extension/contraction of mechanical restraints at each end of a single pipe segment.
4. σ_y is the pipe steel specified minimum yield strength
5. Tension strain limits based upon meeting the following minimum requirements:
   a. Weld metal yield strength, ultimate strength, and toughness exceed the expected maximum values for the pipe body steel
   b. Fillet welds on lap joints are full-thickness welds
   c. Full-penetration welds are 100% inspected using radiography or ultrasound and reviewed against CAN/CSA Z662[1] workmanship criteria
6. Due to the eccentricity in longitudinal load path, compression strain double lap-welded pipe joints is limited to the strain associated with the onset of pipe wall wrinkling, ε_w. Lacking other information, it is acceptable to define the strain at the onset of wrinkling using the equation below from PRCI seismic guidelines[3] for a pipe butt weld with a girth weld offset and pipe steel exhibiting a distinct yield plateau.

$$\varepsilon_w = 10.6\left(\frac{t}{D}\right)^2 (1-p_r)^{-1}\,\varepsilon_y^{-0.70}\left(1.10-\left(\frac{\Delta}{t}\right)\right)$$

where
t = pipe wall thickness; D = pipe outside diameter
$p_r = \frac{pD}{2t\sigma_y}$; $\varepsilon_y = \frac{\sigma_y}{E}$
p = internal pressure; Δ = girth weld offset
With Δ equal to t for double lap-welded slip joints, the expression for ε_w simplifies to

$$\varepsilon_w = 10.6\left(\frac{t}{D}\right)^2 (1-p_r)^{-1}\,\varepsilon_y^{-0.70}$$

7. The reduction in acceptable tensile strain for groove-welds completed with a backing bar accounts for the fact that these types of welds cannot be inspected using radiographic or ultrasonic methods.

No.	Discipline	Criteria Description	Origin (Owner, Good Practice, Code, Regulation)	Reference Document	Comments	Responsible
10.3.5	Electrical Isolation	Electrical isolation devices as required to maintain DC isolation between protected piping and all grounded structures and foreign piping (e.g. chamber piping, municipal tie-ins)	Owner, Good Practice	CRD Water Engineering Specifications		
10.3.6	Electrical Continuity	Continuity bonding included as required to ensure electrical continuity between all protected structures	Owner, Good Practice	CRD Water Engineering Specifications		
10.3.7	Cathodic Protection for DI	Cathodic protection provided for supply main DI piping, including bell-and-spigot joint continuity bonding	Owner, Good Practice	CRD Water Engineering Specifications	DI included in scope of CRD CP specification (CRD (RWS) CP-SPEC-001)	
11	**Hydraulics**					**Jacobs**
11.1	**General**					
11.1.1	Design Flowrates	2100-MDD scenario modeling output results				
11.1.2	Minimum velocity	N/A				
11.1.3	Maximum Velocity for Pipelines	Maximum Velocity for Transmission Mains: ≤ 2.0 m/s	Regulation	Engineering specifications and standard drawings		
11.1.4	Maximum velocity for Valves	Maximum Headloss Gradient for Transmission Mains: ≤ 2.5 m/km	Good Practice			
11.1.5	Maximum velocity for Valves	Maximum Velocity for Control Valve: ≤ 6.0 m/s	Good Practice			
11.1.6	Storage Tank	Storage Tank is filling under MDD scenario	Good Practice			
11.1.7	Roughness Coeffcient (c)	c = 120	Good Practice		Conservative value	
12	**Chamber (General)**					**Jacobs**
12.1	**General**					
12.1.1	Entry Access	New Underground Valve Chambers will have maintenance hole / hatch access with ladder for CSE.	Owner, Good Practice			
12.1.2	Access to Main Valves	Permanent Platform Access; Aluminum or Fiberglass Grating	Owner/Good Practice			
12.1.3	Access to Air Valves	Permanent Platform Access; Aluminum or Fiberglass Grating	Owner/Good Practice			
13	**Chamber (Structural)**					**Jacobs**
13.1	**General**					
13.1.1	Loading Combinations	Per BCBC 2024 supplemented by the User's Guide in NBCC 2015	Code	BCBC 2024, NBCC 2015		
13.1.2	Loading Conditions	To suit equipment, services and soil/underground water	Good practice			
13.1.3	Loading	Chambers will be designed to CL-625 / H-20 / fire truck loading whichever is higher	Good Practice			
13.1.4	Foundations	Raft on grade to TBC by/per geotechnical recommendation	Good practice			
13.1.5	Waterproofing	Concrete integral with water stops and exterior membrane. Admixture as secondary protection against water egress.	Good practice			
13.1.6	Structural Design Standards	Design of all the structures will conform BCBC 2024, and NBC 2015 commentary.	Good practice			
13.1.7	Importance	Chambers to be designed to post-disaster importance with expected life of 100 years for seismic events.	Code	BCBC 2024, NBCC 2015		
13.2	**Dead Loads**					
13.2.1	Dead Loads	Selfweight of concrete, portion of equipment/services	Owner / Code			
13.3	**Live Loads**					
13.3.1	Collateral Loads	As per project specific requirements	Owner / Code	BCBC 2024		
13.3.2	Minimum Uniform Live Loads	As per building code and to suit project specific requirements	Owner / Code	BCBC 2024		
13.3.3	Minimum Concentrated Live Loads	As per building code and to suit project specific requirements	Owner / Code	BCBC 2024		
13.3.4	Other Live Loads	As per building code and to suit project specific requirements	Owner / Code	BCBC 2024		
13.3.5	Impact Loads	Pipe thrust, if applicable	Owner / Code	BCBC 2024		
13.4	**Earth, Hydrostatic and Hydrodynamic Loads**					

No.	Discipline	Criteria Description	Origin (Owner, Good Practice, Code, Regulation)	Reference Document	Comments	Responsible
13.4.1	Usual and Extreme Load Condition	To be specified in the geotechnical report.	Owner / Code	Geotech. Report		
13.5	**Stability Analyses**					
13.5.1	Factor of Safety for Loading Conditions	As prescribed in the BCBC 2024	Owner / Code	DS-GEN-0100, BCBC 2024		
13.5.2	Limit States Design	As prescribed in the BCBC 2024	Code	BCBC 2024		
13.6	**Concrete Design**					
13.6.1	General	Design of Concrete Structures	Code	CSA 23.3-19		
13.6.2	Concrete Material	Concrete materials and methods of concrete construction/Test methods and standard practices for concrete	Code	CSA 23.1-19/CSA 23.2-19		
13.7	**Steel Design**					
13.7.1	General	Limit States Design of Steel Structures	Code	CSA S16-19		
13.7.2	Steel Material	Limit States Design of Steel Structures and other applicable standards for manufacturing	Code	CSA S16-19		
13.8	**Access**					
13.8.1	Man Access	Hatches for man access.	Owner			
13.8.2	Equipment Removal	Removable pre-cast concrete lids for valve replacement	Good Practice		Consider locating in boulevards to limit wear where possible	
14	**Chamber (Process Mechanical)**					**Jacobs**
14.1	**Piping and Joints**					
14.1.1	Piping and Fitting	Carbon Steel, TBC	Owner	AWWA M11 Steel Pipe Manual ASTM A53 for Seamless and Welded Steel Pipe		
14.1.2	Design Pressure	TBC & Per the Hydraulics Analysis and System Pressures inclusing Surges	Owner, Regulation	CRD Water Services Engineering Specifications		
14.1.3	Pipe Class	TBC & Per the Hydraulics Analysis and System Pressures inclusing Surges	Owner, Regulation	CRD Water Services Engineering Specifications		
14.1.4	Lining and Coating	- Steel Pipe: Epoxy Lining and Polyurethane Coating - Ductile Iron Pipe: Cement Mortar Lining and Asphaltic Shop Applied Coating	Owner, Code	NSF-61 AWWA C222; AWWA C210 CRD Water Services Engineering Specifications; AWWA C104; AWWA C151		
14.1.5	Pipe Connections and Flanges	- Steel Pipe: Flanges and Welding Joints per AWWA Standards - Ductile Iron Pipe: Flanges and Push-on Joint with Gasket per AWWA Standards	Owner, Regulation, Code	AWWA- M11 Steel Pipe AWWA C207; AWWA C219; CRD Water Services Engineering Specifications; AWWA C151		
14.2	**Valves**					
14.2.1	Main Isolation Valves	For Open/Close Operations: - Rubber Seated Butterfly Valves (BFV) with Manual Actuator for Pipes larger than 300mm - Resilient-Seated Gate Valves (GV) with Manual Operation for pipes equal and smaller than 300mm For Regulating & Controling Operations: - Rubber Seated Butterfly Valves (BFV) with Electric Actuator	Good Practice, Owner, Regulation	AWWA C504 AWWA C509		
14.2.2	Drain/ Bypass Valves	Resilient-Seated Gate Valves (GV) with Manual Operation	Good Practice	AWWA C509 CRD Water Services Engineering Specifications;		
14.2.3	Air Valves	Combination Air Release and Vacuum Break Valves	Good Practice, Regulation	AWWA M51		
14.2.4	Check Valves	Swing Check Valves	Owner, Regulation	CRD Water Services Engineering Specifications; AWWA C508		
14.3	**Flowmeters**					
14.3.1	Type	TBC				
14.4	**Dismantling Joints**					
14.4.1	Type	Mechanical Flexible Coupling restrained by AWWA M11 joint harness	Owner			
15	**Chamber (Building Mechanical)**					**Jacobs**
15.1	**Ventilation / Heating (Permanent)**					
15.1.1	Ventilation	Ventilation in accordance with WorkSafe BC Section 9 requirements for confined spaces.	Good Practice, Code	CR-02-02-SD-CIV-00107		
15.1.2	Heating	No heating is provided in the chambers	-	-		
15.2	**Plumbing**					
15.2.1	Pumping and Drainage	Sump Pump and Piping	Good Practice, Owner, Regulation	CRD Engineering Specifications and Drawings		
15.3	**Fire Protection**					
15.3.1	General	Inclusion of Fire Protection based on requirements set by BC Building Code and BC Fire Code	Code	BCBC-2024 BCFC-2018		
16	**Chamber (Electrical, Instrumentation, and Controls)**					**Jacobs**
16.1	**General**					
16.1.1	Electrical, Instrumentation and Control Works	Electrical, Instrumentation and Control Work to conform with Canadian Electrical Code and CRD Design Standards	Owner, Code	CRD Engineering Specifications and Drawings		
16.1.2	Backup Power Requirements	No generator backup power supply or Uninterruptible Power Supply (UPS) has been accounted for in the chambers				
16.1.3	Power Utilization	Power utilization to be 120VAC, or 208VAC, 3 phase, 4 wire, 60 Hz (TBC) on available electrical service.	Owner			
16.1.4	Lighting	Lighting levels shall be calculated per Illuminating Engineering Society (IES) of North America	Code			

Appendix B.
Multi-Criteria Analysis Memorandum

Main No. 4 (Leigh Road to Veterans Memorial Parkway) Multi-Criteria Alternative Alignment Assessment Results Memorandum

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Capital Regional District

RWS/SPW 2023-2026 Transmission Main Upgrade Program
September 12, 2025

Main No. 4 (Leigh Road to Veterans Memorial Parkway) Multi-Criteria Alternative Alignment Assessment Results Memorandum

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Project Name:	RWS/SPW 2023-2026 Transmission Main Upgrade Program		
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Anita Le, PMP
Project Manager

Permit to Practice No.: 1003650

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Acronyms and Abbreviations

AOA	Archaeological Overview Assessment
AOP	Area of Potential
CAPEX	capital expenditure
City	City of Langford
CPP	concrete pressure pipe
CRD	Capital Regional District
E&N Railway	Esquimalt and Nanaimo Railway
ICF	Island Corridor Foundation
km	kilometre(s)
m	metre(s)
mm	millimetre(s)
No.	number
O&M	operations and maintenance

1. Introduction

The Capital Regional District (CRD) is undertaking a program of works on their transmission network with the aim to improve system capacity, redundancy, and resiliency. One project in this program is the upgrade of the CRD's Main Number (No.) 4, currently on Goldstream Avenue, from Leigh Road to Veterans Memorial Parkway.

The existing Main No. 4 alignment on Goldstream Avenue is a 1.9 kilometre (km) section of 1,372 millimetre (mm) diameter concrete pressure pipe (CPP) along Goldstream Avenue from Leigh Road to Veterans Memorial Parkway. This section of Goldstream Avenue has several challenges, as follows:

- It is a highly congested corridor with significant critical infrastructure, including overhead and buried utilities.
- There are traffic volumes in the order of 15,000 vehicles per day (in addition to being a transit route) (CRD 2025).
- There are many stakeholders due to the location in a mixed-use residential and commercial environment.

2. Objectives

To support effective decision-making in determining the best solution for the upgrades of Main No. 4 on Goldstream Avenue, an alternative alignment analysis has been undertaken. The analysis evaluated the identified routing options against a number of criteria, which include impacts on stakeholders as well as engineering, scheduling, and cost.

This technical memorandum summarizes the assessment process and preferred alignments for the transmission main upgrade for the Main No. 4 (Leigh Road to Veterans Memorial Parkway) upgrade based on the evaluation methodology detailed in Appendix A.

3. Identified Alternative Alignments

The evaluation process investigated eight primary alternate alignment options for the Main No. 4 (Leigh Road to Veterans Memorial Parkway) upgrade and several suboptions, which are described in this section.

3.1 Primary Alignment Options

Table 3-1 lists the alignment options considered in the alternate alignment assessment.

Figure 3-1 shows the alignment options maps for the project, with detailed maps of individual routes in Appendix B.

Table 3-1. Alignment Option Routes

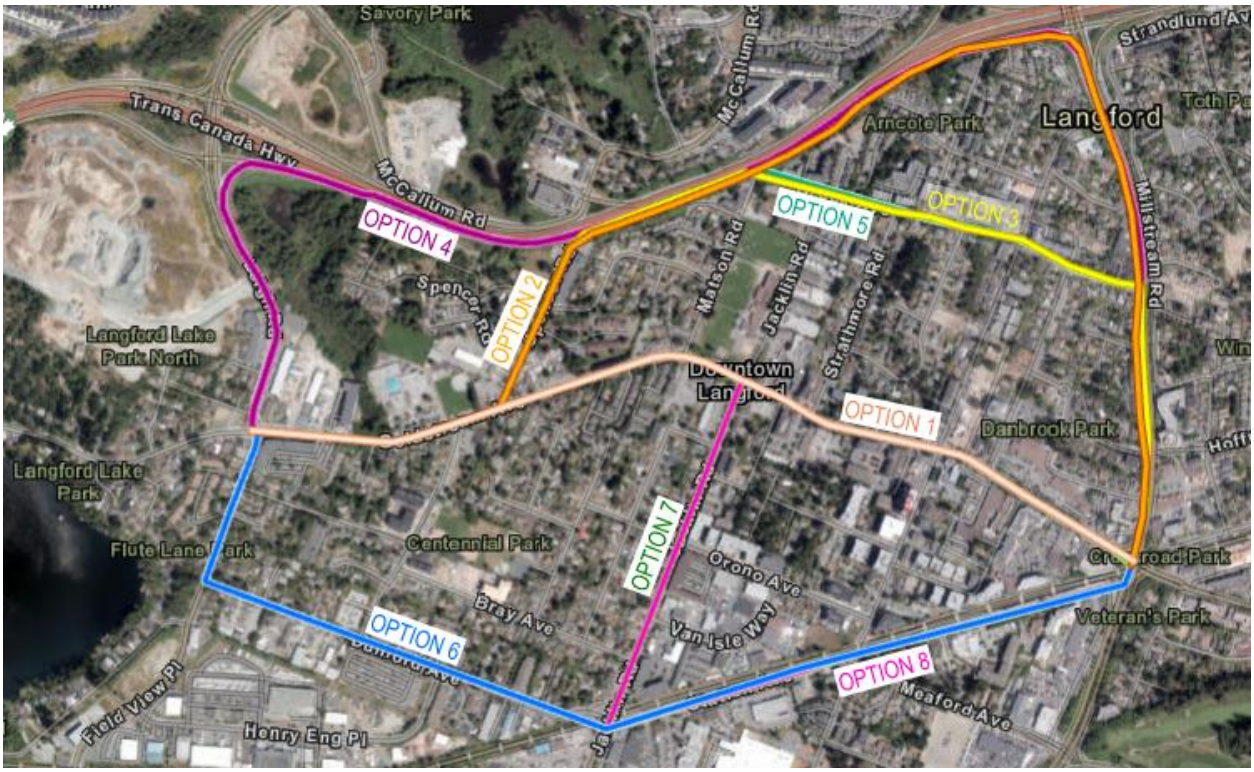
Option	Route
1	1. Goldstream Avenue from Leigh Road to Veterans Memorial Parkway
2	1. Goldstream Avenue to the intersection with Spencer Road 2. Spencer Road to the intersection with Highway 1 3. Highway 1 to the intersection with Veterans Memorial Parkway 4. Veterans Memorial Parkway to the tie-in location at Goldstream Avenue
3	1. Goldstream Avenue to the intersection with Spencer Road 2. Spencer Road to the intersection with Highway 1 3. Highway 1 to the intersection with Brock Avenue 4. Brock Avenue, which then continues as Larkhall Road, to the intersection with Veterans Memorial Parkway
4	1. Leigh Road to the intersection with Highway 1 2. Highway 1 to the intersection with Veterans Memorial Parkway 3. Veterans Memorial Parkway to the tie-in location at Goldstream Avenue
5	1. Leigh Road to the intersection with Highway 1 2. Highway 1 to the intersection with Brock Avenue 3. Brock Avenue, which then continues as Larkhall Road, to the intersection with Veterans Memorial Parkway 4. Veterans Memorial Parkway to the tie-in location at Goldstream Avenue
6	1. Leigh Road to the intersection with Dunford Avenue 2. Dunford Avenue to the intersection with Station Road 3. E&N Railway Trail on Station Avenue back to the tie-in location at Goldstream Avenue
7	1. Leigh Road to the intersection of Dunford Avenue 2. Dunford Avenue to the intersection with Jacklin Road 3. Jacklin Road to the intersection with Goldstream Avenue 4. Goldstream Avenue to the tie-in location on Goldstream Avenue

Option	Route
8	1. Goldstream Avenue to the intersection with Jacklin Road 2. Jacklin Road to the Intersection with Station Avenue 3. E&N Railway Trail on Station Avenue to the tie-in location at Goldstream Avenue

E&N Railway = Esquimalt and Nanaimo Railway

Figure 3-1. Main No. 4 Alignment Options

Sources: Esri, Maxar, Earthstar Geographics, and the GIS User Community



4. Evaluation Methodology

Appendix A provides the evaluation criteria and weighting used for evaluation of the alternate alignment options for the Main No. 4 (Leigh Road to Veterans Memorial Parkway) upgrade.

5. Evaluation Results

This section describes the results of the evaluation process undertaken and sensitivity analyses conducted to test the robustness of the results.

The evaluation results show the preferred option for the Main No. 4 (Leigh Road to Veterans Memorial Parkway) upgrade project to be Option 6 (Leigh Road – Dunford Avenue – E&N Railway Trail on Station Avenue).

The rationale for why this option scored the highest is preferred includes:

- Maintaining access to properties on the road rights-of-way for Option 6 is expected to be more feasible and impose fewer constraints on construction, as these corridors are wider than some others (for example, Spencer Road, Brock Avenue, or Larkhall Road).
- Using the E&N Railway Trail on Station Avenue is expected to mitigate some of the social impacts to residents and businesses during construction.
- This option has relatively low capital expenditures (CAPEX) compared to the options on the highway or Goldstream Avenue, as it is a relatively direct route between the tie-ins points that is not expected to require large lengths of complex, costly construction (for example, trenchless installation or rock excavation).
- This option provides interconnectivity opportunity with Mains No. 1 and 3 at locations other than the existing Veterans Memorial Parkway intersection.
- Operations and maintenance (O&M) is expected to be easier than on roads with higher traffic volumes, such as Goldstream Avenue or Highway 1.

Table 5-1. Assessment Scoring Results

No.	1	2	3	4	5	6	7	8
Route	Goldstream	Goldstream – Spencer – Hwy 1 - VMP	Goldstream – Spencer – Brock – Larkhall - VMP	Leigh – Hwy 1 - VMP	Leigh – Hwy 1 – Brock - Larkhall - VMP	Leigh – Dunford – E&N Railway Trail	Leigh – Dunford – Jacklin - Goldstream	Goldstream – Jacklin E&N Railway Trail
Score	2.9	1.9	2.8	1.8	2.7	4.2	3.0	3.5

Hwy = highway

VMP = Veterans Memorial Parkway

Appendix C provides the summary table for this analysis, which contains the scoring breakdown for each option and criteria. Appendices C.2 through C.9 provide the detailed breakdowns for the scoring of each option considered.

5.1 Archaeological and Cultural Impacts

Archaeological and cultural impacts were scored based on the Archaeological Overview Assessments (AOAs) undertaken by Millenia in July 2024.

Table 5-2Table 5-2 shows the Archaeological Areas of Potential (AOPs) identified along the different routes. There are also previously recorded archaeological sites in the vicinity of some options, as shown in Table 5-3.

Most AOPs and recorded sites are located to the north of Goldstream Avenue. Based on this, Options 6, 7, and 8 scored higher than the other options, as they use routes on or south of Goldstream Avenue, such as Jacklin Road, Dunford Avenue, or Station Avenue, which appear to have less archaeological potential.

Appendix D provides the AOAs.

Table 5-2. Route Option Areas of Potential

AOP	Option Within AOP
Goldstream Avenue between Leigh Road and Spencer Road	1, 2, 8
Leigh Road between Highway 1 and Goldstream Avenue	4, 5
Leigh Road between Goldstream Avenue and Dunford Avenue	6, 7
Highway 1 between Leigh Road and Spencer Road	4, 5
Highway 1 between Spencer Road and Brock Avenue	2, 3, 4, 5
Highway 1 between Brock Avenue and Veterans Memorial Parkway	2, 4
Brock Avenue	3, 5
Intersection of Highway 1 and Veterans Memorial Parkway	2, 4

Table 5-3. Route Options Nearby Recorded Archaeological Sites

Recorded Site Location	Option Near Recorded Site
30 m west of Veterans Memorial Parkway, 152 m north of Larkhall Road	2, 4
4 m south of Highway 1 south lane, 8 m north of Brock Avenue	2, 3, 4, 5
80 m north of Highway 1 south lane	4, 5
205 m north of Highway 1 south lane	4, 5
200 m north of Highway 1 south lane	4, 5
165 m north of Highway 1 south lane	4, 5
195 m north of Highway 1 south lane	4, 5

Recorded Site Location	Option Near Recorded Site
11 m south of Leigh Road onramp to Highway 1 south	4, 5
42 m south of Leigh Road onramp to Highway 1 south	4, 5

5.2 Social Impacts (Residential, Business, and Traffic)

The main drivers for the social impact scoring are based on traffic and transit use on the roads, streets, and trails proposed in the options assessment.

As Main No. 4 is a large-diameter pipeline, an indicative construction zone and corridor locations within the right-of-way were determined to estimate the expected traffic and access impacts during construction. Options on Goldstream Avenue, Highway 1, or Veterans Memorial Parkway scored lower for this criterion, as these roads are heavily trafficked, and shutting down a lane is expected to have significant impact on travel times in Langford and neighbouring municipalities.

The section of Goldstream Avenue between Jacklin Road and Veterans Memorial Parkway also scored low due to the number of businesses with access from Goldstream Avenue that would be impacted during construction.

The roads south of Goldstream Avenue that were considered include Dunford Avenue, Jacklin Road, and Station Avenue. These scored higher, as these roads appear to have less traffic than Goldstream Avenue, Highway 1, and Veterans Memorial Parkway.

Additionally, being able to complete construction using the E&N Railway Trail in the Vancouver Island Railway corridor meant that routes using Station Avenue scored highly, as these are expected to have social impacts restricted to trail users. A temporary replacement route for the trail would be used to minimize the impact to trail users during construction.

There are also the potential partnerships that could result in amenity improvements to the E&N Railway Trail, such as widening, landscaping, and lighting, to be included in the construction and site restoration of the section of the alignment on the E&N Railway Trail that would result in a positive community impact.

5.2.1 City of Langford – Dunford Avenue Impacts Feedback

During the workshop between the CRD, City of Langford (City), and Jacobs conducted on the October 23, 2024, the City raised concerns about impacts during construction on Dunford Avenue. The concerns were based on the feasibility of maintaining access to businesses on the southern side of Dunford Avenue during construction of the relocated transmission main.

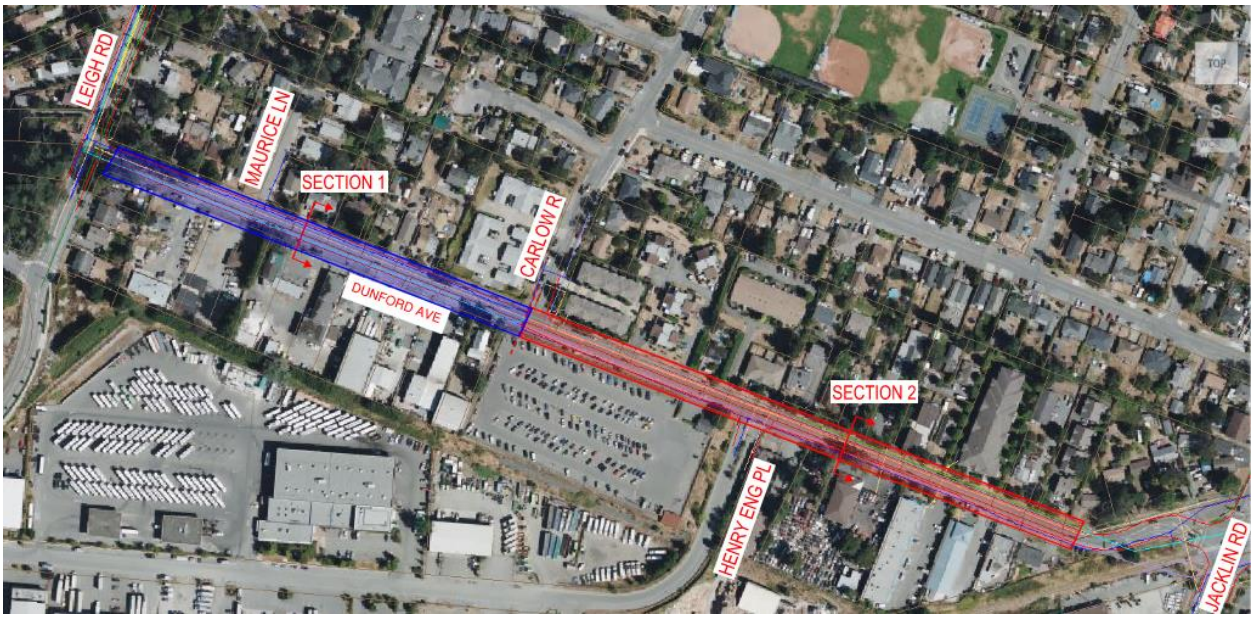
Jacobs conducted further investigation into what the potential construction section may look like on Dunford Avenue based on the understanding of the existing utilities developed from a review of BC1 Call and City and CRD existing utility WebMap information (CRD 2024).

Dunford Avenue can be broken down into two sections based on the different utilities and location of existing utilities present in each section. **Figure 5-1** shows the location of these sections on Dunford Avenue. The maximum construction zone length allowable on Dunford Avenue can be investigated during detailed design and incorporated into the contract documents to mitigate potential impacts to property access during construction.

- Section 1 – Leigh Road to Carlow Road
- Section 2 – Carlow Road to Jacklin Road

Figure 5-1. Dunford Avenue Construction Plan View

Sources: Esri, Maxar, Earthstar Geographics, and the GIS User Community



5.2.1.1 Dunford Avenue – Section 1 Potential Construction Zone

Based on concerns from the City about access to the businesses located on the southern side of Dunford Avenue during construction, it is preferred for construction to occur on the northern side of Dunford Avenue to mitigate these potential impacts. This option will involve coordination with BC Hydro for the relocation of the two underground BC Hydro electrical lines, expected to comprise one primary and one secondary conduit in the same trench. Figure 5-2 shows this arrangement.

An alternative alignment is shown on Figure 5-3, where construction is shown on the southern side of Dunford Avenue. This alignment does not appear to require third-party utility relocations to facilitate construction; however, having construction on the southern side of Dunford Avenue and traffic on the northern side will mean that further consideration of the construction zone length at each location on Dunford Avenue will be needed to maintain access to businesses during construction.

Figure 5-2. Dunford Avenue Section 1, Proposed Construction Zone Option 1

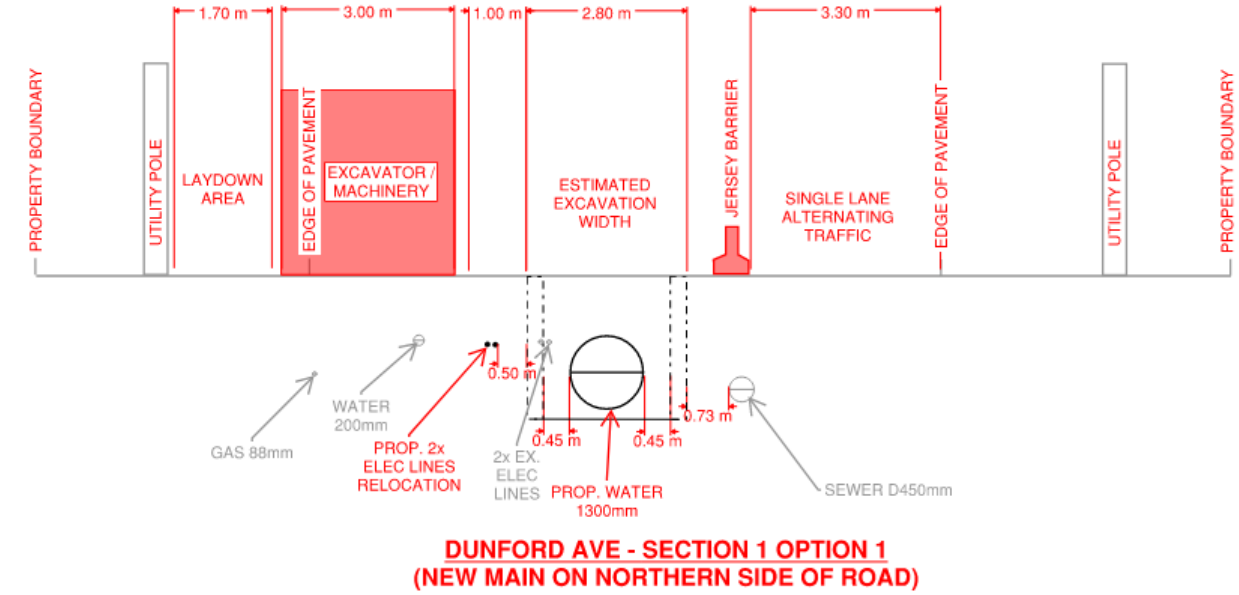
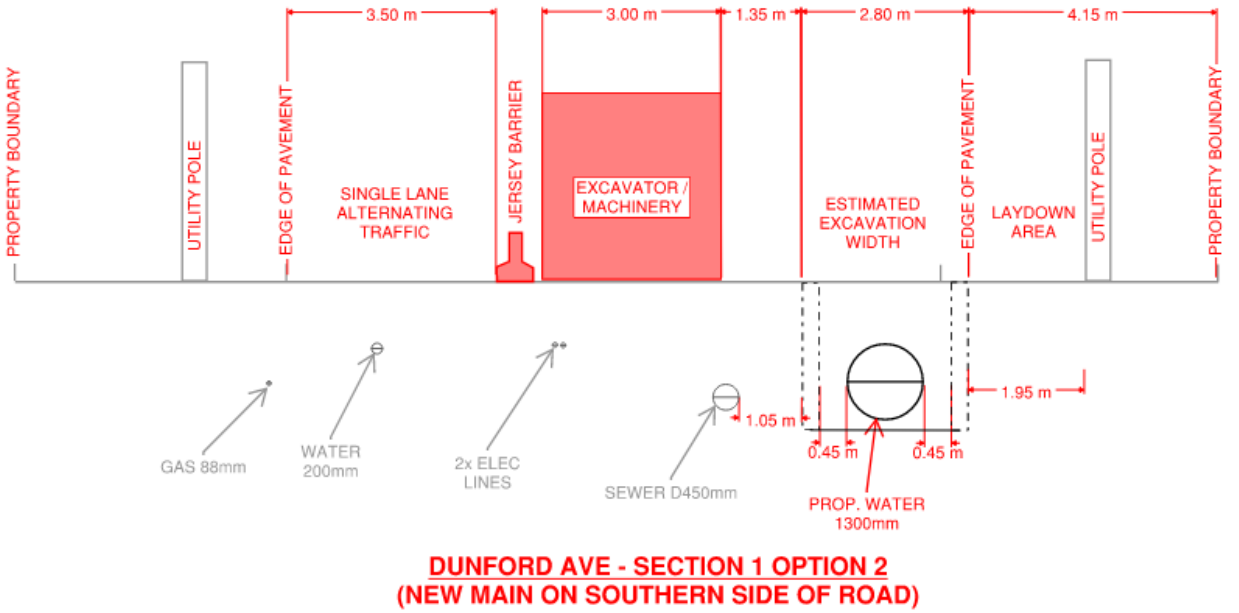


Figure 5-3. Dunford Avenue Section 1, Proposed Construction Zone Option 2

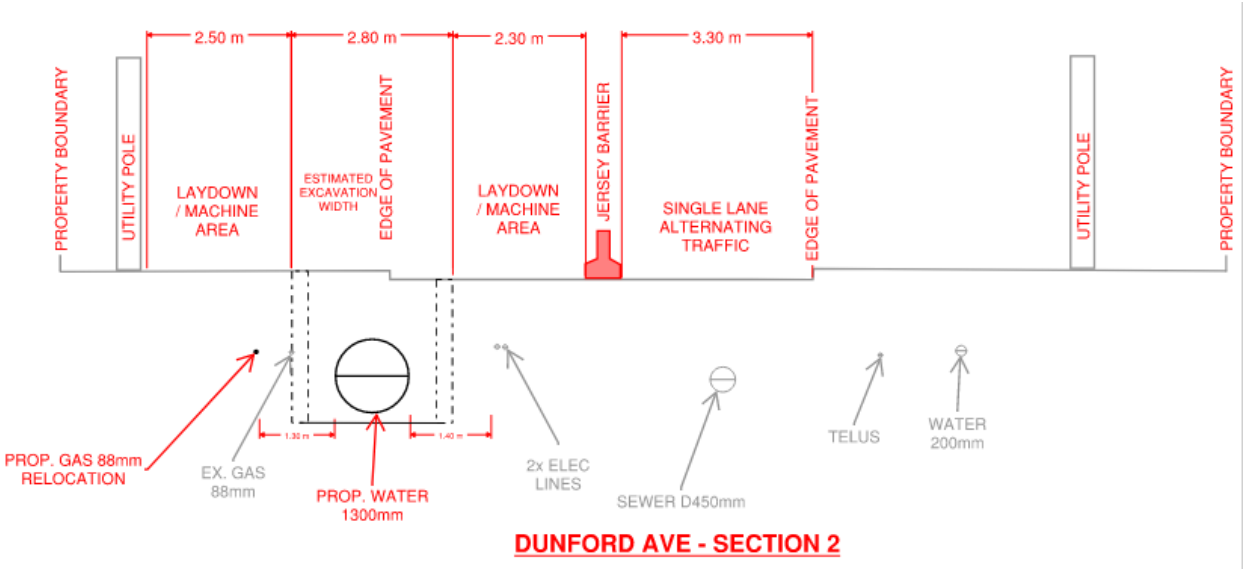


5.2.1.2 Dunford Avenue – Section 2 Potential Construction Zone

Construction on the northern side of Dunford Avenue between Carlow Road and Jacklin Road, with coordination with FortisBC for the relocation of the FortisBC 88 mm diameter distribution pressure gas main, appears feasible from the utility information available. If construction between Leigh Road and Carlow Road is also on the northern side of Dunford Avenue, then this will reduce the need for the transmission main to cross Dunford Avenue.

Figure 5-4 shows this arrangement.

Figure 5-4. Dunford Avenue Section 2, Proposed Construction Zone



5.3 Environmental Impacts

Most of the alignment options considered in the assessment minimize vegetation impacts through construction being within existing paved roads. There are some native and ornamental tree removals expected with most alignments due to the expected footprint of construction. The scores for the eight options are similar, with Options 4, 5, and 6 scoring the lowest due to potential rock excavation or soil contaminant in the historical rail corridor.

Alignments that use Highway 1 (Option 2, 3, 4, and 5) have scored lower, as the presence of shallow rock noted from visual site inspections and the desktop geotechnical review may result in the need for blasting to excavate for installation of the transmission main.

For Options 1, 2, and 8, impacts to vegetation adjacent to 1060 Goldstream Avenue have the risk of impacting the adjacent wetland and riparian area. There is also a wetland complex (Spencer's Pond Park) that is expected to contain sensitive plants, frogs, and butterflies, and is habitat for the painted turtle. Blasting and rock excavation adjacent to this area have the potential to impact this wetland.

There is also tree clearing expected during construction on the E&N Railway Trail. These trees are largely ornamental trees, and it is expected that they can be replaced during site restoration works. However, Options 6 and 8 scored lower in this criterion due to the potential presence of contaminants in the soil from historical use as a rail corridor.

5.4 Resilience (Geotechnical and Seismic, and Proximity to Other Mains)

All alignment options scored similarly for the geotechnical and seismic resilience criteria, with most alignments expected to be *National Building Code of Canada* (NRC 2020) Seismic Site Class C.

5.4.1 Proximity to Other Mains

One consideration for Station Avenue, Goldstream Avenue, and Veterans Memorial Parkway is the proximity of the new main to existing mains due to the potential to increase the risk of impact to the relocated Main No. 4.

The relocated Main No. 4 is expected to be a seismically resilient main, meaning the design process will include design of a transmission main expected to be seismically resilient when subjected to the loads on the pipe from a 1 in 2,475-year annual expectance probability seismic event. While the design features required to achieve this seismic resilience depend on the ground conditions observed from the geotechnical investigations that will occur during a later stage of design, if the potential for liquefaction and lateral spreading is not identified as high in this area, then it is expected that the new transmission main will achieve the required seismic resiliency by using steel pipe material and wall thickness suitable for the seismic loads, and specifying a joint type that is also capable of withstanding the loads subjected to a seismic event. Should the ground investigations show a higher potential for liquefaction or lateral spreading, further works required to provide a seismically resilient pipe may also include ground improvement works.

On Station Avenue, before communication with the Island Corridor Foundation (ICF), Jacobs investigated the potential for the relocated Main No. 4 to be located between Main No. 1 and 3 on Station Avenue. Both of the existing mains are large-diameter (approximately 1,metre [m]) steel mains that were not designed for the same seismic resilience as the Main No. 4 relocation will be, which means these pipes may be subject to brittle failure in a seismic event. This failure could lead to rapid crater formation around the existing Main No. 1 or 3 alignment.

Jacobs conducted an assessment of the proposed transmission main based on American Water Works Association (AWWA) standard *M11 Steel Pipe: A Guide for Design and Installation* (AWWA 2017), which indicated the seismically resilient Main No. 4 relocation is expected to be able to span 15 to 24 m unsupported. While the exact crater size formed by a main failure depends on the specific conditions of the pipe, the crater formed by a failure of Main No. 1 or 3 is expected to be on the order of 4 to 5 m using the sensitivity testing described in *Predicting crater formation from failure of pressurized water mains through analogy with buried explosive events* (Barr et al. 2020). As such, it was deemed the proximity of the relocated Main No. 4 to Mains No. 1 and 3 was not expected to significantly increase the seismic risk.

5.5 Constructability Impacts

One of the drivers for the alternative alignment assessment for the Main No. 4 upgrade of the existing transmission main on Goldstream Avenue was the constructability concerns on Goldstream Avenue due to the congestion of utilities, a narrow corridor, and high usage of the corridor for transit. Further investigation during the alignment assessment noted many storm and sewer lateral connections across Goldstream Avenue that would result in the new transmission main needing to be constructed deeper, with temporary support of the existing utilities used during construction. This would result in slower, more complex, and more expensive construction.

Construction on Veterans Memorial Parkway is expected to have similar complications, with several larger-diameter utilities and a number of other utilities within the corridor. This resulted in a low constructability score for Goldstream Avenue and Veterans Memorial Parkway.

While complications due to existing utilities are not anticipated on Highway 1, the construction complexity is also expected to be high on the highway due to the large traffic volumes, large embankments and escarpments, and shallow rock. While the eastbound existing shoulder appears to provide the lateral width

necessary for the permanent pipe location, construction on the highway would require removal of existing verge side barrier, lighting, and several rock cuts, which may require blasting, as well as some areas where large embankments would need to be constructed. This resulted in a low constructability score for options on Highway 1.

Brock Avenue, Larkhall Road, and Spencer Road are all narrow corridors with several residential property accesses. As some of these properties are single access, there may be some restrictions on the length of the construction zone during construction. Spencer Road also has the additional complication of being a dead-end road with a multiresident apartment complex at the end. This will require a minimum of single-lane alternative traffic to remain open on the narrow corridor throughout construction.

While construction on Brock Avenue, Larkhall Road, or Spencer Road is not expected to be as complex as Highway 1 or Goldstream Avenue and Veterans Memorial Parkway, the additional road width on Leigh Road and Dunford Avenue means that managing traffic and property access during construction is likely to be less restrictive during the construction staging on these roads than Brock Avenue, Larkhall Road, and Spencer Road.

Several of the businesses on Dunford Avenue also have wide property accesses or multiple accesses to the one property, which is likely to make maintaining access to these properties during construction less complicated.

The increased width on Leigh Road and Dunford Avenue also allows for utility relocations to facilitate a clear corridor for construction and mitigate potential complications supporting existing utility crossings or working in proximity to existing utilities.

While the E&N Railway Trail itself is narrow in some locations, there are no accesses off this trail, which means that the length of the construction zone is able to be extended farther. Early engagement with the ICF has also indicated potential temporary construction access paths across the existing rail tracks is also acceptable, which will further decrease the construction complexity. Alignment options using the E&N Railway Trail on Station Avenue have scored the highest for constructability.

5.6 Property and Land Acquisition Impacts

Property and land acquisition impacts, both temporary during construction and permanent, are similar across most options due to the alignment options being within road rights-of-way in Langford. Alignment options on Highway 1 or Veterans Memorial Parkway have scored lower than those on City roads, as the options that require a new right-of-way on Ministry of Transportation and Transit controlled roads and highways will likely require further conditions to be met.

The E&N Railway Trail on Station Avenue is part of ICF property. However, there is already an agreement in place for the CRD to use this section for the CRD operated and maintained E&N Railway Trail. Early consultation with the ICF has indicated they are supportive of amending this agreement to allow for the CRD to access their transmission main in this corridor, with CRD being a part shareholder in ICF.

5.7 Capital Expenditure

Per the adopted methodology for estimating CAPEX, which estimates CAPEX based on the length of the alignment, factored by the anticipated construction complexity (**0** provides further details), alignments that are the shortest in raw length and those expected to have low or moderate construction complexity score the highest in the CAPEX criterion.

As approximately 1,060 m of the total 2,190 m of Option 6 is on the E&N Railway Trail, which is expected to have a low construction complexity due to a reduced number of existing utility crossings and construction zone constraints, this option scored the highest in the CAPEX criterion.

Option 8 scored moderately in the CAPEX criterion, as it uses Station Avenue as a route. Option 1, while expected to be highly complex on Goldstream Avenue, scored moderately for CAPEX, as the raw length of this alignment is the shortest (approximately 1,800 m) due to Goldstream Avenue being the most direct route from the upstream and downstream tie-in points.

Options on Highway 1 scored the lowest for the CAPEX criterion, as these options are the longest routes and also expected to have high construction complexity.

5.7.1 Capital Expenditure Calculation Summary

Table 5-4 shows the estimated length of each alignment, construction complexity, and calculation of the CAPEX criterion score.

As described in the evaluation methodology in 0, the CAPEX for each option is evaluated relative to the other options rather than as an absolute CAPEX to allow for comparison between the options. This relative length is calculated by taking the raw length of the alignment and adding or subtracting up to 50% due to the expected complexity of the construction of that section.

Using Table 5-4 as an example, construction complexity along Goldstream Avenue is expected to be high, as there are several utilities, and residential and commercial properties, and a large traffic volume present within the Goldstream Avenue section. This means that construction is likely to be cumbersome, as there are likely to be many utilities to relocate, several sections of trench where existing utilities will be crossing the trench and require support, and potential limitations on the size of the construction zone to allow for access and to mitigate traffic impacts.

Table 5-4. Capital Expenditure Relative Lengths

Option	Section	Raw Length (m)	Raw Length (m, Total)	Complexity	Relative Length (m)	Total Relative Length (m)	Score
1	Goldstream Avenue (Leigh Road to Spencer Road)	490	1,800	High	735	2,700	2.9
	Goldstream Avenue (Spencer Road to Jacklin Road)	480		High	720		
	Goldstream Avenue (Jacklin Road to VMP)	830		High	1,245		
2	Goldstream Avenue (Leigh Road to Spencer Road)	490	2,950	High	735	3,638	1.0
	Spencer Road	350		Low to Moderate	2,63		
	Highway 1 (Spencer Road to VMP)	1,050		Moderate	1,050		
	Veterans Memorial Parkway (Hwy 1 to Goldstream)	1,060		High	1,590		
3	Goldstream Avenue (Leigh Road to Spencer Road)	490	2,500	High	735	2,913	2.5
	Spencer Road	350		Low to Moderate	263		
	Highway 1 Spencer Road to Brock Avenue)	380		Moderate	380		
	Brock Avenue	640		Moderate	640		
	Larkhall Road	130		Moderate	130		
	Veterans Memorial Parkway Larkhall Road to Goldstream Avenue)	510		High	765		

Option	Section	Raw Length (m)	Raw Length (m, Total)	Complexity	Relative Length (m)	Total Relative Length (m)	Score
4	Leigh Road Goldstream to Hwy 1)	770	3,310	Low to Moderate	577.5	3,648	1.0
	Hwy 1 Leigh Road to Veterans Memorial Parkway)	1,480		Moderate	1,480		
	Veterans Memorial Parkway Hwy 1 to Goldstream)	1,060		High	1,590		
5	Leigh Road Goldstream to Hwy 1)	770	2,850	Low to Moderate	578	2,913	2.5
	Highway 1 Leigh Road to Brock Avenue)	800		Moderate	800		
	Brock Avenue	640		Moderate	640		
	Larkhall Road	130		Moderate	130		
	Veterans Memorial Parkway Larkhall Road to Goldstream Avenue)	510		High	765		
6	Leigh Road Goldstream Avenue to Dunford Avenue)	310	2,190	Moderate	310	1,660	5.0
	Dunford Avenue	820		Moderate	820		
	Station Avenue	1,060		Low	530		

Option	Section	Raw Length (m)	Raw Length (m, Total)	Complexity	Relative Length (m)	Total Relative Length (m)	Score
7	Leigh Road Goldstream Avenue to Dunford Avenue)	310	2,680	Moderate	310	3,095	2.1
	Dunford Avenue	820		Moderate	820		
	Jacklin Road	720		Moderate	720		
	Goldstream Avenue Jacklin Road to VMP)	830		High	1,245		
8	Goldstream Avenue Leigh Road to Spencer Road)	490	2,750	High	735	2,705	2.9
	Goldstream Avenue Spencer Road to Jacklin Road)	480		High	720		
	Jacklin Road	720		Moderate	720		
	Station Avenue	1,060		Low	530		

Source: CRD 2024

5.8 Operations and Maintenance

Option 6 scored the highest in the O&M criterion, followed by Option 8, as maintaining infrastructure in the rail corridor is expected to reduce the risk associated with working adjacent to live traffic for CRD staff and also reduce the need for traffic management during O&M. This scoring assumed the reinstatement of the E&N Railway Trail after construction would allow for vehicle access along the trail for O&M, through the provision of sufficient sealed width and removable bollards at intersections.

Options using other roads in Langford also scored moderately, as it is expected that O&M is able to be performed with lesser traffic management requirements than if the main was on Highway 1. The impacts to traffic related to regular traffic management on Highway 1 to maintain the transmission main, as well as the risk posed to CRD staff operating in proximity to high-speed vehicles, meant the options on Highway 1 scored low for this criterion.

There is the potential that the scoring of Highway 1 options could be increased if maintenance parking bays were provided on the highway for CRD staff to access the transmission main. However, this assessment assumed these would not be constructed, as the cost associated with the additional excavation, pavement, and land acquisition would significantly increase the CAPEX of the project.

5.9 Connectivity

Based on the conceptual hydraulics undertaken, there is only one existing connection to the Juan de Fuca distribution network on the alignment, other than the common connection near the downstream tie-in, and that is located at the intersection on Goldstream Avenue and Jacklin Road. All alignment options were able to retain this connection, Options 1, 7, and 8, and scored a minimum of 3 for this criterion.

Options 6, 7, and 8 scored higher, as they also offer the potential for an interconnection between Main No. 4 with Main No. 1 or Main No. 3 on Station Avenue or in the adjacent historical rail corridor. An interconnection at this location would add the benefit of being more accessible than the current interconnection, which is within the existing high-traffic volume intersection of Goldstream Avenue and Veterans Memorial Parkway.

Options 2, 3, 4, and 5 scored lower due to the restricted potential for connections to the distribution network possible from the transmission main when it is on Highway 1. However, Option 3 has the potential for new connections at Spencer Road, Brock Avenue, or Larkhall Road, and as such, still received a moderate score of 3.

6. Sensitivity Analyses

A series of sensitivity analyses were undertaken to test the robustness of conclusions from the alignment assessment process. These included:

- Using Mains No. 1, 3, and 14 to supplement flows from Main No. 4 from the intersection of Highway 1 and Veterans Memorial Parkway to the intersection of Goldstream Avenue and Veterans Memorial Parkway to mitigate the need for constructing an additional main on Veterans Memorial Parkway
- Construction on Station Avenue in the existing road right-of-way, rather than the E&N Railway Trail
- Alterations of the CAPEX weighting from 25 to 50%

This section describes these analyses and the impacts on results.

6.1 Mains No. 1, 3, and 14 Supplementing Flows in Main No. 4

When assuming options that use Highway 1, and that Main No. 4 construction could be halted at the intersection of Highway 1 and Veterans Memorial Parkway, tying into Main No. 14 and having Main No. 4 flow downstream of Millstream Pressure Control Station coming from Main No. 14 and supplemented by Mains No. 1 and 3, no transmission main would be required to be constructed on Veterans Memorial Parkway.

This option significantly reduced the length of construction for Options 2 and 4. The results are shown in Table 6-1 and indicate that Option 6 remains the preferred option.

This analysis was performed instead of additional hydraulic analysis required to determine the hydraulic feasibility of this option. As this did not change the preferred option, no further hydraulic analysis was undertaken.

Appendix E.1 providers the detailed scoring summary sheet.

Table 6-1. Main No. 4 (Leigh Road to Veterans Memorial Parkway) Alignment Assessment Results (not including Veterans Memorial Parkway)

Option	1	2	3	4	5	6	7	8
Score	2.7	3.0	2.5	2.9	2.4	4.2	2.7	3.2

6.2 Station Avenue Road Right-of-Way Construction

The assessment was also completed with the assumption of construction on Station Avenue being within the road right-of-way should the E&N Railway Trail not be available. This showed Option 6 as the preferred option for the project. Table 6-2 summarizes these results, with detailed results in Appendix E.2.

Table 6-2. Main No. 4 (Leigh Road to Veterans Memorial Parkway) Assessment Results, Station Avenue Road Right-of-Way

Option	1	2	3	4	5	6	7	8
Score	3.7	2.1	3.4	2.0	3.3	3.9	3.5	2.7

6.3 Weighting Sensitivity

Additional tests were completed on the original assessment for Main No. 4 (Leigh Road to Veterans Memorial Parkway), altering the CAPEX from the bottom to top range, 20 to 50%, observed from previous transmission main alternative alignment assessments. The preferred options did not change when this assessment was undertaken.

7. Early Stakeholder Engagement

Following the alignment assessment workshop undertaken on August 18, 2024, the CRD and Jacobs undertook a series of stakeholder engagement workshops with the local municipalities and the ICF in September 2024 before undertaking preliminary design.

7.1 Island Corridor Foundation

From the initial meeting with the ICF, the following details were agreed to and reflected in the assessment scoring:

- The ICF is open to the use of their corridor for utilities, including this transmission main.
- Temporary construction access across the existing railway tracks is possible to facilitate easier construction.

In this meeting, the ICF also asked the CRD and Jacobs to consider the alignment that uses additional ICF rail corridor, rather than road right-of-way, by continuing the water main alignment on Leigh Road down to the rail line at Langford Parkway. Figure 7-1 shows this alignment that Jacobs conducted an additional assessment for on Main No. 4 (Leigh Road to Veterans Memorial Parkway) and considered this alignment as Option 6A. Table 7-2 summarizes the results of this assessment.

Class D cost estimates were generated for Option 6 and Option 6A. Table 7-1 shows the summary of the cost estimates. Appendix F provides the detailed estimates.

Table 7-1. Option 6 and 6A Class D Cost Estimate Summary

Alignment	Approx. Alignment Length (m)	Cost Estimate		
		Low (20%)	Mid Range	High (+30%)
Option 6 (Leigh Road, Dunford Avenue, E&N Rail Trail)	2,260	$37M	$46M	$60M
Option 6A (Leigh Road, E&N Rail Trail)	2,915	$47M	$59M	$76M

Option 6 is still the preferred alignment for the Main No. 4 transmission main relocation as, while Option 6A offers other benefits to the community of reducing social impacts during construction and co-benefits of potentially reducing the CAPEX of an extension of the E&N Railway Trail through the section of rail line between Leigh Road and Jacklin Road, Option 6A is approximately 600 m longer than Option 6. An additional 600 m of large-diameter steel water main to be constructed results in a larger CAPEX.

Appendix E.3 provides the detailed results.

Figure 7-1. Additional E&N Railway Trail Option 6A

Sources: Esri, Maxar, Earthstar Geographics, and the GIS User Community



Table 7-2. Main No. 4 (Leigh Road to Veterans Memorial Parkway) Assessment Results, including Extended Railway Corridor Alignment

Option	1	2	3	4	5	6	6A	7	8
Score	2.9	1.9	2.8	1.8	2.7	4.2	4.0	3.0	3.5

7.2 City of Langford

During the October monthly meeting with the City, conducted as a follow-up to the first meeting with the City in September, concerns were raised by the City about using Dunford Avenue. The City is concerned around potential impacts to businesses on Dunford Avenue should access be impacted during construction.

Following this meeting, Jacobs undertook an assessment of the utilities on Dunford Avenue to determine a high-level section of what construction may entail and where the transmission main may be able to be located within Dunford Avenue. Section 5.2.1 summarizes these investigations, with high-level plan and section views of the potential construction zones along Dunford Avenue provided.

While these investigations found construction is likely able to be completed on the northern side of Dunford Avenue, allowing traffic to remain open as single-lane alternating traffic on the southern side of the road (where the business accesses are), the social impacts score for Dunford Avenue was reduced to 1.

7.3 Capital Regional District Regional Transport Team

On December 2, 2024, Jacobs met with the CRD's Regional Transport Team to discuss the potential future use of the Vancouver Island Railway corridor on Station Avenue, currently occupied by the E&N Rail Trail and disused historical single railway track, for transit use and how that interacts with this project.

The directive for the Main No. 4 relocation project is that if the transmission main is going to be within the corridor, then it should be located such that it does not require relocation should the corridor be revitalized for a dual-track light rail transit system.

Jacobs has conducted further investigations into the corridor layout and potential future use, with the summary and recommendations presented in this section.

7.3.1 Conceptual Alignment

Based on the initial investigation of the corridor, the design alignment is expected to be within the area currently dedicated for the E&N Railway Trail. **Figure 7-2** and **Figure 7-3** show the plan and typical section of what construction in this corridor could look like.

From aerial imagery, it appears the area currently fenced for the E&N Railway Trail is 7 to 9 m. The conceptual alignment proposes to retain this width, with the E&N Railway Trail reinstated to allow for Regional Water Supply (RWS) staff to access the main for O&M.

This arrangement results in the permanent transmission main infrastructure being within 3 to 5 m of the property boundary, which allows approximately 25 to 27 m clear in the corridor for future transit use, with a low risk of requiring relocation of the transmission main.

Figure 7-2. Main No. 4 Relocation Plan E&N Railway Trail

Sources: Esri, Maxar, Earthstar Geographics, and the GIS User Community

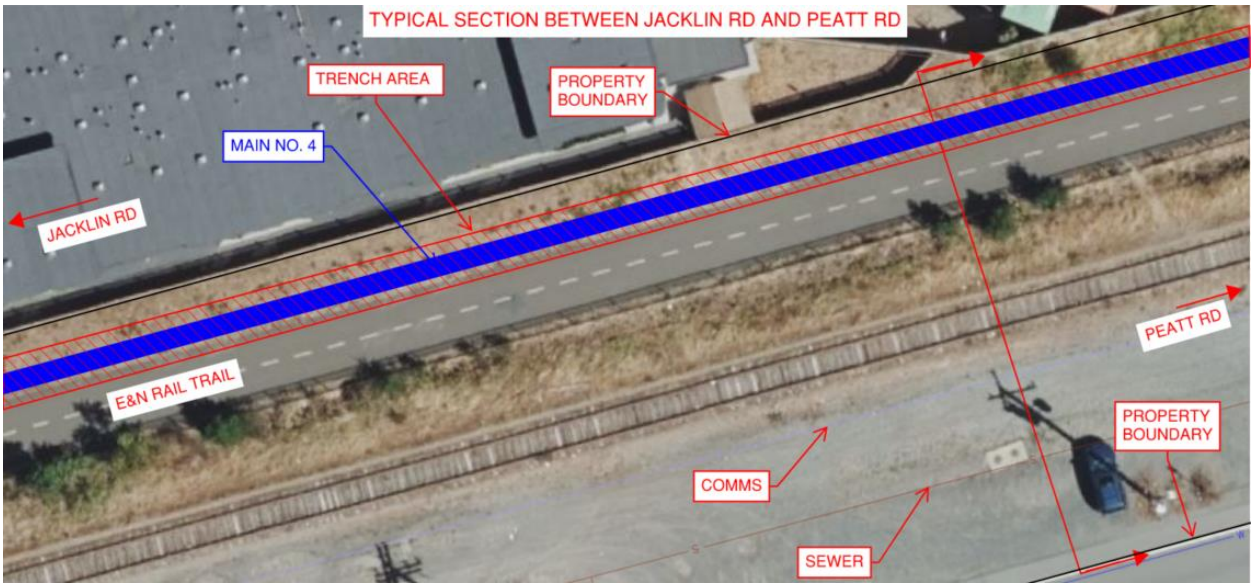
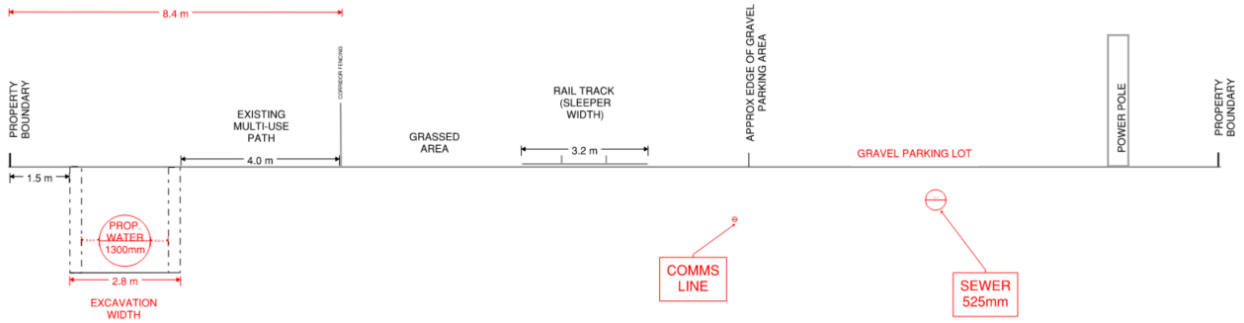


Figure 7-3. Main No. 4 Relocation Typical Section E&N Railway Trail



7.3.1.1 Peatt Road Property Conflicts

There is one property at the intersection of Peatt Road and Station Avenue where the property boundary is 5 m more constrained than most of the corridor. Figure 7-4 shows this area.

Initial investigations shown on Figure 7-5 concluded that the alignment can be constructed without impacting the existing rails and remaining within this property boundary. However, this may limit future transit use of the corridor.

Jacobs recommends the CRD undertake an investigation into acquisition or a statutory right-of-way to continue the alignment of Main No. 4 through this area and minimize potential impacts to future use of the corridor.

Figure 7-4. Constrained Property Area at Peatt Road

Sources: Esri, Maxar, Earthstar Geographics, and the GIS User Community

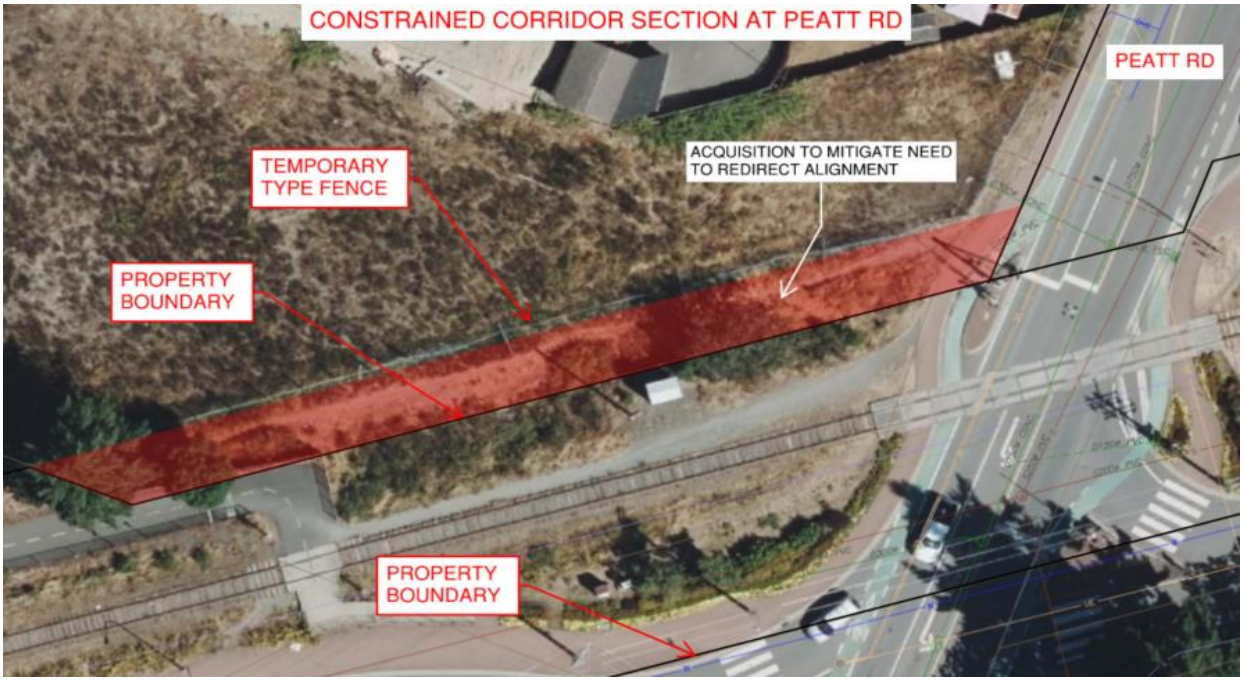
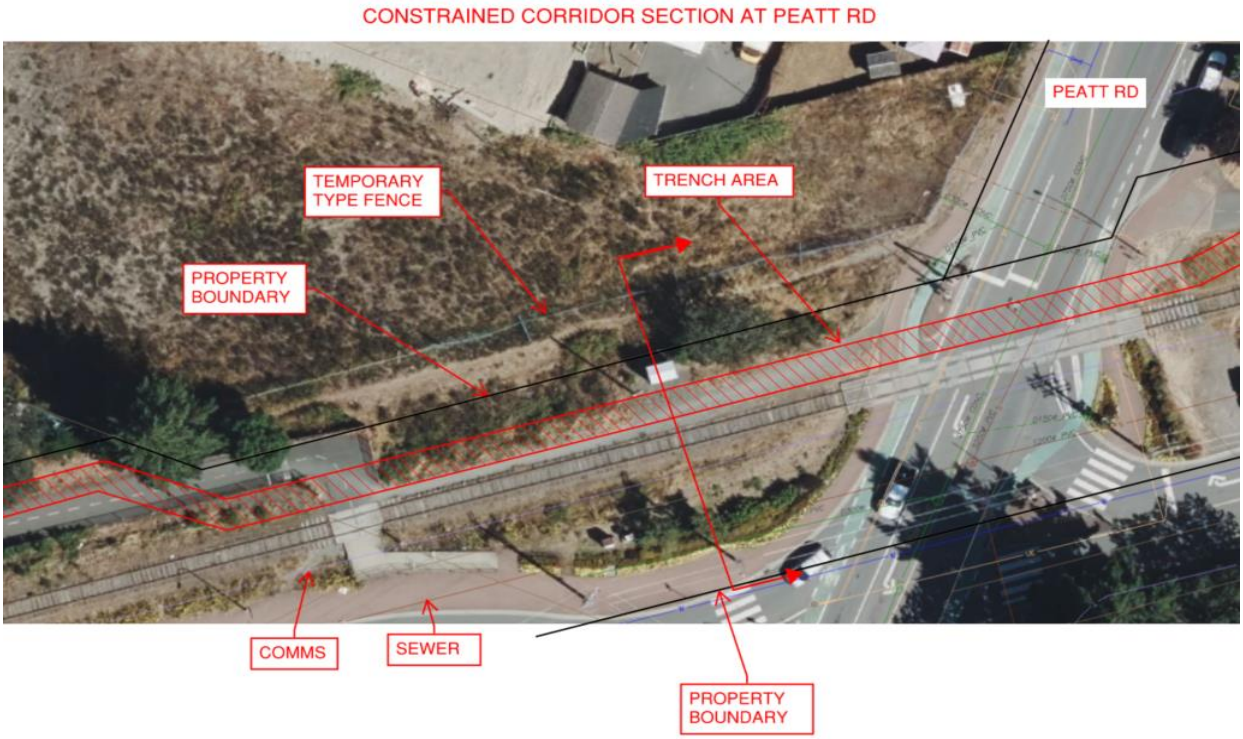


Figure 7-5. Potential Alignment Within the Property Boundaries

Sources: Esri, Maxar, Earthstar Geographics, and the GIS User Community



7.3.2 Potential Rail Use

From the Transport Canada *Standards Respecting Railway Clearances* (2014), Diagram 1, the clear width required for a dual-track rail corridor at 3.96 m track centres is as follows:

- 14.9 m, assuming no maintenance road access is required to be constructed within the fenced area, as Station Avenue and the E&N Railway Trail are able to be used for this
- 17.4 m, assuming maintenance road access on one side
- 19.8 m, assuming maintenance road access on both sides

7.3.3 Vancouver Island Railway Corridor – Interaction with Live Rail Feasibility Investigation Outcome

Based on the high-level layouts and estimates of required width for transit usage, the use of the E&N Railway Trail for Main No. 4 appears feasible in maintaining adequate corridor width for potential future transit development and usage.

8. Recommendation

Based on the alternative alignment assessment and sensitivity analyses conducted, it is recommended the CRD proceed with Option 6 (Leigh Road, Dunford Avenue, E&N Railway Trail) for the realignment of Main No. 4.

9. References

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Appendix A
Main No. 4 (Leigh Road to Veterans Memorial Parkway) Alternative Alignment Options Evaluation Methodology

Main No. 4 (Leigh Road to Veterans Memorial Parkway) Alternative Alignment Options Evaluation Methodology

Date:	September 12, 2025
Project Name:	RWS/SPW - 2023-2026 Transmission Main Upgrade Program
Project No.:	CE881400
Attention:	Capital Regional District
Client:	Capital Regional District
Prepared By:	Patrick Moore, Jacobs
Reviewed By:	Anita Le, Jacobs
Document No.:	250908084322_bdfc7ea0
Revision No.:	A

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1. Introduction

The Capital Regional District (CRD) is undertaking a program of works on their transmission network with the aim to improve system capacity, redundancy, and resiliency. One project in this program is the upgrade of the CRD's Main Number (No.) 4, currently on Goldstream Avenue, from Leigh Road to Veterans Memorial Parkway.

The existing Main No. 4 alignment on Goldstream Avenue is a 1.9 kilometre (km) section of 1,372 millimetre (mm) diameter concrete pressure pipe along Goldstream Avenue from Leigh Road to Veterans Memorial Parkway. This section of Goldstream Avenue has several challenges, as follows:

- It is a highly congested corridor with significant critical infrastructure, including overhead and buried utilities.
- There are traffic volumes in the order of 15,000 vehicles per day (in addition to being a transit route) (CRD 2025).
- There are many stakeholders due to the location in a mixed-use residential and commercial environment.

2. Objectives

To support effective decision-making in determining the best solution for the upgrades of this transmission main in existing congested corridors, an alternative alignment analysis is required to be undertaken. The objective of this analysis is to identify several alignment options to be explored and evaluate these against a number of criteria, which include the impacts on stakeholders, as well as engineering, schedule, and cost.

This technical memorandum summarizes the methodology proposed for evaluating alternative alignment options for the upgrade of Main No. 4 from Leigh Road to Veterans Memorial Parkway.

3. Methodology

A multicriteria assessment will be completed to provide relative scoring for each alignment option.

Attachment 1 provides the evaluation matrices to be used to evaluate the route options. The following categories are proposed to be included as part of the evaluation:

- Archaeological and Cultural Impacts
- Social Impacts (Residential, Business, and Traffic)
- Environmental Impacts
- Resilience (Geotechnical and Seismic, and Proximity to Other Mains)
- Constructability Impacts (including Third-Party Utilities)
- Property and Land Acquisition
- Capital Expenditure
- Operations and Maintenance (O&M)
- Connectivity

For each option, categories will be given a score of 1 to 5, where 1 is the worst-case and unfavourable conditions, 3 is the base-case and in-between conditions, and 5 is the best-case and favourable conditions. Where the alignment option comprises multiple sections, each subsection will be evaluated independently; and the score for the option will be a result of the weighted average of these scores. This is of particular importance for routes that have subsections on Veterans Memorial Parkway, as there is the potential to use the Main No. 14, supplemented by flows from Mains No. 1 and 3 (subject to hydraulic analysis) to complete this section.

Weighting has been assigned to each category based on feedback from the CRD on the proposed criteria and their knowledge of recent projects and the network.

3.1 Archaeological and Cultural Impacts

The alignments for the sections of Main No. 4 proposed for the Main No. 4 (Leigh Road to Veterans Memorial Parkway) project cross terrain considered to hold potential for known and undocumented archaeological sites. An evaluation of archaeological impacts for specific route alignments will consider the presence and proximity of known archaeological sites and the potential that undocumented archaeological materials may be encountered and impacted by routing activities.

Archaeological potential evaluations will be drawn from the following sources:

- Results and recommendations of previously conducted local area archaeological overview assessments
- Existing archaeological field studies and site distribution patterns
- Local area knowledge

Information on the extent and kind of historical disturbance is also an important consideration, noting that historical disturbance does not reduce the chance that archaeological materials may be present.

Alignment routing with direct impact to a documented archaeological site or situated in proximity (within 50 to 100 metres [m]) to known sites will be ranked least preferred (that is, a score of 1 or 2). Preferred alignments exhibit historical disturbances where post-glacial deposits are verified or strongly expected to be absent (that is, a score of 4 or 5). Routes with generalized archaeological potential but no documented sites in proximity, and historical disturbances likely to retain post-glacial sediments (intact or remixed) are allotted a moderate score (3); a high level of effort to assess these areas for cultural materials during construction is recommended.

The recognition and respect of First Nations cultural heritage is a leading principle of cultural revitalization and land stewardship. For this reason, alignment alternative scoring will be weighted toward avoiding archaeological sites and reducing the potential for ongoing and cumulative impacts to heritage places.

Other valued stewardship properties include:

- Reducing impacts on riparian habitats
- Enhancing and safeguarding wildlife corridors
- Conserving green space
- Rewilding historically modified terrain

A recognition of cumulative impacts on territorial lands and resources will be weighted in routing scoring that consolidates project impacts to the most heavily previously impacted terrain.

3.2 Social Impacts (Residential, Business, and Traffic)

The evaluation will consider impacts to local residents and businesses from construction and operations. In general, route alignments within road alignments could cause local, temporary disruption due to traffic, parking, access, and noise during construction. Alignments through parks, trails, and other areas also have the potential to impact public and resident access. The method for evaluation will include a review of existing information from public sources (geographical information system [GIS] mapping and traffic databases), and other digital base map resources.

In addition to the impact to residences and businesses due to noise and removal of trees that may impact privacy, the various alignment options will also include assessment of the following:

- Vehicle impacts
- Transit impacts
- Bicycle impacts
- Private access impacts, including to businesses, schools, residential areas, and other areas

To evaluate traffic impacts, the workspace required and the duration of impact during construction will be considered. A large-diameter pipeline will require a significantly larger workspace and may take longer to construct than a smaller municipal line.

In general, alignments will be considered the least preferrable (that is, a score of 1 or 2) where there are more substantial impacts to local residences through local parking, traffic, and other nuisance effects and through tree removal that may impact privacy. Alignments will be considered moderate (that is, a score of 3) where fewer residences and businesses are affected by traffic, noise, parking, and access. In addition, these effects can be managed through Traffic Management Plans. Alignments will be rated as the most preferrable (that is, a score of 4 or 5) where impacts to local residences and businesses are few and easily managed.

Potential social impacts can be mitigated through the following measures:

- Development of a Traffic Management Plan
- Compliance with local noise bylaws
- Notification to the public and provision of alternative trail and park access points, where impacted
- Reduction of tree clearing

3.3 Environmental Impacts

A desktop evaluation of potential environmental impacts of each alignment option during both construction and operations will be completed using a variety of data sources, and planning and development information, and an evaluation of recent aerial imagery.

In general, alignment options will be considered least preferrable (that is, a score of 1 or 2) near watercourses and where substantial tree clearing would be required. Alignments that use existing rights-of-way, but still require some tree clearing, will be considered moderate (that is, a score of 3). Alignments within existing roadways that avoid or minimize tree clearing and avoid streams or riparian areas are preferred (that is, a score of 4 or 5).

Potential environmental impacts can be mitigated through the following measures:

- Select routing alignment options that reduce tree clearing.
- Minimize crossing through critical habitat or riparian areas.
- Develop an Environmental Management Plan.

3.4 Resiliency (Geotechnical and Seismic, and Proximity to Other Mains)

One of the main objectives of the Regional Water Supply (RWS) and Saanich Peninsula Water (SPW) Transmission Upgrade Program is to improve the resiliency of the system. For this project, the important drivers for resiliency are the geotechnical conditions and ability to respond to seismic events. The alternative alignments traverse areas with undulating topography, as well as changes in elevation and geological setting. They also cross varied land use areas, including:

- Parks
- Pedestrian trails
- Municipal roadways
- Highway corridors

The primary objective of the geotechnical component of the assessment is to complete a desktop review that provides an adequate understanding of ground conditions, appropriately identifies geotechnical risks to inform the Design Team, and assists with comparative evaluation of the alternative transmission main alignments under consideration.

Geotechnical issues that will be considered for each of the alternatives include the following:

- Ground condition variability
- Seismic performance
- Proximity to major infrastructure

In assessing the potential risks proposed where transmission mains are close to other utilities (including other transmission mains), a high-level assessment will be undertaken of the potential crater formation that may occur due to failure of a utility during a seismic event.

For the geotechnical and seismic criterion, a favourable score of 4 or 5 will generally reflect competent soil conditions and perched groundwater seepage conditions, and where the main pipe is anticipated to be keyed into or bedded in seismically secure glacial soils away from the slope crest. A reduced rating of 1 to 3 reflects a combination of adverse conditions, including the potential presence of the following:

- Weak or compressible soils
- High groundwater table conditions
- Steep slope construction
- Construction near the slope crest
- Segments where significant liquefaction is expected to occur, and in locations where multiple mains are likely to be affected by the conditions

3.5 Constructability Impacts, Including Third-Party Utility Impacts

A constructability complexity evaluation will be conducted for the various alignment options. This evaluation process considers the feasibility of constructing a large-diameter water main within an urban setting for each of the alignments.

The degree of construction complexity affects the Contractor's productivity. A more complex alignment will increase the construction duration, resulting in delays to the public and increased cost of the project. The extent of the construction workspace requirements and the available width of the corridor will have impact on the adjacent landscape and surface restoration requirements, as well as affecting access and opportunities to accommodate traffic during construction. Trenchless construction requirements for watercourse crossings at highways or the necessity to address other constructability issues will also impact workspace requirements and construction duration. All of these factors will have an impact on the cost and duration of the project.

The construction complexity will include an evaluation of the following elements:

- Utility conflicts along the alignment
- Corridor congestion
- Workspace availability
- Trenchless construction complexity requirements
- Potential presence of contamination in existing soil, groundwater, surface water, or sediment that will need to be addressed during construction

Each alignment option will be reviewed and assessed based on its impacts to the underground and aboveground third-party utilities. This review will be based on the information received from the CRD in the form of utility and cadastral basemaps, record drawings, and high-resolution imagery.

Geo-environmental constructability concerns will be typically associated with areas of industrial or commercial activities, or with transportation (for example, spills from accidents or salt application to combat icy winter roads).

The utilities considered in this assessment process include:

- BC Hydro infrastructure, including overhead distribution power poles, overhead transmission towers, and underground duct banks
- Fortis BC infrastructure, including distribution and intermediate pressure gas lines
- Telecommunications infrastructure, including Telus underground fibre cables
- CRD infrastructure, including:

  - Water mains
  - Tunnels
  - Valves
  - Hydrants
  - Anodes
- Municipal infrastructure, including:
  - Water mains
  - Stormwater sewers and culverts
  - Sanitary sewers and culverts
  - Streetlights
  - Traffic signal conduits

Main No. 4 (Leigh Road to Veterans Memorial Parkway) is contained in Langford.

The proposed alignments for the transmission upgrades with a direct conflict with existing underground and aboveground utilities requiring utility relocations will result in lower scores. Where the proposed alignment of the transmission main runs parallel or crosses major or critical existing utilities (or both) or would require minor relocations of small or noncritical infrastructure (or both), a medium score will be assigned. A high score means there are no conflicts with existing utilities.

Other considerations are related to constructability on the construction site and workspace requirements. The assessment using these criteria will focus on the area requirement to accommodate construction workspace for the proposed pipeline. Assessment of the permanent right-of-way required will be incorporated into the O&M Impacts described in Section 3.8.

The amount of temporary workspace will vary, depending on the following factors:

- Size of the pipeline
- Depth of the excavation
- Soil conditions
- Safety requirements

The ability of each alignment option corridor to accommodate construction workspace requirements will also be considered in the alignment evaluation.

Alignment options along narrow workspace corridors with highly congested utilities or contamination, or both, will be ranked as the least preferred (that is, a score of 1 or 2). Preferred alignments have large, open workspace availability, few utilities, and minimal traffic congestion (that is, a score of 4 or 5).

3.6 Property and Land Acquisition Impacts

An evaluation of property impacts and land acquisition will be conducted for the various alignment options. Property impacts will include consideration of proximity or crossing agreements that may be required for third-party utilities. Land acquisition considerations will include whether temporary or permanent rights-of-way are required to accommodate the construction work zone or the final built alignment of the proposed water main upgrades.

Evaluation criteria are based on the extent of property acquisition required, with alignments contained within municipal road allowances being preferred (that is, a score of 4 or 5). Alignments that cross existing third-party utilities, requiring agreements, or alignments requiring significant new permanent rights-of-way will score the lowest in the evaluation (that is, a score of 1 or 2).

3.7 Capital Expenditure Impacts

A comparative capital expenditure cost evaluation will be conducted on the various alignment options. A high-level comparative approach, based primarily on the length of the alignments, with weighting applied based on expected construction complexity, will be used for this process, as detailed construction costs have not been prepared at this stage of the design.

Other evaluation criteria that impact comparative cost include the impact on existing utilities, impact to roadways, and potential geo-environmental contamination remediation. For alignments where there is a direct conflict between the proposed transmission main with existing utilities that results in third-party utilities requiring relocation, evaluation of capital expenditure will include consideration of the costs involved with this relocation.

Each alignment will be assigned a relative length based on the raw length of the alignment, multiplied by a construction complexity factor shown in Table 3-1. The shortest relative length of the options considered will be scored a 5, while the longest will be scored a 1. All other options will be distributed linearly between 1 and 5 based on their relative length.

Table 3-1. Construction Complexity Factors

Construction Complexity	Adjustment (%)
High	+50
Moderate to High	+25
Moderate	0
Low to Moderate	-25
Low	-50

3.8 Operations and Maintenance

An assessment of the operability and maintainability of the alternative alignments will be conducted comparatively for the various alignment options developed. The primary consideration for O&M will be an assessment of the permanent right-of-way required to operate and maintain the pipeline safely. This includes consideration of accessibility, traffic management, and disruptions for both routine and emergency maintenance, and the safety of maintenance.

Alignment options along narrow corridors where routine maintenance will result in significant traffic disruptions, or where workers are subject to hazards such as live traffic, confined spaces, or potentially hazardous nearby overhead or underground utilities that impact maintenance work, will be ranked as least preferred (that is, a score of 1 or 2). Preferred alignments will have large, open workspace with limited conflicts with other utilities and minimal traffic disruptions as a result of routine maintenance (that is, a score of 4 or 5).

3.9 Connectivity

Connectivity is based on the potential for the alignment to retain existing connections to other transmission mains and the distribution network and for potential new connections that could increase the redundancy of the system to be incorporated.

The farther away a route is moved from an essential connection point or cross connection, the higher the risk of complicated and lengthy tie-ins being required if alternative connection sources cannot be established. This criterion will also explore the potential service disruptions and redundancy associated with each alternative alignment.

For the routing assessment, tie-in points will be retained where they are proposed at Leigh Road and Veterans Memorial Parkway. However, these locations can be altered and optimized in subsequent design phases based on the selected route and developments during design.

Alignment options that minimize disruption to existing operations during works or allow other projects to run concurrently or have a high connectivity potential will score higher (that is, a 4 or 5). Alignments that require more significant temporary works or limit redundancy or connectivity of the system or ability to construct projects concurrently are least preferred (that is, a score of 1 or 2).

4. Evaluation Criteria Weighting

Weighting for each category has been assigned based on input from the CRD on the importance of each criterion to the selection of an alignment. Table 4-1 shows the weighting to be adopted for this assessment.

With the works being performed for this project being part of the great RWS/SPW Transmission Main Upgrade Program, connectivity is of high importance for these projects. Similarly, to emphasize the alignment option chosen meets one of the project criterion, resiliency is also of high importance. From experience undertaking other recent capital works projects in the Greater Victoria region (for example, Goldstream AC Water Main Replacement), constructability and social impacts to residents, businesses, and traffic are also of high importance.

Capital expenditure and O&M are of moderate to high importance, while archaeology and cultural impacts, and environmental impacts are of moderate importance, and property and land acquisition is of low to moderate importance.

The adopted weighting is based on a combination of the weighting inputs provided by the CRD, with typical criteria weighting ranges adopted for previous transmission main upgrade projects.

Table 4-1.Evaluation Criteria Weighting

Criteria	Weighting[a]	Typical Criteria Weighting Range (%)	Adopted Weighting (%)
Archaeological and Cultural Impacts	3	5-10	6
Social Impacts (Residential, Business, and Traffic)	5	5-10	10
Environmental Impacts	3	5-10	6
Resiliency (Geotechnical and Seismic, and Proximity to Other Mains)	5	5-10	10

Criteria	Weighting[a]	Typical Criteria Weighting Range (%)	Adopted Weighting (%)
Constructability Impacts, including Third-Party Utilities	5	5-10	10
Property and Land Acquisition	2	5-10	5
Capital Expenditure	4	20-50	35
O&M	4	5-10	8
Connectivity	5	5-10	10

[a] 1 = Low Importance
2 = Low to Moderate Importance
3 = Moderate Importance
4 = Moderate to High Importance
5 = High Importance

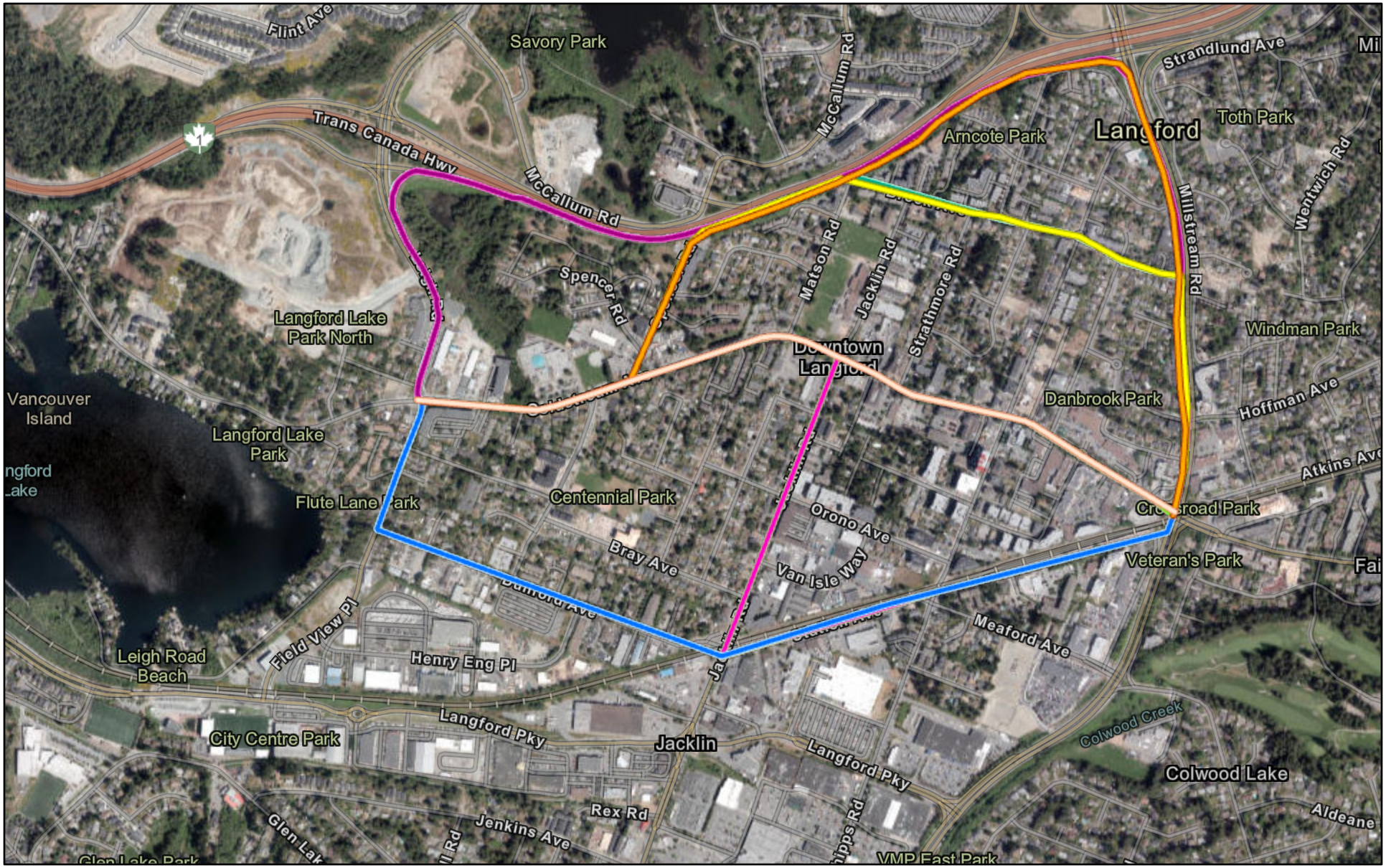
Attachment 1
Option Evaluation Matrices

Technical Scoring Approach (Input into Matrices by Project Team Technical Leads)				
Criteria		Worst-Case / Unfavourable Conditions	Base Case / In Between Conditions	Best-Case / Favourable Conditions
1	Archaeological and Cultural Impacts	1	3	5
2	Social Impacts (Residential, Business and Traffic)	1	3	5
3	Environmental Impacts	1	3	5
4	Resiliency (Geotechnical, Seismic & Proximity to Other Mains)	1	3	5
5	Constructability Impacts (including Third-Party Utility Impacts)	1	3	5
6	Property and Land Acquisition Impacts	1	3	5
7	Capital Expenditure Impacts	1	3	5
8	Operation and Maintenance	1	3	5
9	Connectivity	1	3	5

Category Weighting (input into this Table)				
	Criteria	Weighting 1 = Low Importance 2 = Low-Moderate 3 = Moderate Importance 4 = Moderate-High 5 = High Importance	*Typical Weight Factor Range*	Proposed Weight Factors
1	Archaeological and Cultural Impacts	3	*5 - 10%*	6%
2	Social Impacts (Residential, Business and Traffic)	5	*5 - 10%*	10%
3	Environmental Impacts	3	*5 - 10%*	6%
4	Resiliency (Geotechnical, Seismic & Proximity to Other Mains)	5	*5 - 10%*	10%
5	Constructability Impacts (including Third-Party Utility Impacts)	5	*5 - 10%*	10%
6	Property and Land Acquisition Impacts	2	*5 - 10%*	5%
7	Capital Expenditure Impacts	4	*20% - 50%*	35%
8	Operation and Maintenance	4	*5 - 10%*	8%
9	Connectivity	5	*5 - 10%*	10%

Appendix B
Main No. 4 (Leigh Road to Veterans Memorial Parkway) Alignment Option Maps

A2.1 - Combined Options Map



8/9/2024, 12:34:13 AM

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0 0.15 0.3 0.6 km

- Option 1 (Goldstream Ave)
- Option 2 (Goldstream Ave, Spencer Rd, Hwy 1, VMP)
- Option 3 (Goldstream Ave, Spencer Rd, Hwy 1, Brock Ave, Larkhall Rd, VMP)
- Option 4 (Leigh Rd, Hwy 1, VMP)
- Option 5 (Leigh Rd, Hwy 1, Brock Ave, Larkhall Rd, VMP)
- Option 6 (Leigh Rd, Dunford Ave, Station Ave [E&N Rail Trail])
- Option 7 (Leigh Rd, Dunford Ave, Jacklin Rd, Goldstream Ave)
- Option 8 (Goldstream Ave, Jacklin Rd, Station Ave [E&N Rail Trail])

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A2.1 - Option 1



8/9/2024, 12:31:16 AM

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A2.1-1- Main No. 4 Upgrade, Goldstream Avenue Alignment

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A2.1 - Option 2



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A2.1-2

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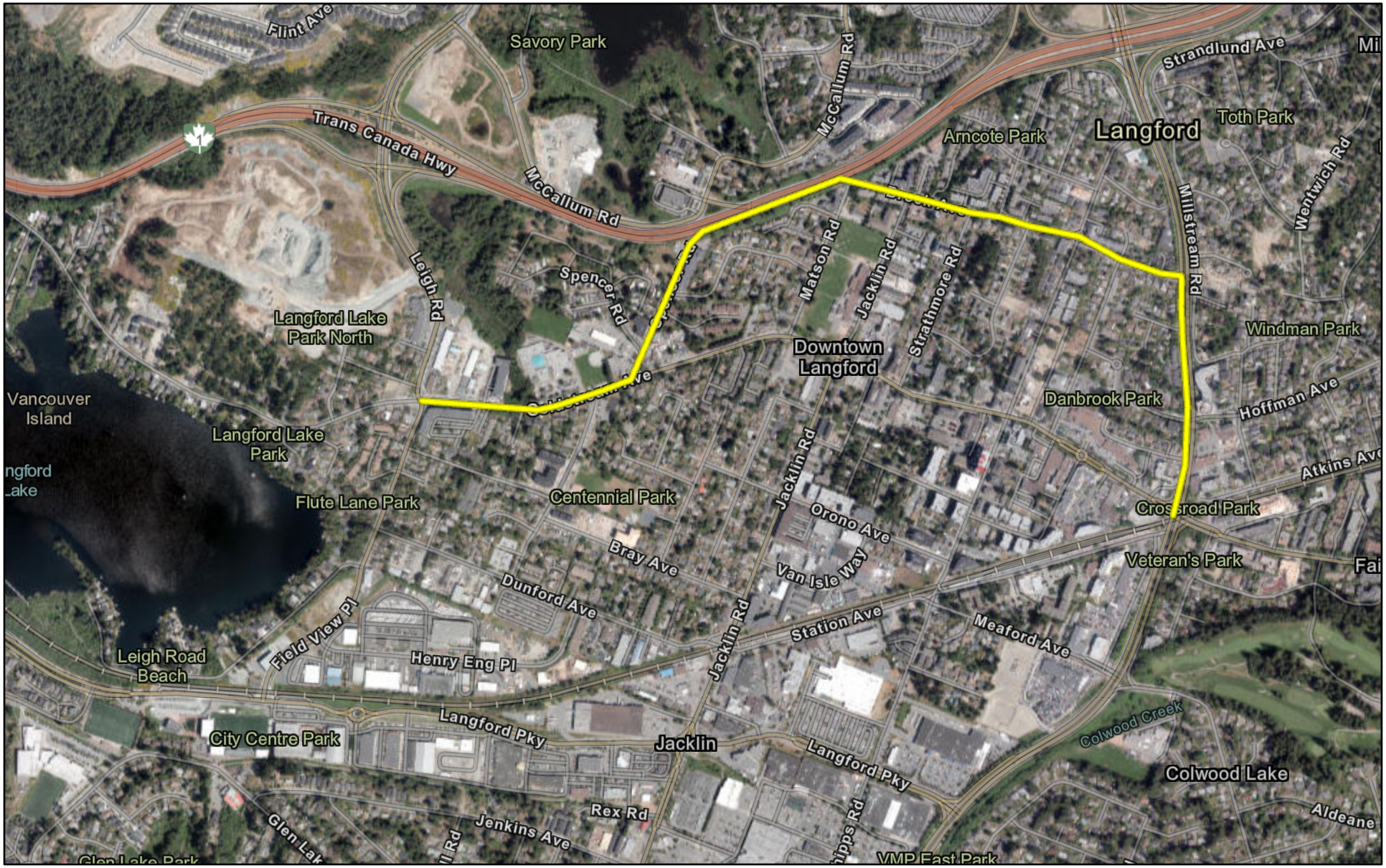
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Capital Regional District, Esri Community Maps Contributors, WA State Parks GIS, Esri Canada, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc,

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A2.1 - Option 3



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A2.1-3

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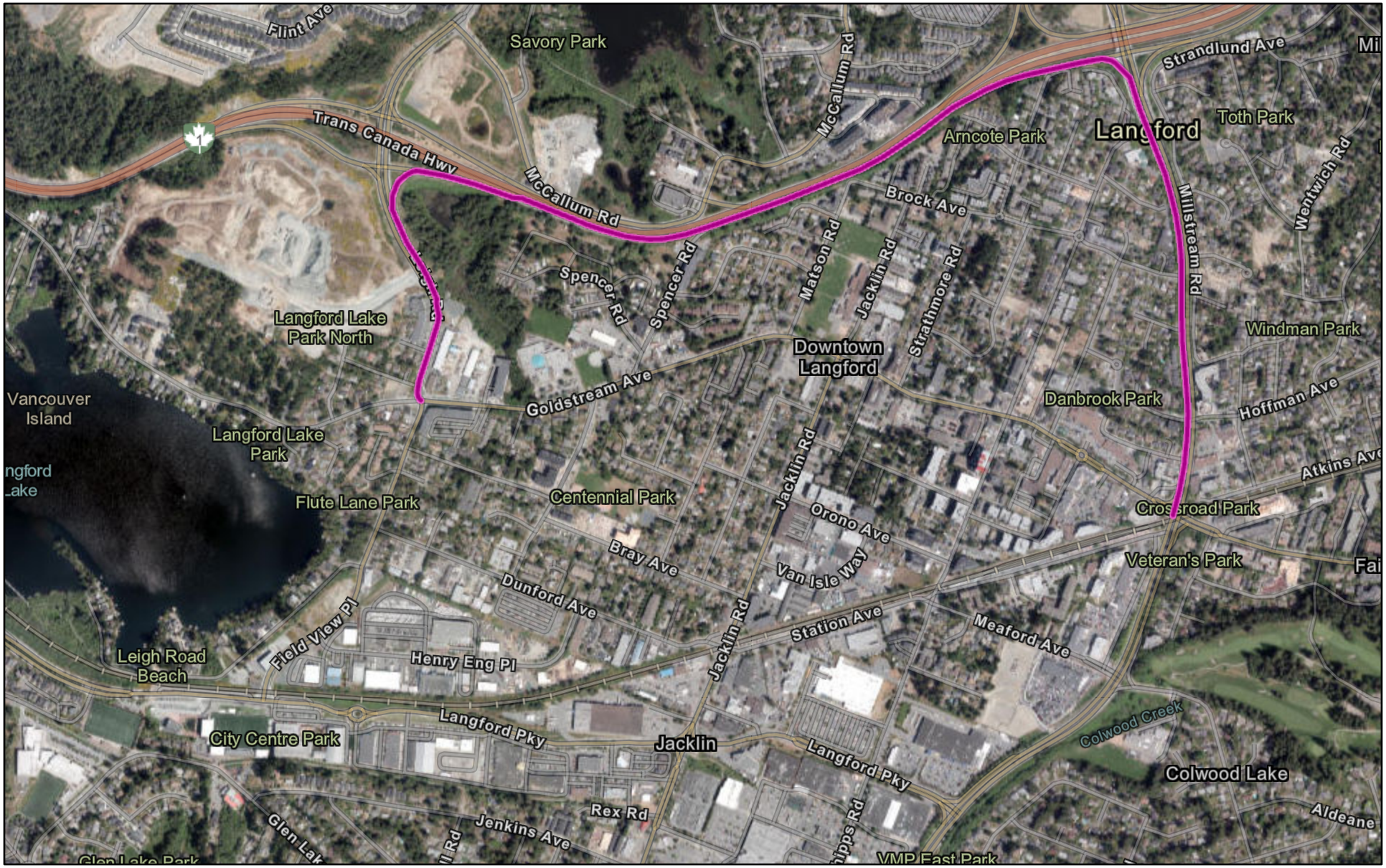
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Capital Regional District, Esri Community Maps Contributors, WA State Parks GIS, Esri Canada, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc,

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A2.1 - Option 4



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A2.1-4

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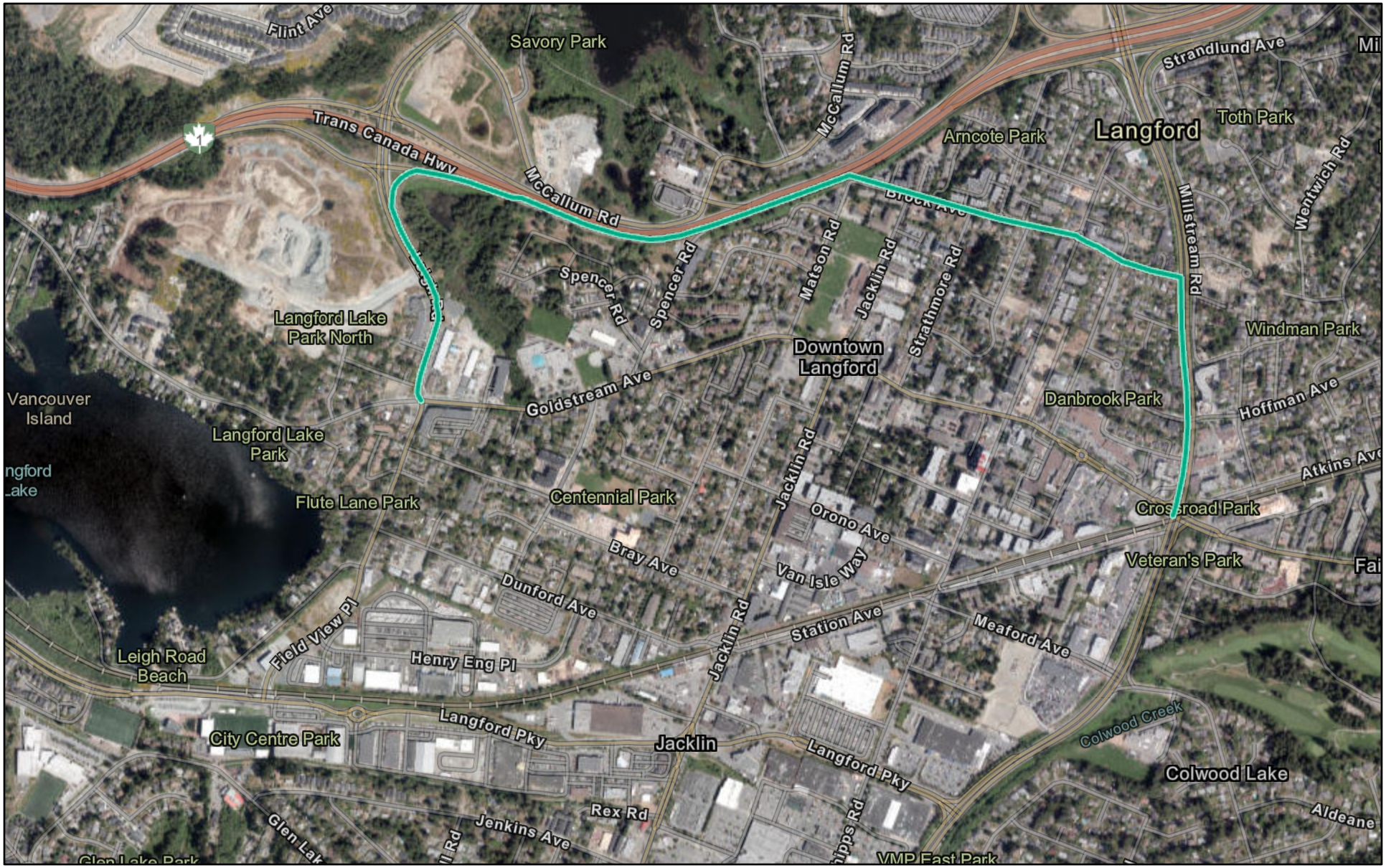
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A2.1 - Option 5



8/9/2024, 12:32:53 AM

A2.1-5

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ArcGIS Web AppBuilder

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A2.1 - Option 6



8/9/2024, 12:33:00 AM

A2.1-6

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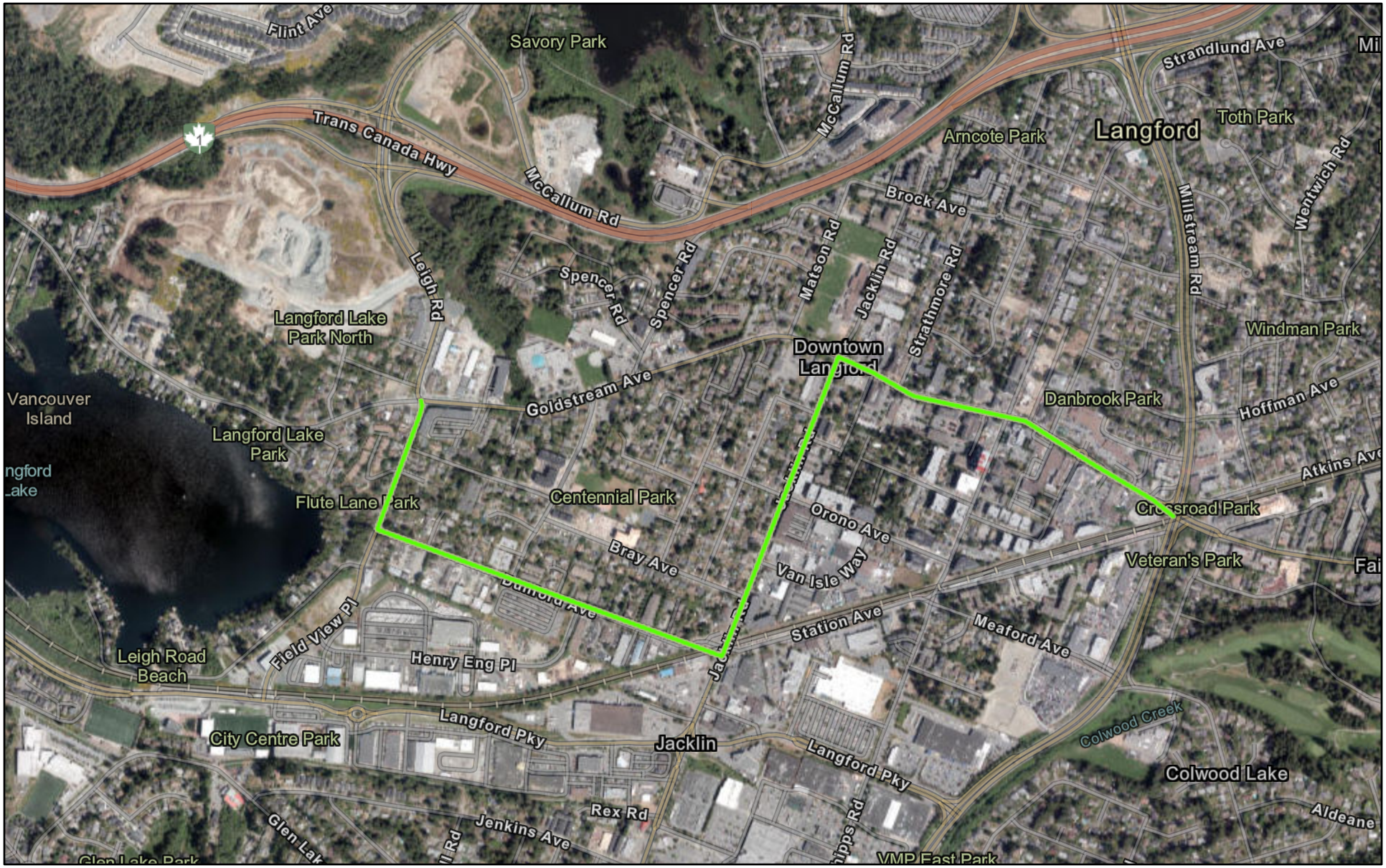
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Capital Regional District, Esri Community Maps Contributors, WA State Parks GIS, Esri Canada, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc,

ArcGIS Web AppBuilder

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A2.1 - Option 7



8/9/2024, 12:33:08 AM

A2.1-7

1:18,056

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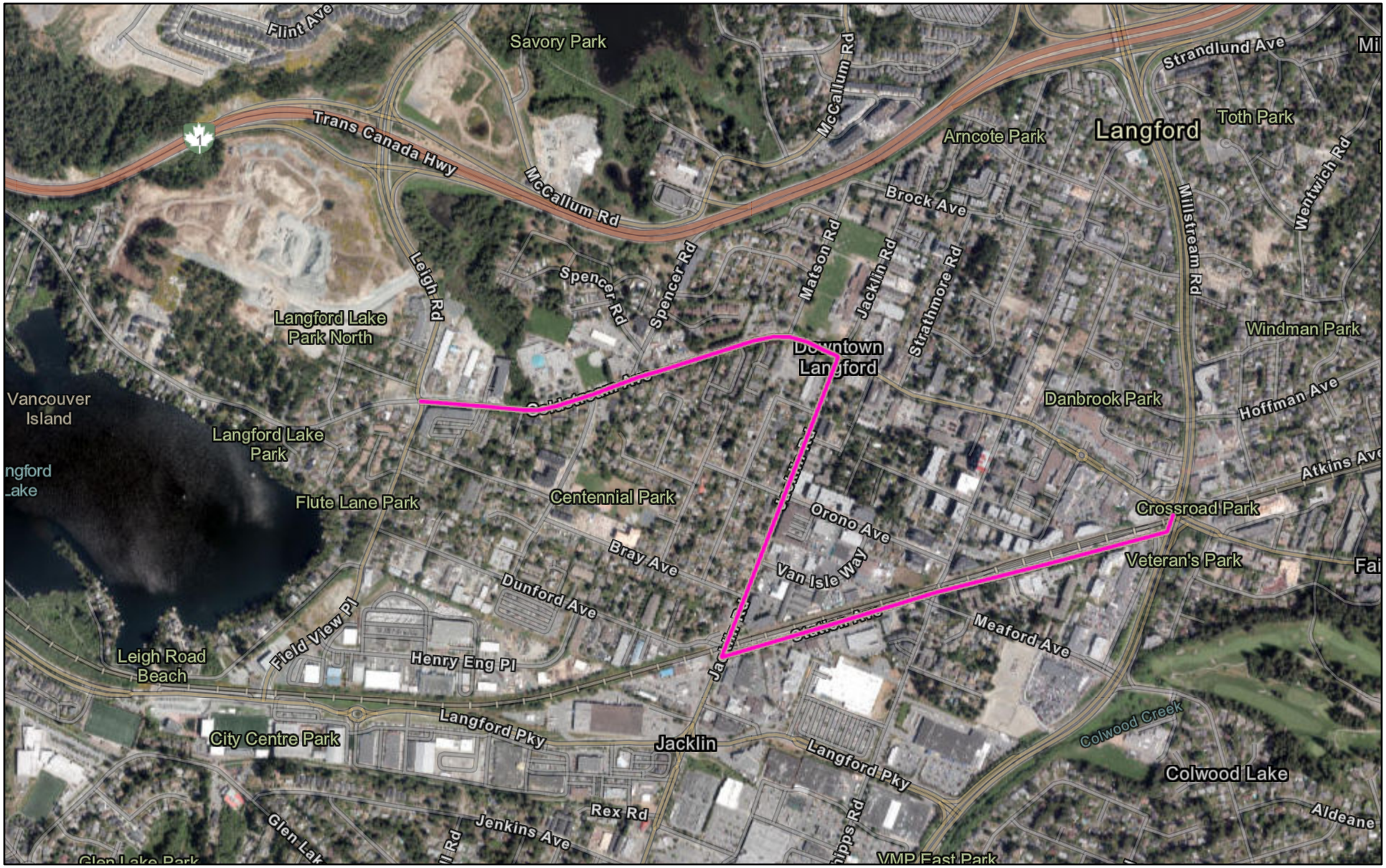
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Capital Regional District, Esri Community Maps Contributors, WA State Parks GIS, Esri Canada, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc,

ArcGIS Web AppBuilder

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A2.1 - Option 8



8/9/2024, 12:33:14 AM

A2.1-8

1:18,056

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Appendix C
Assessment Results

Appendix C. Assessment Results

C.1 Results Summary

Project A2.1
High-Level Feasibility Alignment Review
Multi-Criteria Assessment

ASSESSMENT CRITERIA	WEIGHTING FACTOR	TECHNICAL SCORE								SCORING RATIONALE							
		OPT 1	OPT 2	OPT 3	OPT 4	OPT 5	OPT 6	OPT 7	OPT 8	OPT 1: Goldstream Avenue (1,800m Long)	OPT 2: Goldstream - Spencer - Hwy 1 - VMP (2,950m Long)	OPT 3: Goldstream - Spencer - Hwy 1 - Brock - Larkhall - VMP (2,950m Long)	OPT 4: Leigh - Hwy 1 - VMP (3,310m Long)	OPT 5: Leigh - Hwy 1 - Brock - Larkhall - VMP (2,850m Long)	OPT 6: Leigh - Dunford - Station (E&N Rail) (2,190m Long)	OPT 7: Leigh - Dunford - Jacklin - Goldstream (2,680m Long)	OPT 8A: Goldstream - Jacklin - Station (E&N Rail) (2,750m Long)
Archaeological and Cultural Impacts	6%	3.9	1.6	2.7	1.5	2.4	4.3	4.5	4.3	Interacts with areas of archaeological potential on Goldstream Avenue (Leigh Rd to Jacklin Rd)but does not have any previously recorded sites. The section of Goldstream Avenue east of Jacklin Road does not have any areas with identified archaeological potential. There are no previously recorded sites on this alignment.	This alignment interacts with areas of archaeological potential and a previously recorded site on Highway 1 (near Brock Avenue) and near Veterans Memorial Parkway (north of Brock Avenue). There are also areas of archaeological potential on Goldstream Avenue and Spencer Road.	This alignment interacts with a previously recorded site and area of archaeological potential near Highway 1 and Brock Avenue. Larkhall Road and Veterans Memorial Parkway (south of Larkhall Road) do not have any identified areas of archaeological potential or previously recorded sites.	This alignment interacts with areas of archaeological potential and a previously recorded site on Highway 1 (near Brock Avenue) and near Veterans Memorial Parkway (north of Brock Avenue). There are also areas of archaeological potential on Goldstream Avenue.	This alignment interacts with a previously recorded site and area of archaeological potential near Highway 1 and Brock Avenue. Larkhall Road and Veterans Memorial Parkway (south of Larkhall Road) do not have any identified areas of archaeological potential or previously recorded sites.	There is an area of archaeological potential identified on Leigh Road, however this alignment option does not interact with any other archaeological areas of potential or previously recorded sites.	There is an area of archaeological potential identified on Leigh Road, however this alignment option does not interact with any other archaeological areas of potential or previously recorded sites.	There is an area of archaeological potential identified on Goldstream Avenue, however this alignment option does not interact with any other archaeological areas of potential or previously recorded sites.
Social Impacts (Residential, Business and Traffic)	10%	1.5	1.9	2.4	2.1	2.6	4.2	2.8	3.7	Goldstream Avenue is a high volume transit corridor. Construction is expected to result in a lane closure which will impact vehicles, buses, and bike traffic to a number of properties along the mixed-use corridor which include residential, commercial, and two schools. Particularly, the section of Goldstream Avenue east of Jacklin Road is particularly congested and social impacts are expected to be significant.	Social impacts are expected to be major for this route. Goldstream Avenue, Highway 1 and Veterans Memorial Parkway are major traffic routes in the area and, while there are no lane closures expected on Highway 1 due to construction, impacts are still expected to be significant. Spencer Road is a dead-end corridor with limited residential and commercial use, reduction to single lane for this corridor is not expected to be a significant issue.	Social impacts are expected to be moderate for this route. While the impacts on Goldstream Avenue and Veterans Memorial Parkway are expected to be significant, this is for short distances. Construction on Highway 1 is also expected to be able to be completed without lane closures. Brock Avenue, Spencer Road, Brock Avenue, and Larkhall Road have low traffic volumes and lane closures on these roads is not expected to be significant. However, Brock Avenue and Larkhall Road are residential streets and the increased noise during construction may have adverse effects.	Social impacts are expected to be major for this route. While no lane closures are expected for Leigh Road or Highway 1, there is expected to be a longer duration of speed reduction on the highway due to construction being completed from Leigh Road to Veterans Memorial Parkway. Impacts on Veterans Memorial Parkway are expected to be significant as this will result in lane closures on a congested corridor.	Social impacts are expected to be moderate to low for this alignment. While the impact on Veterans Memorial Parkway is expected to be significant, this is for a short distance. Construction on Leigh Road and Highway 1 is also expected to be able to be completed without lane closures. Brock Avenue and Larkhall Road have low traffic volumes and lane closures are not expected to have significant impacts. However, Brock Avenue and Larkhall Road are residential streets and the increased noise during construction may have adverse effects.	Social impacts are expected to be minor. While the reduced width of the Leigh Road corridor will likely result in single lane alternating traffic during construction, both Dunford Avenue and Station Avenue have lower volumes of traffic and the impacts are not expected to be significant. On Station Avenue in particular, using the E&N rail trail will allow this road to remain open during construction.	Social impacts are expected to be moderate. While the reduced width of the Leigh Road corridor will likely result in single lane alternating traffic during construction, both Dunford Avenue and Jacklin Road have lower volumes of traffic and the impacts are not expected to be significant. However, the section of Goldstream Avenue in this alignment is the busiest part of Goldstream Avenue and the impacts there are expected to be major.	Social impacts are expected to be moderate to low for this alignment. While the route goes down Goldstream Avenue to Jacklin Road, this section of Goldstream Avenue is less busy than the section to the east of Jacklin Road. Both Jacklin Road and Station Avenue have low volumes of traffic and impacts are not expected to be major. On Station Avenue in particular, using the E&N rail trail will allow this road to remain open during construction.
Environmental Impacts	6%	4.0	3.6	3.8	2.9	3.0	2.9	4.2	3.5	Potential tree impacts around 1060 Goldstream Avenue which may be associated with the wetland/riparian area adjacent to this. East of this location, no tree clearing or vegetation impacts are expected.	Potential tree impacts around 1060 Goldstream Avenue which may be associated with the wetland/riparian area adjacent to this. There are also potential ornamental trees which may be impacted on Brock Avenue. Other than these two areas, there is no tree clearing anticipated and all stream crossings appear to be culverted. There are also potential environmental risks associated with rock excavation (and potential blasting) for construction on Highway 1.	Potential tree impacts around 1060 Goldstream Avenue which may be associated with the wetland/riparian area adjacent to this. There are also potential ornamental trees which may be impacted on Brock Avenue. Other than these two areas, there is no tree clearing anticipated and all stream crossings appear to be culverted. There are also potential environmental risks associated with rock excavation (and potential blasting) for construction on Highway 1.	Wetland complex on Leigh Road (Spencer's Pond Park) contains environmentally sensitive plants, frogs, butterfly, and is critical habitat for the painted turtle. There is also a steep slope towards this completed. Ornamental tree clearing also expected on Brock Avenue. No major impacts are anticipated on Highway 1 or Veterans Memorial Parkway. There are also potential environmental risks associated with rock excavation (and potential blasting) for construction on Highway 1.	Wetland complex on Leigh Road (Spencer's Pond Park) contains environmentally sensitive plants, frogs, butterfly, and is critical habitat for the painted turtle. There is also a steep slope towards this completed. Ornamental tree clearing also expected on Brock Avenue. No major impacts are anticipated on Highway 1 or Veterans Memorial Parkway. There are also potential environmental risks associated with rock excavation (and potential blasting) for construction on Highway 1.	There are several trees in close proximity to Leigh Road which may be impacted, however it is assumed that work will occur in the existing paved areas. There are also a small number of mature trees at the intersection of Dunford Avenue and Station Avenue which may be impacted. Working on the E&N rail trail alignment will also increase the likelihood of encountering contaminated soil.	There are several trees in close proximity to Leigh Road which may be impacted, however it is assumed that work will occur in the existing paved areas. There are also a small number of mature trees at the intersection of Dunford Avenue and Station Avenue which may be impacted.	There are several trees in close proximity to Leigh Road which may be impacted, however it is assumed that work will occur in the existing paved areas. There are also a small number of mature trees at the intersection of Dunford Avenue and Station Avenue which may be impacted.
Resiliency (Geotechnical, Seismic & Proximity to Other Mains)	10%	3.5	3.1	3.4	3.2	3.6	3.8	3.7	3.7	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain, Topography: Flat (0-5degrees) overall slope, Groundwater: Estimated to be Moderately deep (<5m) in dry season. Seismic Demand: Assumed Site Class C. No other major active transmission mains identified in this corridor other than the existing Main No. 4 which is expected to be decommissioned.	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain and possible (D3) Peat over Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (<5m) in dry season. Seismic Demand: Assumed Site Class C No other major transmission mains identified in these corridors other than Main No. 14 on Veterans Memorial Parkway. The existing Main No. 4 is expected to be decommissioned. The presence of the existing main is not expected to significantly increase the seismic risk	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain and possible (D3) Peat over Sand and Gravel of the Colwood Delta and Outwash Plain. There are also sections with possible thin soil or bedrock outcrops. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (<5m) in dry season. Seismic Demand: Assumed Site Class C. No other major transmission mains identified in these corridors other than Main No. 14 on Veterans Memorial Parkway. The existing Main No. 4 is expected to be decommissioned. The presence of the existing main is not expected to significantly increase the seismic risk	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain and possible (D3) Peat over Sand and Gravel of the Colwood Delta and Outwash Plain. There are also sections with possible thin soil or bedrock outcrops. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (<5m) in dry season. Seismic Demand: Assumed Site Class C. No other major transmission mains identified in these corridors other than Main No. 14 on Veterans Memorial Parkway. The presence of the existing main is not expected to significantly increase the seismic risk	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain and possible (D3) Peat over Sand and Gravel of the Colwood Delta and Outwash Plain. There are also sections with possible thin soil or bedrock outcrops. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (<5m) in dry season. Seismic Demand: Assumed Site Class C. No other major transmission mains identified in these corridors other than Main No. 14 on Veterans Memorial Parkway. The presence of the existing main is not expected to significantly increase the seismic risk	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (<5m) in dry season. Seismic Demand: Assumed Site Class C. Main No. 1 and Main No. 3 are also present on Station Avenue. The presence of the existing main is not expected to significantly increase the seismic risk as it is expected that the new main will be seismically resilient and able to span a crater created by an adjacent main break.	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (<5m) in dry season. Potentially some shallowed groundwater on Goldstream Avenue section. Seismic Demand: Assumed Site Class C No other major transmission mains are identified in these corridors. The existing Main No. 4 is expected to be decommissioned.	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (<5m) in dry season. Potentially some shallowed groundwater on Goldstream Avenue section. Seismic Demand: Assumed Site Class C Main No. 1 and Main No. 3 are also present on Station Avenue. The existing Main No. 4 is expected to be decommissioned. The presence of the existing mains is not expected to significantly increase the seismic risk as it is expected that the new main will be seismically resilient and able to span a crater created by an adjacent main break.
Constructability Impacts (including Third-Party Utility Impacts)	10%	1.3	2.4	2.6	2.6	2.7	3.9	3.0	3.1	Existing utilities including Main No.4 will limit routing options for the new main. Traversing a large number of storm and sewer laterals along the entire section of Goldstream Avenue also perceived as an added complexity. Would be very involved for a contractor to maintain business access along this route, productivity would likely suffer as the work zone would probably need to be kept tight. Mature trees in medians and boulevards could potentially be in the way.	Existing utilities including Main No.4 along Goldstream will limit routing options for the new main. Maintaining access along Spencer Rd will be a challenge as this is a dead-end narrow road with existing utilities to work around. Consideration also required for emergency services and alternate parking options. TCH will require significant coordination with MoTI. If routing along southern boulevard, about 60% the alignment might need to be cut down (including in rock) and another 20% built up. Some larger utilities present in VMP. Relocations may be required. Parkway is wide which give options for relocation if required.	Existing utilities including Main No.4 along Goldstream will limit routing options for the new main. Maintaining access along Spencer Rd will be a challenge as this is a dead-end narrow road with existing utilities to work around. Consideration also required for emergency services and alternate parking options. TCH will require significant coordination with MoTI. If routing along southern boulevard, about half the alignment might need to be cut down (including in rock) and the other half built up. Multi-residential complexes along Brock and Larkhall may only have access from one driveway. Consider opportunity to widen driveway and/or locate pipe joints to maintain access to this properties. Some larger utilities present in VMP. Relocations may be required. Parkway is wide which give options for relocation if required.	Leigh Rd: municipal WM, gravity mains, large fortis main and BCH ducts. The road is wide and there are options to relocate utilities if required. Businesses typically have 2 driveways. TCH: It appears the area for the Leigh road onramp would need to be built up significantly which is ~15% of alignment. Another 10% might need to be built up, with ~40% needing to be cut down which would mainly be from HWY1 and we would need to consider several utility crossings near Spencer. There is also some type of headwall west of Spencer. Site access would probably be limited to HWY1. Coordination with MoTI will be significant. Some larger utilities present in VMP. Relocations may be required. Parkway is wide which give options for relocation if required.	Leigh Rd: municipal WM, gravity mains, larger fortis main and BCH ducts. The road is wide and there are options to relocate utilities if required. Businesses typically have 2 driveways. TCH: it appears the area for the Leigh road onramp would need to be built up significantly which is ~15% of alignment. Another 10% might need to be built up, with ~40% needing to be cut down which would mainly be from HWY1 and we would need to consider several utility crossings near Spencer. Site access would probably be limited to HWY1. Coordination with MoTI will be significant. Multi-residential complexes along Brock and Larkhall may only have access from one driveway. Consider opportunity to widen driveway and/or locate pipe joints to maintain access to this properties. Some larger utilities present in VMP. Relocations may be required. Parkway is wide which give options for relocation if required.	Leigh Rd: municipal WM, gravity mains, larger fortis main and BCH ducts. The road is wide and there are options to relocate utilities if required. Businesses typically have 2 driveways. Dunford Rd: Most utilities are present, but the road is wide enough to allow relocations. The businesses usually have driveways that will allow for flexible access. Station Ave: Working in the E&N rail trail, while being a narrow corridor, is likely to make for more efficient construction as this corridor appears to be relatively clear of existing utilities and does not have vehicle traffic.	Leigh Rd: Relatively congested utility corridor with watermain, gravity mains, BCH conduit, larger fortis main. Dunford Rd: Most utilities are present, but the road is wide enough to allow relocations. The businesses usually have driveways that will allow for flexible access. Goldstream: Existing 1372 WM, also 300/400 DI, comms, gravity, larger fortis present. The existing 1372 would limit routing options for new main and any potential relocations. Would be very involved for a contractor to maintain business access along this route, productivity would likely suffer as the work zone would probably need to be kept tight. Mature trees in medians and boulevards could potentially be in the way.	Goldstream: Existing 1372 WM, also 300/400 DI, comms, gravity present. The existing 1372 will limit routing options for new main and any potential relocations. Jacklin: Most utilities are present including larger fortis main, watermain, gravity mains, comms. The road is wide and could accommodate relocation if required. Most driveways have duplicate entrances or are wide. Station Ave: Working in the E&N rail trail, while being a narrow corridor, is likely to make for more efficient construction as this corridor appears to be relatively clear of existing utilities and does not have vehicle traffic.
Property and Land Acquisition Impacts	5%	4.3	3.2	3.8	3.2	3.7	3.8	4.1	4.1	Temporary rights-of-way (ROW): Construction corridor within road ROW. Compound areas opportunities along route: Limited (private land) Permanent ROW: In existing road ROW on Goldstream Avenue where the CRD already have a ROW for the existing Main No. 4.	Temporary ROW: Construction corridor within road ROW. Compound areas opportunities along route: Combination of private and public land Permanent ROW: In existing road ROW. However, the CRD will likely need to obtain a ROW from MoTI for the sections of the main on Hwy 1 and VMP so that they are able to do future work on their main without the need for obtaining additional permits (notification would suffice).	Temporary ROW: Construction corridor within road ROW. Compound areas opportunities along route: Combination of private and public land Permanent ROW: In existing road ROW. However, the CRD will likely need to obtain a ROW from MoTI for the sections of the main on Hwy 1 and VMP so that they are able to do future work on their main without the need for obtaining additional permits (notification would suffice).	Temporary ROW: Construction corridor within road ROW. Compound areas opportunities along route: Combination of private and public land Permanent ROW: In existing road ROW. However, the CRD will likely need to obtain a ROW from MoTI for the sections of the main on Hwy 1 and VMP so that they are able to do future work on their main without the need for obtaining additional permits (notification would suffice).	Temporary ROW: Construction corridor within road ROW. Compound areas opportunities along route: Combination of private and public land Permanent ROW: However, the CRD will likely need to obtain a ROW from MoTI for the sections of the main on Hwy 1 and VMP so that they are able to do future work on their main without the need for obtaining additional permits (notification would suffice).	Temporary ROW: Construction corridor within road ROW. Compound areas opportunities along route: Combination of private and public land Permanent ROW: In existing road ROW. However, the CRD will likely need to obtain a ROW from MoTI for the sections of the main on Hwy 1 and VMP so that they are able to do future work on their main without the need for obtaining additional permits (notification would suffice).	Temporary ROW: Construction corridor within road ROW. Compound areas opportunities along route: Combination of private and public land Permanent ROW: In existing road ROW. However, the CRD will likely need to obtain a ROW from MoTI for the sections of the main on Hwy 1 and VMP so that they are able to do future work on their main without the need for obtaining additional permits (notification would suffice).	Temporary ROW: Construction corridor within road ROW. Compound areas opportunities along route: Combination of private and public land Permanent ROW: In existing road ROW for the majority. However, based on the assumed alignment down the E&N rail trail on Station Avenue, while any crossings of the railway are avoided, a permanent ROW on the Island Rail Foundation land will be required. This is not expected to be an issue as this option will only be progressed if the Foundation is open to having the transmission main on their property.	Temporary ROW: Construction corridor within road ROW. Compound areas opportunities along route: Limited (mostly private land) Permanent ROW: In existing road ROW.	Temporary ROW: Construction corridor within road ROW. Compound areas opportunities along route: Limited along Goldstream and Jacklin (private land). Rail corridor along Station Ave. Permanent ROW: In existing road ROW for the majority. However, based on the assumed alignment down the E&N rail trail on Station Avenue, while any crossings of the railway are avoided, a permanent ROW on the Island Rail Foundation land will be required. This is not expected to be an issue as this option will only be progressed if the Foundation is open to having the transmission main on their property.
Capital Expenditure Impacts	35%	2.9	1.0	2.5	1.0	2.5	5.0	2.1	2.9	Construction complexity: High Utility impacts: Significant. Corridor is heavily congested with existing utilities (water, sewer, stormwater, sections of U/G electrical and gas),and existing water main No.4 (1370mm), The abandoned D900mm steel main on Goldstream Avenue would also be required for removal to allow adequate space for constructing the new main. New main location may be forced in the VMP roadway unless significant utility relocation is undertaken. Roadway impacts: Significant. High traffic volumes on Goldstream, TCH and VMP. Third party utility relocation: May be required. (Moderate CAPEX score due to short length)	Construction complexity: High Utility impacts: Significant coordination works required along Goldstream Ave and VMP. Large number of distribution lines for water, sewer, gas, electrical. Main No.4 on Goldstream and Main No.14 on VMP. The abandoned D900mm steel main on Goldstream Avenue would also be required for removal to allow adequate space for constructing the new main. New main location may be forced in the VMP roadway unless significant utility relocation is undertaken. Roadway impacts: Moderate - Significant. High traffic volumes on Goldstream, TCH and VMP. Traffic impacts to Goldstream Ave and VMP are subject to the location of existing utilities and available space for the new main. On TCH, 2-lanes east bound could potentially remain open (with speed reduction and localised realignment past work zone) during works, subject to alignment finalisation and discussions with MoTI. Third party utility relocation: Potentially significant relocation works, depending on the available space and preference of service relocation vs construction in the VMP travel lanes. (Low CAPEX criteria score due to long length and expected high construction complexity)	Construction complexity: Moderate - High Utility impacts: Significant coordination works required along Goldstream Ave and VMP. Large number of distribution lines for water, sewer, gas, electrical. Main No.4 on Goldstream and Main No.14 on VMP. The abandoned D900mm steel main on Goldstream Avenue would also be required for removal to allow adequate space for constructing the new main. New main would likely be located under roadway unless significant utility relocation is undertaken. Roadway impacts: Moderate - High. High traffic volumes on Goldstream, TCH and VMP. Traffic impacts to Goldstream Ave and VMP are subject to the location of existing utilities and available space for the new main. On TCH, 2-lanes east bound could potentially remain open (with speed reduction and localised realignment past work zone) during works, subject to alignment finalisation and discussions with MoTI. Spencer, Brock and Larkhall are local roads. Brock and Larkhall in particular are likely to require full closure during construction. Third party utility relocation: Potentially significant relocation works, particularly along Goldstream and VMP. (Low CAPEX criteria score due to long length and expected high construction complexity)	Construction complexity: Moderate-High Utility impacts: Moderate - Significant coordination works required along VMP - existing water, sewer, gas, electrical and Water Main No.14. New main location may be forced in the VMP roadway unless significant utility relocation is undertaken. New main location may be forced in the VMP roadway unless significant utility relocation is undertaken. Roadway impacts: Moderate - Significant. High traffic volumes on TCH and VMP. Traffic impacts to VMP are subject to the location of existing utilities and available space for the new main. On TCH, 2-lanes east bound could potentially remain open (with speed reduction and localised realignment past work zone) during works, subject to alignment finalisation and discussions with MoTI. Maintaining 2-way traffic on Leigh Rd should be achievable during construction. Third party utility relocation: Potentially significant relocation works on VMP, depending on the available space and preference of service relocation vs construction in the VMP travel lanes. (Low CAPEX criteria score due to long length and expected high construction complexity)	Construction complexity: Moderate Utility impacts: Moderate. Minor coordination works required for Leigh, TCH, Larkhall and VMP. Significant coordination works required along VMP - existing water, sewer, gas, electrical and Water Main No.14. New main location may be forced in the VMP roadway unless significant utility relocation is undertaken. Roadway impacts: Moderate - Significant. High traffic volumes on TCH and VMP. Traffic impacts to VMP are subject to the location of existing utilities and available space for the new main. On TCH, 2-lanes east bound could potentially remain open (with speed reduction and localised realignment past work zone) during works, subject to alignment finalisation and discussions with MoTI. Maintaining 2-way traffic on Leigh Rd should be achievable during construction. Spencer, Brock and Larkhall are local roads. Brock and Larkhall in particular are likely to require full closure during construction. Third party utility relocation: Potentially significant relocation works, particularly along VMP.	Construction complexity: Moderate-Low Utility impacts: Typical utility (distribution network) coordination works required for Leigh and Dunford. No major impacts expected on the E&N rail trail on Station Avenue. Roadway impacts: Moderate. Collector roads with moderate traffic volumes. SLAT during construction along Leigh and Dunford. No road closures anticipated on Station Avenue. Third party utility relocation: Minor works may be required along Station Ave depending on the available space in the E&N rail trail corridor.	- Construction complexity: Moderate-High - Utility impacts: Significant along Goldstream - Corridor is heavily congested with existing utilities (water, sewer, stormwater, sections of U/G electrical and gas) and existing water main No.4 (1370mm). Typical utility (distribution network) coordination works required for Leigh, Dunford and Jacklin. Roadway impacts: Significant along Goldstream, high traffic volumes in an active commercial area along Goldstream. Pipe will likely be constructed under pavement. Moderate traffic volumes with SLAT along Leigh, Dunford and Jacklin during construction. - Third party utility relocation: Localised relocations may be required.	Construction complexity: Moderate - High Utility impacts: Significant along Goldstream. The abandoned D900mm steel main on Goldstream Avenue would also be required for removal to allow adequate space for constructing the new main. Goldstream corridor is heavily congested with existing utilities (water, sewer, stormwater, electrical, gas) and existing water main No.4 (1370mm). No major impacts expected on the E&N rail trail on Station Avenue. Roadway impacts: Moderate-Significant. High traffic volumes in an active commercial area along Goldstream. Station Ave has moderate traffic volumes but may require total road closure pending available space and pipe location within road corridor. SLAT during construction along Jacklin. Third party utility relocation: Minor works may be required along Station Ave depending on the available space in the E&N rail trail corridor.
Operation and Maintenance	8%	2.5	1.9	2.6	1.9	2.5	4.0	2.8	3.6	Pipe located within road corridor (and under road in sections). Access will require a TMP likely specifying the following arrangement: - Goldstream, Spencer, Brock, SLAT - TCH: Speed reduction past work zone, subject to: pipe location in the corridor, location of the permanent jersey barrier, access methodology, agreements with MoTI, and scale of works required. This will require O&M staff to park on the highway as there is not sufficient space for maintenance bays. - VMP: Reduce to a single travel lane on the impacted side of corridor. Access agreements will MoTI will be required for the length along TCH.	Pipe located within road corridor (and under road in sections). Access will require a TMP likely specifying the following arrangement: - Goldstream, Spencer, Brock, Larkhall: SLAT - TCH: Speed reduction past work zone, subject to: pipe location in the corridor, location of the permanent jersey barrier, access methodology, agreements with MoTI, and scale of works required. This will require O&M staff to park on the highway as there is not sufficient space for maintenance bays. - VMP: Reduce to a single travel lane on the impacted side of corridor. Access agreements will MoTI will be required for the length along TCH.	Pipe located within road corridor (and under road in sections). Access will require a TMP likely specifying the following arrangement: - Goldstream, Spencer, Brock, Larkhall: SLAT - TCH: Speed reduction past work zone, subject to: pipe location in the corridor, location of the permanent jersey barrier, access methodology, agreements with MoTI, and scale of works required. This will require O&M staff to park on the highway as there is not sufficient space for maintenance bays. - VMP: Reduce to a single travel lane on the impacted side of corridor. Access agreements will MoTI will be required for the length along TCH.	Pipe located within road corridor (and under road in sections). Access will require a TMP likely specifying the following arrangement: - Leigh Rd: SLAT or 2-way with speed reduction for southern portion under the road. - TCH: Speed reduction past work zone, subject to: pipe location in the corridor, location of the permanent jersey barrier, access methodology, agreements with MoTI, and scale of works required. This will require O&M staff to park on the highway as there is not sufficient space for maintenance bays. - VMP: Reduce to a single travel lane on the impacted side of corridor. Access agreements will MoTI will be required for the length along TCH.	Pipe located within road corridor (and under road in sections). Access will require a TMP likely specifying the following arrangement: - Leigh Rd: SLAT or 2-way with speed reduction for southern portion under the road. - Brock and Larkhall: SLAT - TCH: Speed reduction past work zone, subject to: pipe location in the corridor, location of the permanent jersey barrier, access methodology, agreements with MoTI, and scale of works required. This will require O&M staff to park on the highway as there is not sufficient space for maintenance bays. - VMP: Reduce to a single travel lane on the impacted side of corridor. This will require O&M staff to park on the highway as there is not sufficient space for maintenance bays. Access agreements will MoTI will be required for the length along TCH.	Pipe located within the road (under vehicle travel lane). Access will require a TMP likely specifying the following arrangement: - Leigh and Dunford: SLAT - Station Ave: No closure anticipated.	Pipe located within the road (under vehicle travel lane). Access will require a TMP likely specifying the following arrangement: - Leigh and Dunford: SLAT - Station Ave: No closure anticipated.	Pipe located within the road (under vehicle travel lane). Access will require a TMP likely specifying the following arrangement: - Leigh and Dunford: SLAT - Station Ave: No closure anticipated.
Connectivity	10%	4.0	2.0	3.0	1.0	2.0	4.5	5.0	5.0	Connectivity: Connectivity: - Follows the existing alignment, which allows for maintaining existing network connections and operational arrangement to service existing branch connections at both Jacklin Rd and VMP. - Limited opportunity for additional JdF connections. - Limited opportunity for additional connections to Mains 1 or 3	Connectivity: - Existing connection at Jacklin Road no longer possible. However, there is the potential to re-instate the connections at Spencer Rd - Intersection works would also be required to reinstate the connection to Main No. 1 as the alignment of the new Main No. 4 would be on the eastern side of VMP. - Limited opportunity to connect to the JdF on Hwy 1 without connecting to the south through the road batter or by constructing a connection underneath the highway to the north.	Connectivity: - Existing connection at Jacklin Road no longer possible. However, there is the potential to re-instate the connections at Spencer Rd - Intersection works would also be required to reinstate the connection to Main No. 1 as the alignment of the new Main No. 4 would be on the eastern side of VMP. - Limited opportunity to connect to the JdF on Hwy 1 without connecting to the south through the road batter or by constructing a connection underneath the highway to the north. - Some opportunity for additional connections to the JdF on Brock or Larkhall Rd.	Connectivity: - Existing connection at Jacklin Road no longer possible. - Limited connections possible on Leigh Rd as the main terminates south of Highway 1. - Intersection works would also be required to reinstate the connection to Main No. 1 as the alignment of the new Main No. 4 would be on the eastern side of VMP. - Limited opportunity to connect to the JdF on Hwy 1 without connecting to the south through the road batter or by constructing a connection underneath the highway to the north.	Connectivity: - Existing connection at Jacklin Road no longer possible. - Limited connections possible on Leigh Rd as the main terminates south of Highway 1. - Intersection works would also be required to reinstate the connection to Main No. 1 as the alignment of the new Main No. 4 would be on the eastern side of VMP. - Limited opportunity to connect to the JdF on Hwy 1 without connecting to the south through the road batter or by constructing a connection underneath the highway to the north. - Some opportunity for additional connections to the JdF on Brock or Larkhall Rd.	Connectivity: - Existing connection at Jacklin Road no longer possible. However there is the potential to reinstate this at the intersection of Jacklin Rd with Dunford/Station. - Other potential connections to the JdF possible on all routes. - Connection to Main No. 1 and 3 able to be reinstated on Station Ave or Goldstream. Additional connections to Main No. 4 also possible here which could increase the downstream redundancy of the system. - Connection to the JdF at VMP can be retained or reinstated without crossing busy intersection.	Connectivity: - Existing connection at Jacklin Road and VMP able to be retained. - Other potential connections to the JdF possible on all routes. - Additional connections to Main No. 1 and 3 possible at the intersection of Dunford and Jacklin which could increase the downstream redundancy of the system.	Connectivity: - Existing connection at Jacklin Road able to be retained. - Connection to the JdF at VMP can be retained or reinstated without crossing busy intersection. - Other potential connections to the JdF possible on all routes. - Connection to Main No. 1 and 3 able to be reinstated on Station Ave or Goldstream. Additional connections to Main No. 4 also possible here which could increase the downstream redundancy of the system.
Sub Total		**2.9**	**1.9**	**2.8**	**1.8**	**2.7**	**4.3**	**3.1**	**3.5**								

C.2 Option 1 Detailed Scoring Results

Project A2.1
High-Level Feasibility Alignment Review
Multi-Criteria Assessment

Option	1: Goldstream						
Section	**Goldstream Avenue (Leigh Road to Spencer Road)**		**Goldstream Avenue (Spencer Road to Jacklin Road)**		**Goldstream Avenue (Jacklin Road to VMP)**		
Assessment Category	**Technical Score**	**Justification**	**Technical Score**	**Justification**	**Technical Score**	**Justification**	
Archaeological and Cultural Impacts	3	interacts with area of archaeological potential but no previously recorded archaeological sites	3	interacts with area of archaeological potential but no previously recorded archaeological sites	5	Does not interact with archaeological potential model or previously recorded archaeological site	
Social Impacts (Residential, Business and Traffic)	2	Vehicle Impacts: Yes, moderate. Goldstream Ave is high volume road, and has single lane traffic for each direction. Transit Impacts: Yes, transit route. Bicycle Impacts: Yes, bike lane. Private Access Impacts: Yes. Residential (approx 9 Single family homes (SFHs), 2 multi family dwellings (MFDs)), commercial (approx 5 businesses) and institutional, including one school (Spencer Middle School).	2	Vehicle Impacts: Yes, moderate. Goldstream Ave is high volume road, and has single lane traffic for each direction. Transit Impacts: Yes, transit route. Bicycle Impacts: Yes, bike lane. Private Access Impacts: Yes. Residential (approx 8 SFHs, 1 MFD), commercial (approx 3 businesses) and institutional, including one school (Ruth King Elementary).	1	Vehicle Impacts: Yes, moderate. Goldstream Ave is high volume road, particularly in this section, and has single lane traffic for each direction. Transit Impacts: Yes, transit route. Bicycle Impacts: Yes, bike lane. Private Access Impacts: Yes. Residential (approx 6 MFDs), commercial (approx 10 businesses) and institutional.	
Environmental Impacts	3	Tree Clearing: Minimal. Alignment is in existing ROW, however potential for trees to be impacted that are associated with the treed area at 1060 Goldstream Ave. ESAs (such as riparian): Yes, wetland/riparian area with associated species of conservation concern occurrences at 1060 Goldstream Ave	5	Tree Clearing: Not anticipated. Alignment is in existing ROW. ESAs (such as riparian): None	4	Tree Clearing: Potential impacts to mature trees in median and boulevards. Alignment is in existing ROW. ESAs (such as riparian): None	
Resiliency (Geotechnical, Seismic & Proximity to Other Mains)	3.5	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain, Topography: Flat (0 - 5degrees) overall slope, Groundwater: Estimated to be Moderately deep (<5m) in dry season. Seismic Demand: Assumed Site Class C. Existing Main No. 4 in same corridor, assumed to be decommissioned	3.5	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain, Topography: Flat (0 - 5degrees) overall slope, Groundwater: Estimated to be Moderately deep (<5m) in dry season. Seismic Demand: Assumed Site Class C. Existing Main No. 4 in same corridor, assumed to be decommissioned following construction of replacement main.	3.5	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain, Topography: Flat (0 - 5degrees) overall slope, Groundwater: Estimated to be Moderately deep (<5m) in dry season. Seismic Demand: Assumed Site Class C. Existing Main No. 4 in same corridor, assumed to be decommissioned following construction of replacement main.	
Constructability Impacts (including Third-Party Utility Impacts)	1.5	Existing 1372 WM, also 300/400 DI, comms, gravity present. The existing 1372 will limit routing options for new main and any potential relocations. From assessment of the current arrangement on Goldstream Ave, it appears the abandoned D900mm steel main will also need to be removed.	1.5	Existing 1372 WM, also 300/400 DI, comms, gavity present. The existing 1372 will limit routing options for new main and any potential relocations. From assessment of the current arrangement on Goldstream Ave, it appears the abandoned D900mm steel main will also need to be removed.	1	Existing 1372 WM, also 300/400 DI, comms, gravity, larger fortis present. The existing 1372 would limit routing options for new main and any potential relocations. Would be very involved for a contractor to maintain business access along this route, productivity would likely suffer as the work zone would probably need to be kept tight. Mature trees in medians and boulevards could potentially be in the way. From assessment of the current arrangement on Goldstream Ave, it appears the abandoned D900mm steel main will also need to be removed.	
Property and Land Acquisition Impacts	4.5	Temporary rights-of-way: Minor arterial road in developed urban area. Compound areas during construction may not fit in road ROW and require private carpark areas to be used temporarily. Permanent right-of-way: In existing road ROW. The CRD already have a ROW in Goldstream Avenue for the existing Main No. 4. Third party utility proximity or crossing agreements: No new agreements anticipated.	4.5	Temporary rights-of-way: Minor arterial road. 2-3 lanes widths + bike lane either side. Construction corridor maintained within road ROW. Permanent right-of-way: In existing road ROW. Third party utility proximity or crossing agreements: No new agreements anticipated.	4	Temporary rights-of-way: Arterial road in developed urban area.Generally 3 lanes widths + bike lane either side. Road widens at intersections and narrows in areas. Construction corridor maintained within road ROW. Compound area options within the road ROW appear limited. The are a number of commercial carparks along Goldstream Ave that may potentially be used as temporary compound areas. Permanent right-of-way: In existing road ROW. Third party utility proximity or crossing agreements: No new agreements anticipated.	
Capital Expenditure Impacts (adjudged as whole alignment, not in sections)		Length:490m Construction complexity: High Utility impacts: Significant coordination works required. Corridor has 4 water lines running along corridor, sewer, sections of stormwater. 88mm gas line along south side of corridor. Roadway impacts: Significant. Minor arterial road. Pipe will likely be under the road. 2-way traffic (1- lane each way) during construction should be achievable, except for the narrow elevated road section adjacent Rodney Rd (~120m), which may require single lane alternating traffic. Third party utility relocation: Localised relocation of existing utilities may be required. The abandoned D900mm steel main running adjacent the existing Main No. 4 will need to be removed.		Length:480m Construction complexity: High Utility impacts: Significant. Coordination with existing utilities may require significant works or limit opportunities to locate the new pipe. Corridor has 4 water lines (including main No.4-1370mm), 1 sewer main, and sections of stormwater. Water and sewer service connections/interconnections and stormwater pipes cross the corridor frequently. 1 U/G electrical crossing. 88mm gas line along south side of corridor. Roadway impacts: Significant. Minor arterial road. Due to the location of existing utilities, particularly main No.4 (based on GIS map location), the new main would be installed close to the middle of the road, resulting in single lane alternating traffic during construction, with short periods of total road closure. Residential and commercial driveway access and parking be impacted. Third party utility relocation: Localised relocation of existing utilities may be required. The abandoned D900mm steel main running adjacent the existing Main No. 4 will need		Length:830m Construction complexity: High (high commercial activity and traffic area) Utility impacts: Significant. Coordination with existing utilities may require significant works or limit opportunities to locate the new pipe. Corridor has water distribution line (400mm) sewer main(450mm), existing main No.4 (1370mm), stormwater. Water and sewer service connections and stormwater pipes cross the corridor frequently. Approx 6 U/G electrical crossings of primary and secondary lines, with short lengths of line running along the corridor. 168mm gas line along south side of corridor, 4 gas distribution line crossings. U/G Telus on along south side of corridor with crossings at road intersections. Roadway impacts: Significant. Minor arterial road with high traffic volumes to be managed during construction. Pipe will be under the road. Single lane alternating traffic control likely required during construction, with short periods of total road closure. Residential and commercial driveway access and parking be impacted. Third party utility relocation: Localised relocation of existing utilities may be required. The abandoned D900mm steel main running adjacent the existing Main No. 4 will need to be	2.9	Length: 1800 Construction Complexity: Goldstream Avenue (Leigh Road to Spencer Road) - High Goldstream Avenue (Spencer Road to Jacklin Road) - High Goldstream Avenue (Jacklin Road to VMP) - High
Operation and Maintenance	2.5	Location of the permanent right-of-way (accessibility, traffic management/disruption): Within active road corridor. Traffic control likely required when accessing the main. Traffic disruption expected and traffic management plan likely required.	2.5	Location of the permanent right-of-way (accessibility, traffic management/disruption): Pipe located within the road (under vehicle travel lane). Access for O&M will require a TMP likely specifying 1-way alternating traffic at the work zone.	2.5	Location of the permanent right-of-way (accessibility, traffic management/disruption): Pipe located within the road (under vehicle travel lane). Access for O&M will require a TMP likely specifying 1-way alternating traffic past the work zone.	
Connectivity and Project Synergies (adjudges as whole alignment, not in sections)	4	Connectivity: - Follows the existing alignment, which allows for maintaining existing network connections and operational arrangement to service existing branch connections at both Jacklin Rd and VMP. - Limited opportunity for additional JdF connections. - Limited opportunity for additional connections to Mains 1 or 3					

C.3 Option 2 Detailed Scoring Results

Project A2.1
High-Level Feasibility Alignment Review
Multi-Criteria Assessment

Option	2: Goldstream - Spencer - Hwy 1 - VMP								
Section	**Goldstream Avenue (Leigh Road to Spencer Road)**		**Spencer Road**		**Highway 1 (Spencer Road to VMP)**		**Veterans Memorial Parkway (Hwy 1 to Goldstream)**		
Assessment Category	**Technical Score**	**Justification**	**Technical Score**	**Justification**	**Technical Score**	**Justification**	**Technical Score**	**Justification**	
Archaeological and Cultural Impacts	3	interacts with area of archaeological potential but no previously recorded archaeological sites	3	interacts with area of archaeological potential but no previously recorded archaeological sites	1	interacts with areas of archaeological potential and a previously recorded archaeological site near Hwy 1 and Brock Ave	1	interacts with areas of archaeological potential and a previously recorded archaeological site near Veterans Memorial Parkway north of Brock Ave	
Social Impacts (Residential, Business and Traffic)	2	Vehicle Impacts: Yes, moderate. Goldstream Ave is high volume road, and has single lane traffic for each direction. Transit Impacts: Yes, transit route. Bicycle Impacts: Yes, bike lane. Private Access Impacts: Yes. Residential (approx 9 Single family homes (SFHs), 2 multi family dwellings (MFDs)), commercial (approx 5 businesses) and institutional, including one school (Spencer Middle School).	4	Vehicle Impacts: Minor. Single land, dead end road. Transit Impacts: None. Bicycle Impacts: No bike lane. Private Access Impacts: One large commercial building, approx 12 SFHs . Other:	2	Vehicle Impacts: High. TCH is high traffic volume highway regulated by MoTI. Transit Impacts: Not applicable . Bicycle Impacts: Not applicable. Private Access Impacts: Not applicable . Other: There is also likely to be noise creating through the need to excavate rock for the pipeline construction.	1	Vehicle Impacts: High. TCH and VMP are high traffic volume highways regulated by MoTI. Transit Impacts: Yes. Bicycle Impacts: No. Private Access Impacts: Approx 16 SFHs + 105FHs, 3 MFDs + 5 MFDs, Langford Fire Hall and RCMP detachment. Other:	
Environmental Impacts	3	Tree Clearing: Minimal. Alignment is in existing ROW, however potential for trees to be impacted that are associated with the treed area at 1060 Goldstream Ave. ESAs (such as riparian): Yes, wetland/riparian area with associated species of conservation concern occurrences at 1060 Goldstream Ave	5	Tree Clearing: Not anticipated. Alignment is in existing ROW. Road appears to have been recently widened and trees removed. ESAs (such as riparian): None	3	Tree Clearing: Not anticipated. Alignment is in existing ROW. ESAs (such as riparian): stream crossings, but all will be culverted Rock excavation is likely to be required, potential blasting. This increases environmental risks.	4	Tree Clearing: Ornamental trees may be impacted. Alignment is in existing ROW. ESAs (such as riparian): Culverted watercourse at highway. Other: Gas station at VMP and Goldstream is not expected to be impacted by construction.	
Resiliency (Geotechnical, Seismic & Proximity to Other Mains)	3.5	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain, Topography: Flat (0 - 5degrees) overall slope, Groundwater: Estimated to be Moderately deep (<5m) in dry season. Seismic Demand: Assumed Site Class C. Existing Main No. 4 in same corridor, assumed to be decommissioned following construction of replacement main.	3	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain and possible (O3) Peat over Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C	3	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain and possible (O3) Peat over Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C	3	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain and possible (O3) Peat over Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C Existing Main No. 14 in the same corridor. It is assumed that there is adequate space that adverse impacts of having the new main in the same corridor as the existing Main No. 14 are not expected. The presence of the existing main is not expected to significantly increase the seismic risk as it is expected that the new main will be seismically resilient and able to span a crater created by an adjacent main break.	
Constructability Impacts (including Third-Party Utility Impacts)	1.5	Existing 1372 WM, also 300/400 DI, comms, gravity present. The existing 1372 will limit routing options for new main and any potential relocations. From assessment of the current arrangement on Goldstream Ave, it appears the abandoned D900mm steel main will also need to be removed.	3	Narrow road. Two watermains to work around. Maintaining access for the two new multi residential buildings will be a challenge due to the dead end . There is also a townhome complex (2771) with one exit onto Spencer. Need to consider things like potential emergency vehicle access and alternative parking for residents of larger buildings/complexes.	2	Looks like there are multiple utilities that cross HWY1 at spencer (WMs, comms, Hydro), otherwise pretty clear. Site access would probably be limited to HWY1. Coordination with MoTI will be significant. If routing along south boulevard, about 60% the alignment might need to be cut down (including in rock) and another 20% built up.	3	Some larger utilities present (500 dia WM, 600 dia sani, BCH ducting, sani force main etc). Some relocations may be required based on location within road RoW. The parkway is wide which will give options for relocations if required.	
Property and Land Acquisition Impacts	4.5	Temporary rights-of-way: Minor arterial road in developed urban area. Compound areas during construction may not fit in road ROW and require private carpark areas to be used temporarily. Permanent right-of-way: In existing road ROW. The CRD already have a ROW in Goldstream Avenue for the existing Main No. 4. Third party utility proximity or crossing agreements: No new agreements anticipated.	4.5	Temporary rights-of-way: Local road with narrow road corridor. Compound areas in clear land at northern end of Spencer Road. Permanent right-of-way: In existing road ROW. Third party utility proximity or crossing agreements: No new agreements anticipated.	3	Temporary rights-of-way: Pipe located under southern edge-of-pavement/boulevard of highway. Construction corridor maintained within highway ROW. Compound areas: - Clear land at northern end of Spencer Road. - Possibly the park on Matson Rd. Potential to install temporary construction access tracks at intermediate locations along alignment: - Northern end of Matson Road - Northern end of Deville Road Permanent right-of-way: In existing Trans-Canada Highway ROW. However, the CRD would need to obtain a ROW for their main from MoTI so they are able to access this as needed. Third party utility proximity or crossing agreements: No new agreements anticipated.	2.5	**Note, the following route has been assumed:** **Peatt Rd, underbore VM Pkwy, Millstream service road (to the end), WM Pkwy to Goldstream Intersection. Main No.14 generally follows a similar alignment.** Temporary rights-of-way: Developed urban area. Compound areas during construction may not fit in road ROW and require private carpark areas to be used temporarily. Potential compound areas appear limited. Possible options: - Grassed area at Strandlund Ave, Millstream Rd intersection - Boston Pizza carpark Permanent right-of-way: In existing road ROW. However, the CRD would need to obtain a ROW for their main from MoTI. This would be additional to the ROW already in place on VMP for Main No. 14. Third party utility proximity or crossing agreements: No new agreements anticipated.	
Capital Expenditure Impacts (adjudged as whole alignment, not in sections)		Length:490m Construction complexity: High Utility impacts: Significant coordination works required. Corridor has 4 water lines running along corridor, sewer, sections of stormwater. 88mm gas line along south side of corridor. Roadway impacts: Significant. Minor arterial road. Pipe will likely be under the road. 2-way traffic (1- lane each way) during construction should be achievable, except for the narrow elevated road section adjacent Rodney Rd (~120m), which may require single lane alternating traffic. Third party utility relocation: Localised relocation of existing utilities may be required. The abandoned D900mm steel main running adjacent the existing Main No. 4 will need to be removed.		Length:350m Construction complexity: Low-Moderate Utility impacts: Moderate. Some coordination works may be required. Corridor has 2 water lines running along corridor, a short length of sewer at the southern end, and stormwater crossings. U/G primary and secondary electrical lines north of Preston Way, 5 crossings. 60mm gas line south of preston way on west side of corridor. U/G Telus north of Preston Way. Roadway impacts: Minor. Local, dead-end road with low traffic volumes. Due to narrow corridor, single lane alternating with short periods of total road closure likely. Potential to open up Preston Way and provide alternate access to northern end of road during total road closure. Third party utility relocation: Road corridor is narrow and relocations may be required if there is insufficient space between existing utilities		Length:1050m Construction complexity: Moderate Utility impacts: Low. 1 small sewer crossing, 1 small stormwater crossing. Coordination with highway street lighting. Roadway impacts: Moderate-High. Highway with high traffic volumes and high speed limit. It is expected that 2-lanes travelling north-east can remain open for the duration of the works . 13m construction corridor. 7m traffic corridor, 2-lanes, 3.5m each, with speed reduction. Third party utility relocation: None anticipated.		Length: 1060m Construction complexity: High Utility impacts: Significant. Coordination works required. Corridor has 2 water lines (one is Main No.14) and 450mm sewer line running along corridor, and multiple water, sewer and stormater crossings. U/E primary and secondary lines running along the northern half of VMP, and around Goldstream intersection, ~6 crossings estimated. 88mm gas adjacent east road corridor boundary, and 42mm on west side south of Massie Rd, location likely clearly of construction corridor, 5 crossings estimated. U/G Telus lines down east side of road north of Percy Pl crossings, and west side of road south of Percy Pl. **Note:** Given number of utilities along Millstream service road. New main location may be forced in the VMP roadway unless significant utility relocation works are completed. Roadway impacts: Moderate - significant (pending location in road corridor). Approx 750m is along Peatt Rd and Millstream service road which are local residential roads with low traffic volumes. These areas would likely be single lane alternating with short periods of total road closure during construction. Approx 310m is along VM Pkwy which has high traffic volumes. The pipe would likely be located under the road and northbound traffic would be reduced to a single lane during construction in this area. Third party utility relocation: Minor up to significant relocation works may be required depending on the available space and preference of service relocation vs construction in the VMP.	1.0	Length: 2950 Construction Complexity: Goldstream Avenue (Leigh Road to Spencer Road) - High Spencer Road - Low-Mod Highway 1 (Spencer Road to VMP) - Mod Veterans Memorial Parkway (Hwy 1 to Goldstream) - High
Operation and Maintenance	2.5	Location of the permanent right-of-way (accessibility, traffic management/disruption): Within active road corridor. Traffic control likely required when accessing the main. Traffic disruption expected and traffic management plan likely required.	3.5	Location of the permanent right-of-way (accessibility, traffic management/disruption): Pipe likely located within the road (vehicle travel lane), however, this is a local road with very low traffic volumes. Access for O&M managed with 1-way alternating traffic.	1	Location of the permanent right-of-way (accessibility, traffic management/disruption): Pipe likely located under edge of pavement/boulevard. Permanent jersey barrier (currently in place) to be located between pipe and travel lanes. Potential for O&M crews to have clear access behind barrier where works can take place with no traffic impacts and low traffic risk. However, O&M crews will still need to park on the highway to access any infrastructure here as there is not sufficient space for the construction of maintenance bays on the highway.	2	Location of the permanent right-of-way (accessibility, traffic management/disruption): Within active road corridor. Traffic control likely required when accessing the main. Particularly the section under VM Pkwy (southern 310m). Traffic disruption expected and traffic management plan likely required.	
Connectivity and Project Synergies (adjudges as whole alignment, not in sections)	2	Connectivity: - Existing connection at Jacklin Road no longer possible. However, there is the potential to re-instate the connections at Spencer Rd - Intersection works would also be required to reinstate the connection to Main No. 1 as the alignment of the new Main No. 4 would be on the eastern side of VMP. - Limited opportunity to connect to the JdF on Hwy 1 without connecting to the south through the road batter or by constructing a connection underneath the highway to the north.							

C.4 Option 3 Detailed Scoring Results

Option	3: Goldstream - Spencer - Hwy 1 - Brock - Larkhall - VMP													
Section	**Goldstream Avenue (Leigh Road to Spencer Road)**		**Spencer Road**		**Highway 1 (Spencer Road to Brock Avenue)**		**Brock Avenue**		**Larkhall Road**		**Veterans Memorial Parkway (Larkhall Road to Goldstream Avenue)**			
Assessment Category	**Technical Score**	**Justification**	**Technical Score**	**Justification**	**Technical Score**	**Justification**	**Technical Score**	**Justification**	**Technical Score**	**Justification**	**Technical Score**	**Justification**		
Archaeological and Cultural Impacts	3	*Interacts with area of archaeological potential but no previously recorded archaeological sites*	3	*Interacts with area of archaeological potential but no previously recorded archaeological sites*	1	Interacts with areas of archaeological potential and a previously recorded archaeological site near Hwy 1 and Brock Ave	1	Interacts with areas of archaeological potential and a previously recorded archaeological site near Hwy 1 and Brock Ave	5	Does not interact with areas of archaeological potential or previously recorded archaeological sites	5	Does not interact with areas of archaeological potential or previously recorded archaeological sites		
Social Impacts (Residential, Business and Traffic)	2	*Vehicle Impacts: Yes, moderate. Goldstream Ave is high volume road, and has single lane traffic for each direction. Transit Impacts: Yes, transit route. Bicycle Impacts: Yes, bike lane. Private Access Impacts: Yes. Residential (approx 9 Single family homes (SFHs), 2 multi family dwellings (MFDs)), commercial (approx 5 businesses) and institutional, including one school (Spencer Middle School).*	4	*Vehicle Impacts: Minor. Single land, dead end road. Transit Impacts: None. Bicycle Impacts: No bike lane. Private Access Impacts: One large commercial building, approx 12 SFHs . Other:*	2	Vehicle Impacts: High. TCH is high traffic volume highway regulated by MoTI . Transit Impacts: Not applicable . Bicycle Impacts: Not applicable. Private Access Impacts: Not applicable . Other: There is also likely to be noise creating through the need to excavate rock for the pipeline construction.	3	Vehicle Impacts: Minor. Transit Impacts: Not applicable . Bicycle Impacts: Not applicable. Private Access Impacts: Approx 23 SFHs and 10 MFDs. Other: Narrow residential street with all residential dwellings which is likely to require full closure through the construction zone. Noise during construction may be undesirable.	3	Vehicle Impacts: Minor. Transit Impacts: Not applicable . Bicycle Impacts: Not applicable. Private Access Impacts: Approx 17 SFHs and 1 MFDs. Other: Narrow residential street with all residential dwellings which is likely to require full closure through the construction zone. Noise during construction may be undesirable.	1	Vehicle Impacts: High. VMP is high traffic volume highways regulated by MoTI. Transit Impacts: Yes. Bicycle Impacts: No. Private Access Impacts: Approx 105FHs, 5 MFDs, and RCMP detachment. Other:		
Environmental Impacts	3	*Tree Clearing: Minimal. Alignment is in existing ROW; however potential for trees to be impacted that are associated with the treed area at 1060 Goldstream Ave. ESAs (such as riparian): Yes, wetland/riparian area with associated species of conservation concern occurrences at 1060 Goldstream Ave*	5	*Tree Clearing: Not anticipated. Alignment is in existing ROW. Road appears to have been recently widened and trees removed. ESAs (such as riparian): None*	3	Tree Clearing: Not anticipated. Alignment is in existing ROW. ESAs (such as riparian): stream crossings, but all will be culverted Rock excavation is likely to be required, potential blasting. This increases environmental risks.	4	Tree Clearing: Ornamental trees may be impacted. Alignment is in existing ROW. ESAs (such as riparian): Potential watercourse/drainage crossed. Other: Steep slope adjacent to HWY1, weeds on slope	5	Tree Clearing: Not anticipated. Alignment is in existing ROW. ESAs (such as riparian): none	4	Tree Clearing: Ornamental trees may be impacted. Alignment is in existing ROW. ESAs (such as riparian): None. Other: Gas station at VMP and Goldstream (not considered in scoring as assumed to be captured in constructability)		
Resiliency (Geotechnical, Seismic & Proximity to Other Mains)	3	*Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain, Topography: Flat (0 - 5degrees) overall slope, Groundwater: Estimated to be Moderately deep (>5m) in dry season. Seismic Demand: Assumed Site Class C.* *Existing Main No. 4 in same corridor, assumed to be decommissioned following construction of replacement main.*	3	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain and possible (O3) Peat over Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0.5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C	3	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain and possible (O3) Peat over Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C.	4	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain and possible (R1/2) Thin soil or bedrock outcrops. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class B	3.75	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C	3.75	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C. Existing Main No. 14 in the same corridor. It is assumed that there is adequate space that adverse impacts of having the new main in the same corridor as the existing Main No. 14 are not expected. The presence of the existing mains is not expected to significantly increase the seismic risk as it is expected that the new main will be seismically resilient and able to span a crater created by an adjacent main break.		
Constructability Impacts (including Third-Party Utility Impacts)	2.5	*Existing 1372 WM, also 300/400 DI, comms, gravity present. The existing 1372 will limit routing options for new main and any potential relocations.* *From assessment of the current arrangement on Goldstream Ave, it appears the abandoned D900mm steel main will also need to be removed.*	3	*Narrow road. Two watermains to work around. Maintaining access for the two new multi residential buildings will be a challenge due to the dead end . There is also a townhome complex (2771) with one exit onto Spencer. Need to consider things like potential emergency vehicle access and alternative parking for residents of larger buildings/complexes.*	2	Looks like there are multiple utilities that cross HWY1 at spencer (WMs, comms, Hydro), otherwise pretty clear. Site access would probably be limited to HWY1. Site access would probably be limited to HWY1. Coordination with MoTI will be significant. If routing along south boulevard, about half the alignment might need to be cut down and the other half built up.	3	No significant concerns with 3rd party utilities. Some relocations may be required based on location within road ROW. There are up to 4 multi-residential complexes that might have access from one driveway. It might be possible to widen driveways and/or locate pipe joints to maintain access to these properties, Potential that, due to the limited width of the road, the construction zone may result in a full closure and mean that the construction zone needs to be shorter to allow for residential access	3	No significant concerns with 3rd party utilities. Some relocations may be required based on location within road ROW. There is one multi-residential complex that might have access from one driveway. It might be possible to widen the driveway and/or locate pipe joints to maintain access to this properties.	3	Some larger utilities present (500 Dia WM, 600 Dia Sani, BCH ducting etc.). Some relocations may be required based on location within road RoW. The parkway is wide which will give options for relocations if required.		
Property and Land Acquisition Impacts	4.5	Temporary rights-of-way: Minor arterial road in developed urban area. Compound areas during construction may not fit in road ROW and require private carpark areas to be used temporarily. Permanent right-of-way: In existing road ROW. The CRD already have a ROW in Goldstream Ave for the existing Main No. 4. Third party utility proximity or crossing agreements: No new agreements anticipated.	4.5	Temporary rights-of-way: Local road with narrow road corridor. Compound areas in open land at northern end of Spencer Road. Permanent right-of-way: In existing road ROW. Third party utility proximity or crossing agreements: No new agreements anticipated.	3	Temporary rights-of-way: Pipe located under southern edge-of-pavement/boulevard of highway. Construction corridor maintained within highway ROW. Compound areas: - Clear land at northern end of Spencer Road. - Potential the park on Matson Rd. Permanent right-of-way: In existing Trans-Canada Highway ROW. However, the CRD would need to obtain a ROW for their main from MoTI as they are able to access this as needed. Third party utility proximity or crossing agreements: No new agreements anticipated.	4	Temporary rights-of-way: Local road with narrow road corridor. Construction corridor maintained within road ROW. Residential parking and driveway access will be impacted. Compound area opportunities appear limited, none identified at this stage. - Park near northern end of Matson Rd. - No area identified near east end of Brock Ave.) Permanent right-of-way: In existing road ROW. Third party utility proximity or crossing agreements: No new agreements anticipated.	4	Temporary rights-of-way: Local road with narrow road corridor. Construction corridor maintained within road ROW. Compound area opportunities appear limited, none identified at this stage. Permanent right-of-way: In existing road ROW. However, the CRD would need to obtain a ROW for their main from MoTI so they are able to access this as needed. Third party utility proximity or crossing agreements: No new agreements anticipated.	3	Note, the assumed route is along the western side of VM Pkwy. Temporary rights-of-way: Developed urban area. Compound areas during construction may not fit in road ROW and require private carpark areas to be used temporarily. Potential compound areas appear limited. Possible option is carparks off Dashbrook Ave. Permanent right-of-way: In existing road ROW. However, the CRD would need to obtain a ROW for their main from MoTI so they are able to access this as needed. Third party utility proximity or crossing agreements: No new agreements anticipated.		
Capital Expenditure Impacts (adjudged as whole alignment, not in sections)		Length:490m Construction complexity: High Utility impacts: Significant coordination works required. Corridor has 4 water lines running along corridor, sewer, sections of stormwater. 88mm gas line along south side of corridor. Roadway impacts: Significant. Minor arterial road. Pipe will likely be under the road. 2 way traffic (1- lane each way) during construction should be achievable, except for the narrow elevated road section adjacent Rodney Rd (~120m), which may require single lane alternating traffic. Third party utility relocation: Localised relocation of existing utilities may be required. The abandoned D900mm steel main running adjacent the existing Main No. 4 will need to be removed.		Length:350m Construction complexity: Low-Moderate Utility impacts: Moderate. Some coordination works may be required. Corridor has 2 water lines running along corridor, a short length of sewer at the southern end, and stormwater crossings. UJG primary and secondary electrical lines north of Preston Way, 5 crossings. 60mm gas line south of preston way on west side of corridor. UJG Telus north of Preston Way. Roadway impacts: Minor. Local, dead-end road with low traffic volumes. Due to narrow corridor, single lane alternating with short periods of total road closure likely. Potential to open up Preston Way and provide alternate access to northern end of road during total road closure. Third party utility relocation: Road corridor is narrow and relocations may be required if there is insufficient space between existing utilities		Length: 380m Construction complexity: Moderate Utility impacts: Very Low-Low. 1 small sewer crossing. Coordination with highway street lighting. Roadway impacts: Moderate. Highway with high traffic volumes and high speed limit. It is expected that 2 lanes travelling north-east can remain open for the duration of the works . 15m construction corridor. 7m traffic corridor, 2-lanes, 3.5m each, with speed reduction. Third party utility relocation: None anticipated.		Length: 640m Construction complexity: Moderate Utility impacts: Moderate. Utility coordination works will be required. Corridor has 1 water distribution line and 1 sewer main running along corridor. Water and sewer service connections and stormwater pipes cross the corridor frequently. Water and sewer mains are relatively small. (<=200mm). 3 UJG electrical crossings at western end of road. 88mm gas line running along corridor. Comms requires further investigation. Need to relocate existing mains considered unlikely. Roadway impacts: Moderate. Local road, relatively low traffic volumes expected. Due to narrow corridor, full road closure through the construction zone is considered likely. Alternate access options available during total road closure. Residential parking and driveway access will be impacted. Third party utility relocation: Need to relocate existing mains considered unlikely.		Length: 130m Construction complexity: Moderate Utility impacts: Moderate. Utility coordination works will be required. Corridor has 1 water distribution line and 1 sewer main running along corridor. Water and sewer service connections and stormwater pipes cross the corridor frequently. Water and sewer mains are relatively small. (<=200mm). 2 UJG electrical crossing. Comms requires further investigation. Roadway impacts: Moderate. Local road, relatively low traffic volumes expected. Due to narrow corridor, full road closure through the construction zone is considered likely. Alternate access options available during total road closure. Residential parking and driveway access will be impacted. Third party utility relocation: Need to relocate existing mains considered unlikely.		Length: 510m Construction complexity: High Utility impacts: Moderate. Water and sewer main run parallel south of Massie Dr with small number of connecting lines. Multiple UJG electrical primary and secondary lines around Goldstream Ave intersection, 3 crossings estimated. 88mm gas adjacent east road corridor boundary. 42mm on west side south of Massie Rd, location likely clearly of construction corridor, crossings estimated. UJG Telus lines down east side of road north of Percy Pl crossings, and west side of road south of Percy Pl. Roadway impacts: High. Alignment is along VM Pkwy which is a main road with high traffic volumes. The pipe would likely be located under the road (eastern lane) and southbound traffic would be reduced to a single lane during construction Third party utility relocation: Minor relocations anticipated. Scale of relocation will depend upon on the available space and preference of service relocation vs construction in the VMP.		2.5	Length: 2500 Construction Complexity: Goldstream Avenue (Leigh Road to Spencer Road) - High Spencer Road - Low-Mod Highway 1 (Spencer Road to Brock Avenue) - Mod Brock Avenue - Mod Larkhall Road - Mod Veterans Memorial Parkway (Larkhall Road to Goldstream Avenue) - High
Operation and Maintenance	2.5	Location of the permanent right-of-way (accessibility, traffic management/disruption): Within active road corridor. Traffic control likely required when accessing the main. Traffic disruption expected and traffic management plan likely required.	3.5	location of the permanent right-of-way (accessibility, traffic management/disruption): Pipe likely located within the road (vehicle travel lane), however, this is a local road with very low traffic volumes. Access for O&M managed with 1-way alternating traffic and alternate travel routes.	1	location of the permanent right-of-way (accessibility, traffic management/disruption): Pipe likely located under edge of pavement/boulevard. Permanent jersey barrier (currently in place) to be located between pipe and travel lanes. O&M crews to have clear access behind barrier where works can take place with no traffic impacts and low traffic risk. This will require O&M staff to park on the highway as there is not sufficient space for maintenance bays.	3.5	location of the permanent right-of-way (accessibility, traffic management/disruption): Pipe likely located within the road (vehicle travel lane), however, this is a local road with low traffic volumes. Access for O&M managed with 1-way alternating traffic and alternate travel routes.	3.5	location of the permanent right-of-way (accessibility, traffic management/disruption): Pipe likely located within the road (vehicle travel lane), however, this is a local road with low traffic volumes. Access for O&M managed with 1-way alternating traffic and/or alternate travel routes.	2	location of the permanent right-of-way (accessibility, traffic management/disruption): Within active road corridor. Traffic control required when accessing the main. Traffic disruption expected and traffic management plan likely required.		
Connectivity and Project Synergies (adjudges as whole alignment, not in sections)	3	Connectivity - Existing connection at Jacklin Road no longer possible. However, there is the potential to re-instate the connections at Spencer Rd - Intersection works would also be required to reinstate the connection to Main No. 1 as the alignment of the new Main No. 4 would be on the eastern side of VMP. - Limited opportunity to connect to the JdF on Hwy 1 without connecting to the south through the road batter or by constructing a connection underneath the highway to the north. - Some opportunity for additional connections to the JdF on Brock or Larkhall Rd.													

C.5 Option 4 Detailed Scoring Results

Option	4: Leigh - Hwy 1 - VMP							
Section	**Leigh Road (Goldstream to Hwy 1)**		**Hwy 1 (Leigh Road to Veterans Memorial Parkway)**		**Veterans Memorial Parkway (Hwy 1 to Goldstream)**			
Assessment Category	**Technical Score**	**Justification**	**Technical Score**	**Justification**	**Technical Score**	**Justification**		
Archaeological and Cultural Impacts	3	Interacts with areas of archaeological potential but no previously recorded archaeological sites	1	interacts with areas of archaeological potential and previously recorded archaeological sites	1	interacts with areas of archaeological potential and a previously recorded archaeological site near Veterans Memorial Parkway north of Brock Ave		
Social Impacts (Residential, Business and Traffic)	4	Vehicle Impacts: Moderate. Leigh Rd is high traffic volume. Transit Impacts: Yes . Bicycle Impacts: Not applicable. Private Access Impacts: Approx 2 SFHs, 3 commercial buildings and one ambulance station . Other: There is likely to be noise created through the need to excavate rock for the pipeline construction. Minimal adjacent residential properties.	2	Vehicle Impacts: High. TCH is high traffic volume highway regulated by MoTI. Transit Impacts: Not applicable . Bicycle Impacts: Not applicable. Private Access Impacts: Not applicable . Other: There is also likely to be noise created through the need to excavate rock for the pipeline construction.	1	Vehicle Impacts: High. TCH and VMP are high traffic volume highways regulated by MoTI. Transit Impacts: Yes. Bicycle Impacts: No. Private Access Impacts: Approx 16 SFHs + 10SFHs, 3 MFDs + 5 MFDs, Langford Fire Hall and RCMP detachment. Other:		
Environmental Impacts	1	Tree Clearing: None anticipated. ESAs (such as riparian): Yes, wetland and associated species of conservation concern occurrences [plants, frog, and butterfly] and painted turtle critical habitat associated with wetland complex (Spencer's Pond Park). Other: Steep slope towards wetland complex Rock excavation is likely to be required, potential blasting. This increases environmental risks.	3	Tree Clearing: Minimal. Alignment is in existing ROW). ESAs (such as riparian): Minor. Painted turtle critical habitat and stream crossings, however will all be culverted under project footprint Rock excavation is likely to be required, potential blasting. This increases environmental risks.	4	Tree Clearing: Ornamental trees may be impacted. Alignment is in existing ROW. ESAs (such as riparian): Culverted watercourse at highway. Other: Gas station at VMP and Goldstream is not expected to be impacted by construction.		
Resiliency (Geotechnical, Seismic & Proximity to Other Mains)	3.75	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain, (R1/2) Outcrops and Thin soil cover over bedrock, and possible (O3) Peat over Sand and Gravel of the Colwood Delay and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class B or C	3	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain and possible (O3) Peat over Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C.	3	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain and possible (O3) Peat over Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C. Existing Main No. 14 in the same corridor. It is assumed that there is adequate space that adverse impacts of having the new main in the same corridor as the existing Main No. 14 are not expected. The presence of the existing main is not expected to significantly increase the seismic risk as it is expected that the new main will be seismically resilient and able to span a crater created by an adjacent main break.		
Constructability Impacts (including Third-Party Utility Impacts)	3	Municipal WM, gravity mains present. Larger fortis main. Larger BCH ducts. The road is wide and there are options to relocate utilities if required. Businesses typically have 2 driveways.	2	It appears the area for the Leigh road onramp would need to be built up significantly which is ~10% of alignment. Another 10% might need to be built up, with ~40% needing to be cut down including rock. Access would mainly be from HWY1 and we would need to consider several utility crossings near Spencer. There is also some type of headwall west of Spencer. Site access would probably be limited to HWY1. Coordination with MoTI will be significant.	3	*Some larger utilities present (500 dia WM, 600 dia sani, BCH ducting, sani force main etc). Some relocations may be required based on location within road RoW. The parkway is wide which will give options for relocations if required.*		
Property and Land Acquisition Impacts	4.5	Temporary rights-of-way: - Commercial / industrial area (first 200m): Compounds in this area during construction may not fit in road ROW and may require private carparks/clear private land to be used temporarily. - Undeveloped area (last 580m): The road ROW is wide (+-50m). Potential for pipe to be located in eastern boulevard with space available for compound areas along the corridor. Permanent right-of-way: In existing road ROW. Third party utility proximity or crossing agreements: No new agreements anticipated.	3	Temporary rights-of-way: Pipe located under southern edge-of-pavement/boulevard of highway. Construction corridor maintained within highway ROW. Compound areas: - 'Kramer Lands', adjacent construction corridor. - Clear land at northern end of Spencer Road. - Possibly the park on Matson Rd. Potential to install temporary construction access tracks at intermediate locations along alignment: - Northern end of Matson Road - Northern end of Deville Road Permanent right-of-way: In existing Trans-Canada Highway ROW. However, the CRD would need to obtain a ROW for their main from MoTI so they are able to access this as needed. Third party utility proximity or crossing agreements: No new agreements anticipated.	2.5	Note, the following route has been assumed: Peatt Rd, underbore VM Pkwy, Millstream service road (to the end), WM Pkwy to Goldstream Intersection. Main No.14 generally follows a similar alignment. Temporary rights-of-way: Developed urban area. Compound areas during construction may not fit in road ROW and require private carpark areas to be used temporarily. Potential compound areas appear limited. Possible options: - Grassed area at Strandlund Ave, Millstream Rd intersection - Boston Pizza carpark Permanent right-of-way: In existing road ROW. However, the CRD would need to obtain a ROW for their main from MoTI. This would be additional to the ROW already in place on VMP for Main No. 14. Third party utility proximity or crossing agreements: No new agreements anticipated.		
Capital Expenditure Impacts (adjudged as whole alignment, not in sections)		Length:770m Construction complexity: Low-Moderate Utility impacts: Minor-moderate. Coordination works required. One sewer (200mm), stormwater (450mm) and water (300mm) run along the corridor, with service connection crossings. 3 U/G electrical lines running along corridor, 6 distribution connection crossings. 168mm gas line along west side of corridor, then crossing to the east, 5 gas distribution line crossings. U/G Telus lines on east side of road. Roadway impacts: Moderate. Collector road with moderate traffic volumes to be managed during construction. - Commercial / industrial area (first 200m): The pipe will likely be under the road. 2-way traffic (1- lane each way) during construction should be achievable. - Undeveloped area (last 580m): Pipe may be located in the eastern boulevard (out of the pavement area). In this area it is likely that 1 northbound lane would remain open during construction.		Length:1480m Construction complexity: Moderate Utility impacts: Very minor-minor. 1 small sewer crossing, 1 small stormwater crossing. . 1 U/G electrical crossing (of highway), coordination with Hwy street lighting. Roadway impacts: Moderate. Highway with high traffic volumes and high speed limit. It is expected that 2-lanes travelling north-east can remain open for the duration of the works . 13m construction corridor. 7m traffic corridor, 2-lanes, 3.5m each, with speed reduction. Third party utility relocation: None anticipated.		Length:1060m Construction complexity: High Utility impacts: Significant. Coordination works required. Corridor has 2 water lines (one is Main No.14) and 450mm sewer line running along corridor, and multiple water, sewer and stormater crossings. U/E primary and secondary lines running along the northern half of VMP, and around Goldstream intersection, ~6 crossings estimated. 88mm gas adjacent east road corridor boundary, and 42mm on west side south of Massie Rd, location likely clearly of construction corridor, 5 crossings estimated. U/G Telus lines down east side of road north of Percy Pl crossings, and west side of road south of Percy Pl. Note: Given number of utilities along Millstream service road. New main location may be forced in the VMP roadway unless significant utility relocation works are completed. Roadway impacts: Moderate - significant (pending location in road corridor). Approx 750m is along Peatt Rd and Millstream service road which are local residential roads with low traffic volumes. These areas would likely be single lane alternating with short periods of total road closure during construction. Approx 310m is along VM Pkwy which has high traffic volumes. The pipe would likely be located under the road and northbound traffic would be reduced to a single lane during construction in this area. Third party utility relocation: Minor up to significant relocation works may be required depending on the available space and preference of service relocation vs construction in the VMP	1.0	Length: 3310 Construction Complexity: Leigh Road (Goldstream to Hwy 1) - Low-Mod Hwy 1 (Leigh Road to Veterans Memorial Parkway) - Mod Veterans Memorial Parkway (Hwy 1 to Goldstream) - High
Operation and Maintenance	3.5	Location of the permanent right-of-way (accessibility, traffic management/disruption): - Commercial / industrial area (first 200m): Under the pavement. Traffic control likely required when accessing the main in this area. - Undeveloped area (last 580m): Located in the eastern boulevard and accessed without traffic impacts.	1	Location of the permanent right-of-way (accessibility, traffic management/disruption): Pipe likely located under edge of pavement/boulevard. Permanent jersey barrier (currently in place) to be located between pipe and travel lanes. O&M crews to have clear access behind barrier where works can take place with no traffic impacts and low traffic risk. This will require O&M staff to park on the highway as there is not sufficient space for maintenance bays.	2	Location of the permanent right-of-way (accessibility, traffic management/disruption): Within active road corridor. Traffic control likely required when accessing the main. Particularly the section under VM Pkwy (southern 310m). Traffic disruption expected and traffic management plan likely required.		
Connectivity and Project Synergies (adjudges as whole alignment, not in sections)	1	Connectivity: - Existing connection at Jacklin Road no longer possible. - Limited connections possible on Leigh Rd as the main terminates south of Highway 1. - Intersection works would also be required to reinstate the connection to Main No. 1 as the alignment of the new Main No. 4 would be on the eastern side of VMP. - Limited opportunity to connect to the JdF on Hwy 1 without connecting to the south through the road batter or by constructing a connection underneath the highway to the north.						

C.6 Option 5 Detailed Scoring Results

Project A2.1
High-Level Feasibility Alignment Review
Multi-Criteria Assessment

Option	5: Leigh - Hwy 1 - Brock - Larkhall - VMP									
Section	**Leigh Road (Goldstream to Hwy 1)**		**Highway 1 (Leigh Road to Brock Avenue)**		**Brock Avenue**		**Larkhall Road**		**Veterans Memorial Parkway (Larkhall Road to Goldstream**	
Assessment Category	**Technical Score**	**Justification**	**Technical Score**	**Justification**	**Technical Score**	**Justification**	**Technical Score**	**Justification**	**Technical Score**	**Justification**
Archaeological and Cultural Impacts	3	Interacts with areas of archaeological potential but no previously recorded archaeological sites	1	interacts with areas of archaeological potential and previously recorded archaeological sites	1	interacts with areas of archaeological potential and a previously recorded archaeological site near Hwy 1 and Brock Ave	5	Does not interact with areas of archaeological potential or previously recorded archaeological sites	5	Does not interact with areas of archaeological potential or previously recorded archaeological sites
Social Impacts (Residential, Business and Traffic)	4	Vehicle Impacts: Moderate. Leigh Rd is high traffic volume. Transit Impacts: Yes . Bicycle Impacts: Not applicable. Private Access Impacts: Approx 2 SFHs, 3 commercial buildings and one ambulance station . Other: There is likely to be noise created through the need to excavate rock for the pipeline construction. Minimal adjacent residential properties.	2	Vehicle Impacts: High. TCH is high traffic volume highway regulated by MoTI. Transit Impacts: Not applicable . Bicycle Impacts: Not applicable. Private Access Impacts: Not applicable . Other: There is also likely to be noise creating through the need to excavate rock for the pipeline construction.	3	Vehicle Impacts: Minor. Transit Impacts: Not applicable . Bicycle Impacts: Not applicable. Private Access Impacts: Approx 23 SFHs and 10 MFDs . Other: Narrow residential street with all residential dwellings which is likely to require full closure through the construction zone. Noise during construction may be undesirable.	3	Vehicle Impacts: Minor. Transit Impacts: Not applicable . Bicycle Impacts: Not applicable. Private Access Impacts: Approx 17 SFHs and 1 MFDs . Other: Narrow residential street with all residential dwellings which is likely to require full closure through the construction zone. Noise during construction may be undesirable.	1	Vehicle Impacts: High. VMP is high traffic volume highways regulated by MoTI. Transit Impacts: Yes. Bicycle Impacts: No. Private Access Impacts: Approx 105FHs, 5 MFDs, and RCMP detachment. Other:
Environmental Impacts	1	Tree Clearing: None anticipated. ESAs (such as riparian): Yes, wetland and associated species of conservation concern occurrences [plants, frog, and butterfly] and painted turtle critical habitat associated with wetland complex (Spencer's Pond Park). Other: Steep slope towards wetland complex Rock excavation is likely to be required, potential blasting. This increases environmental risks.	3	Tree Clearing: Not anticipated. Alignment is in existing ROW). ESAs (such as riparian): Minor. Painted turtle critical habitat and stream crossings, however will all be culverted under project footprint Rock excavation is likely to be required, potential blasting. This increases environmental risks.	4	Tree Clearing: Ornamental trees may be impacted. Alignment is in existing ROW. ESAs (such as riparian): Potential watercourse/drainage crossed. Other: Steep slope adjacent to HWY1, weeds on slope	5	Tree Clearing: Not anticipated. Alignment is in existing ROW. ESAs (such as riparian): none	4	Tree Clearing: Ornamental trees may be impacted. Alignment is in existing ROW. ESAs (such as riparian): None. Other: Gas station at VMP and Goldstream (not considered in scoring as assumed to be captured in constructability)
Resiliency (Geotechnical, Seismic & Proximity to Other Mains)	3.75	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain, (R1/2) Outcrops and Thin soil cover over bedrock, and possible (O3) Peat over Sand and Gravel of the Colwood Delay and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class B or C	3	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain and possible (O3) Peat over Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C.	4	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain and possible (R1/2) Thin soil or bedrock outcrops. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class B	3.75	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C	3.75	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C. Existing Main No. 14 in the same corridor. It is assumed that there is adequate space that adverse impacts of having the new main in the same corridor as the existing Main No. 14 are not expected. The presence of the existing mains is not expected to significantly increase the seismic risk as it is expected that the new main will be seismically resilient and able to span a crater created by an adjacent main break.
Constructability Impacts (including Third-Party Utility Impacts)	3	Municipal WM, gravity mains present. Larger fortis main. Larger BCH ducts. The road is wide and there are options to relocate utilities if required. Businesses typically have 2 driveways.	2	It appears the area for the Leigh road onramp would need to be built up significantly which is ~15% of alignment. ~30% needing to be cut down. Access would mainly be from HWY1 and we would need to consider several utility crossings near Spencer. Site access would probably be limited to HWY1. Coordination with MoTI will be significant.	3	No significant concerns with 3rd party utilities. Some relocations may be required based on location within road RoW. There are up to 4 multi-residential complexes that might have access from one driveway. It might be possible to widen driveways and/or locate pipe joints to maintain access to these properties,. Potential that, due to the limited width of the road, the construction zone may result in a full closure and mean that the construction zone needs to be shorter to allow for residential access.	3	No significant concerns with 3rd party utilities. Some relocations may be required based on location within road RoW. There is one multi-residential complex that might have access from one driveway. It might be possible to widen the driveway and/or locate pipe joints to maintain access to this properties.	3	Some larger utilities present (500 Dia WM, 600 Dia Sani, BCH ducting etc.). Some relocations may be required based on location within road RoW. The parkway is wide which will give options for relocations if required.
Property and Land Acquisition Impacts	4.5	Temporary rights-of-way: - Commercial / industrial area (first 200m): Compounds in this area during construction may not fit in road ROW and may require private carparks/clear private land to be used temporarily. - Undeveloped area (last 580m): The road ROW is wide (+-50m). Potential for pipe to be located in eastern boulevard with space available for compound areas along the corridor. Permanent right-of-way: In existing road ROW. Third party utility proximity or crossing agreements: No new agreements anticipated.	3	Temporary rights-of-way: Pipe located under southern edge-of-pavement/boulevard of highway. Construction corridor maintained within highway ROW. Compound areas: - "Kramer Lands', adjacent construction corridor. - Clear land at northern end of Spencer Road. Permanent right-of-way: In existing Trans-Canada Highway ROW. However, the CRD would need to obtain a ROW for their main from MoTI so they are able to access this as needed. Third party utility proximity or crossing agreements: No new agreements anticipated.	4	Temporary rights-of-way: Local road with narrow road corridor. Construction corridor maintained within road ROW. Residential parking and driveway access will be impacted. Compound area opportunities appear limited, option identified are: - Park near northern end of Matson Rd. (- No area identified near east end of Brock Ave.) Permanent right-of-way: In existing road ROW. Third party utility proximity or crossing agreements: No new agreements anticipated.	4	Temporary rights-of-way: Local road with narrow road corridor. Construction corridor maintained within road ROW. Compound area opportunities appear limited, none identified at this stage. Permanent right-of-way: In existing road ROW. Third party utility proximity or crossing agreements: No new agreements anticipated.	3	Note, the assumed route is along the western side of VM Pkwy. Temporary rights-of-way: Developed urban area. Compound areas during construction may not fit in road ROW and require private carpark areas to be used temporarily. Potential compound areas appear limited. Possible option is carparks off Danbrook Ave. Permanent right-of-way: In existing road ROW. However, the CRD would need to obtain a ROW for their main from MoTI so they are able to access this as needed. Third party utility proximity or crossing agreements: No new agreements anticipated.
Capital Expenditure Impacts (adjudged as whole alignment, not in sections)		Length:770m Construction complexity: Low-Moderate Utility impacts: Minor-moderate. Coordination works required. One sewer (200mm), stormwater (450mm) and water (300mm) run along the corridor, with service connection crossings. 3 U/G electrical lines running along corridor, 6 distribution connection crossings. 168mm gas line along west side of corridor, then crossing to the east, 5 gas distribution line crossings. U/G Telus lines on east side of road. Roadway impacts: Moderate. Collector road with moderate traffic volumes to be managed during construction. - Commercial / industrial area (first 200m): The pipe will likely be under the road. 2-way traffic (1- lane each way) during construction should be achievable. - Undeveloped area (last 580m): Pipe may be located in the eastern boulevard (out of the pavement area). In this area it is likely that 1 northbound lane would remain open during construction. Third party utility relocation: None anticipated.		Length:800m Construction complexity: Moderate Utility impacts: Very Low-Low. 1 small sewer crossing. 1 U/G electrical crossing. Coordination with Hwy street lighting. Roadway impacts: Moderate. Highway with high traffic volumes and high speed limit. It is expected that 2-lanes travelling north-east can remain open for the duration of the works . 13m construction corridor. 7m traffic corridor, 2-lanes, 3.5m each, with speed reduction. Third party utility relocation: None anticipated.		Length:640m Construction complexity: Moderate Utility impacts: Moderate. Utility coordination works will be required. Corridor has 1 water distribution line and 1 sewer main running along corridor. Water and sewer service connections and stormwater pipes cross the corridor frequently. Water and sewer mains are relatively small. (<=200mm). 3 U/G electrical crossings at western end of road. 88mm gas line running along corridor. Comms requires further investigation. Need to relocate existing mains considered unlikely. Roadway impacts: Moderate. Local road, relatively low traffic volumes expected. Due to narrow corridor, full road closure through the construction zone is considered likely. Multiple intersecting roads provide alternate access for when total road closure is required. Residential parking and driveway access will be impacted. Third party utility relocation: Need to relocate existing mains considered unlikely.		Length:130m Construction complexity: Moderate Utility impacts: Moderate. Utility coordination works will be required. Corridor has 1 water distribution line and 1 sewer main running along corridor. Water and sewer service connections and stormwater pipes cross the corridor frequently. Water and sewer mains are relatively small. (<=200mm). 2 U/G electrical crossing. Comms requires further investigation. Roadway impacts: Moderate. Local road, relatively low traffic volumes expected. Due to narrow corridor, full road closure through the construction zone is considered likely. Alternate access options available during total road closure. Residential parking and driveway access will be impacted. Third party utility relocation: Need to relocate existing mains considered unlikely.	2.5	Length:510m Construction complexity: High Utility impacts: Moderate. Water and sewer main run parallel south of Massie Dr with small number of connecting lines. Multiple U/G electrical primary and secondary lines around Goldstream Ave intersection, 3 crossings estimated. 88mm gas adjacent east road corridor boundary, 42mm on west side south of Massie Rd, location likely clearly of construction corridor, crossings estimated. U/G Telus lines down east side of road north of Percy Pl crossings, and west side of road south of Percy Pl. Roadway impacts: High. Alignment is along VM Pkwy which is a main road with high traffic volumes. The pipe would likely be located under the road (eastern lane) and southbound traffic would be reduced to a single lane during construction Third party utility relocation: Minor relocations anticipated. Scale of relocation will depend upon on the available space and preference of service relocation vs construction in the VMP.
Operation and Maintenance	3.5	Location of the permanent right-of-way (accessibility, traffic management/disruption): - Commercial / industrial area (first 200m): Under the pavement. Traffic control likely required when accessing the main in this area. - Undeveloped area (last 580m): Located in the eastern boulevard and accessed without traffic impacts.	1	Location of the permanent right-of-way (accessibility, traffic management/disruption): Pipe likely located under edge of pavement/boulevard. Permanent jersey barrier (currently in place) to be located between pipe and travel lanes. O&M crews to have clear access behind barrier where works can take place with no traffic impacts and low traffic risk. This will require O&M staff to park on the highway as there is not	3.5	Location of the permanent right-of-way (accessibility, traffic management/disruption): Pipe likely located within the road (vehicle travel lane), however, this is a local road with low traffic volumes. Access for O&M managed with 1-way alternating traffic and alternate travel routes.	3.5	Location of the permanent right-of-way (accessibility, traffic management/disruption): Pipe likely located within the road (vehicle travel lane), however, this is a local road with low traffic volumes. Access for O&M managed with 1-way alternating traffic and/or alternate travel routes.	2	Location of the permanent right-of-way (accessibility, traffic management/disruption): Within active road corridor. Traffic control required when accessing the main. Traffic disruption expected and traffic management plan likely required.
Connectivity and Project Synergies (adjudges as whole alignment, not in sections)	2	Connectivity: - Existing connection at Jacklin Road no longer possible. - Limited connections possible on Leigh Rd as the main terminates south of Highway 1. - Intersection works would also be required to reinstate the connection to Main No. 1 as the alignment of the new Main No. 4 would be on the eastern side of VMP. - Limited opportunity to connect to the JdF on Hwy 1 without connecting to the south through the road batter or by constructing a connection underneath the highway to the north. - Some opportunity for additional connections to the JdF on Brock or Larkhall Rd.									

Length: 2850
Construction Complexity:
Leigh Road (Goldstream to Hwy 1) - Low-Mod
Highway 1 (Leigh Road to Brock Avenue) - Mod
Brock Avenue - Mod
Larkhall Road - Mod
Veterans Memorial Parkway (Larkhall Road to Goldstream Avenue) - High

C.7 Option 6 Detailed Scoring Results

Option	6: Leigh - Dunford - Station						
Section	**Leigh Road (Goldstream Avenue to Dunford Avenue)**		**Dunford Avenue**		**Station Avenue (E&N Rail Trail)**		
Assessment Category	**Technical Score**	**Justification**	**Technical Score**	**Justification**	**Technical Score**	**Justification**	
Archaeological and Cultural Impacts	3	Interacts with areas of archaeological potential but not with previously recorded archaeological sites	4	May interact with areas of archaeological potential but not with previously recorded archaeological sites	5	Does not interact with areas of archaeological potential or previously recorded archaeological sites	
Social Impacts (Residential, Business and Traffic)	2	This option assumes that due to the close proximity of buildings and utility poles, as well as the narrow width of Leigh Rd south of Goldstream Avenue that single lane alternating traffic will be required during construction. Vehicle Impacts: Moderate. Leigh Rd is high traffic volume road. Transit Impacts: Yes . Bicycle Impacts: Yes. Private Access Impacts: approx. 10 SFHs and 6 MFDs, a couple of commercial buildings . Other: appears to be narrow setbacks to residential properties/fences	4	Vehicle Impacts: Low. Transit Impacts: Yes . Bicycle Impacts: Yes. Private Access Impacts: approx. 20 SFHs, 10 MFDs, 24 businesses . Other:	5	Vehicle Impacts: Low. Transit Impacts: No . Bicycle Impacts: Yes. Private Access Impacts: Not expected to be impacted . Other: potential displacement of parking if using the parking area adjacent to rail corridor for a laydown area. Utilising the E&N rail trail is likely to mitigate vehicle, transit, and property impacts.	
Environmental Impacts	3	Tree Clearing: Alignment is in existing ROW, however there are several mature trees in close proximity to road that may be impacted. ESAs (such as riparian): Within painted turtle critical habitat, however assume that work occurs in paved area and therefore no impact	4	Tree Clearing: There are a small number of mature trees at Leigh and Dunford in close proximity to road that may be impacted. Also current alignment cuts through where mature tree is at Dunford and Station Ave. ESAs (such as riparian): Within painted turtle critical habitat, however assume that work occurs in paved area and therefore no impact. Weedy, vegetated ditch and old railway ROW is crossed	2	Tree Clearing: Ornamental trees may be impacted. Alignment is in rail ROW. ESAs (such as riparian): None. Other: As this alignment is using rail land, it has been assumed that there will be some contaminated soil encountered on this alignment. This could have adverse environmental impacts.	
Resiliency (Geotechnical, Seismic & Proximity to Other Mains)	3.75	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C	3.75	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C	3.75	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C Main No. 1 and 3 are also in the same Station Avenue corridor. However, it is expected that by using the	
Constructability Impacts (including Third-Party Utility Impacts)	3	Pretty congested utility corridor with watermain, gravity mains, BCH conduit, larger fortis main.	4	Most utilities are present, but the road is wide enough to allow relocations. The businesses usually have driveways that will allows for flexible access.	4	Many utilities are present including two large CRD WMs, asbestos 150 watermain, BCH, gravity mains, smaller fortis, BCH, comms. Larger watermains and AC might complicate relocation and routing as initial investigations show there would only be ~1m clearance from the trench shoring to the existing mains in some sections. This increases risk of damage to existing mains during construction. Using the rail trail minimises the impacts with existing utilities. However, this is still a somewhat narrow corridor if the rail corridor is not able to be used for construction so there will still be some complexities in this area.	
Property and Land Acquisition Impacts	4	Temporary rights-of-way: Collector road, 3 lanes widths + bike lane either side. Construction corridor maintained within road ROW. Residential driveway access will be impacted. Compound area opportunities appear limited along construction corridor. Potential options identified are: - 2814 Leigh Rd - Clear block on corner of Leigh Pl and Leigh Rd Permanent right-of-way: In existing road ROW. Third party utility proximity or crossing agreements: No new agreements anticipated.	4	Temporary rights-of-way: Collector road, 1 travel lane + bike lane each direction. Construction corridor maintained within road ROW. Compound area opportunities appear limited along construction corridor. Potential options identified are: - Clear block on corner of Leigh Pl and Leigh Rd - Part of the ICBC Victoria Rd salvage yard - East end, southern side of Dunford Ave, adjacent rail road tracks. Permanent right-of-way: In existing road ROW. Third party utility proximity or crossing agreements: No new agreements anticipated.	3.5	**Assumed installation in the E&N rail trail.** **Rail corridor may be utilized as part of the construction corridor for compound/storage areas.** Temporary rights-of-way: Collector road, 1 travel lane + bike lane each direction. Construction corridor overlays the road ROW and the rail corridor. Opportunity to use cleared sections in rail corridor for compound areas. Permanent right-of-way: In existing road ROW. No rail crossings will be required, however this option will require the a permanent ROW from the Island Rail Foundation. This is not expected to be a minor hold up for the project as the validity of this alignment will be based on initial correspondence with the Island Rail Foundation on the potential to use the trail alignment. Third party utility proximity or crossing agreements: No new permanents agreements anticipated. Temporary agreement with rail corridor owner for access during construction also anticipated.	
Capital Expenditure Impacts (adjudged as whole alignment, not in sections)		Length:310m Construction complexity: Moderate Utility impacts: Moderate. Utility coordination works required. Corridor has 1 water distribution line, 1 stormwater, and 1 sewer main running along corridor (200-400mm diameter). Water and sewer service connections and stormwater pipes cross the corridor frequently. U/G electrical primary and secondary lines running along corridor. 2 gas lines (42mm and 168mm) running along the corridor. Section of Telus lines at northern end of Leigh Rd. Roadway impacts: Moderate. Collector road, moderate traffic volumes expected. Single lane alternating traffic control likely required during construction. Residential driveway access will be impacted. Third party utility relocation: Need to relocate existing utilities running along the corridor considered unlikely.		Length:820m Construction complexity: Moderate Utility impacts: Moderate. Utility coordination works required. Corridor has 1 water distribution line (150mm) and 1 sewer main (450mm) running along corridor. Water and sewer service connections cross the corridor frequently. U/G electrical primary and secondary lines running along corridor, with 7 service and distribution line crossings. 88mm gas line running along the corridor and distribution network crossing. Telus lines along eastern half of corridor (from Carlow Rd going east) Roadway impacts: Moderate. Collector road, moderate traffic volumes expected. Single lane alternating traffic control during construction. Residential and commercial parking and driveway access will be impacted. Third party utility relocation: Need to relocate existing utilities running along the corridor considered unlikely.		Length:1060m Construction complexity: Low Utility impacts: Limited space within the road corridor means this alignment has assumed the use of the E&N rail trail. There are no major utility conflicts expected in this area. Roadway impacts: Minimal roadway impacts expected due to using the E&N rail trail. There will be impacts to bikes and pedestrians using the trail. Third party utility relocation: Minor relocation works may be required depending on the available space. From drawings, there are no obvious major utilities in this corridor.	5.0	Length: 2190 Construction Complexity: Leigh Road (Goldstream Avenue to Dunford Avenue) - Mod Dunford Avenue - Mod Station Avenue - Low
Operation and Maintenance	3	Location of the permanent right-of-way (accessibility, traffic management/disruption): Pipe located within the road (under vehicle travel lane). Access for O&M will require a TMP with either single lane alternating traffic or 2-way traffic with reduced speed, pending location in the corridor.	3	Location of the permanent right-of-way (accessibility, traffic management/disruption): Pipe likely located within the road (under vehicle travel lane). Access for O&M will require a TMP with either 1-way alternating traffic or 2-way traffic with reduced speed, pending O&M works location and pipe installation location in the corridor.	5	Location of the permanent right-of-way (accessibility, traffic management/disruption): Using the rail trail should allow for O&M staff to access the main without vehicle traffic control and risks of working adjacent live traffic.	
Connectivity and Project Synergies (adjudges as whole alignment, not in sections)	4.5	Connectivity: - Existing connection at Jacklin Road no longer possible. However there is the potential to reinstate this at the intersection of Jacklin Rd with Dunford/Station. - Other potential connections to the JdF possible on all routes. - Connection to Main No. 1 and 3 able to be reinstated on Station Ave or Goldstream. Additional connections to Main No. 4 also possible here which could increase the downstream redundancy of the system. - Connection to the JdF at VMP can be retained or reinstated without crossing busy intersection.					

C.8 Option 7 Detailed Scoring Results

Option	7: Leigh - Dunford - Jacklin - Goldstream								
Section	**Leigh Road (Goldstream Avenue to Dunford Avenue)**		**Dunford Avenue**		**Jacklin Road**		**Goldstream Avenue (Jacklin Road to VMP)**		
Assessment Category	**Technical Score**	**Justification**	**Technical Score**	**Justification**	**Technical Score**	**Justification**	**Technical Score**	**Justification**	
Archaeological and Cultural Impacts	3	Interacts with areas of archaeological potential but not with previously recorded archaeological sites	4	May interact with areas of archaeological potential but not with previously recorded archaeological sites	5	Does not interact with areas of archaeological potential or previously recorded archaeological sites	5	Does not interact with archaeological potential model or previously recorded archaeological site	
Social Impacts (Residential, Business and Traffic)	2	This option assumes that due to the close proximity of buildings and utility poles, as well as the narrow width of Leigh Rd south of Goldstream Avenue that single lane alternating traffic will be required during construction. Vehicle Impacts: Moderate. Leigh Rd is high traffic volume road. Transit Impacts: Yes . Bicycle Impacts: Yes. Private Access Impacts: approx. 10 SFHs and 6 MFDs, a couple of commercial buildings . Other: appears to be narrow setbacks to residential properties/fences	4	Vehicle Impacts: Low. Transit Impacts: Yes . Bicycle Impacts: Yes. Private Access Impacts: approx. 20 SFHs, 10 MFDs, 24 businesses . Other:	4	Vehicle Impacts: Low. Transit Impacts: Yes . Bicycle Impacts: Yes. Private Access Impacts: approx. 25 SFHs, 5 MFDs, and a few businesses . Other: potential displacement of parking if using the parking area adjacent to rail corridor	1	Vehicle Impacts: Yes, moderate. Goldstream Ave is high volume road, particularly in this section, and has single lane traffic for each direction. Transit Impacts: Yes, transit route. Bicycle Impacts: Yes, bike lane. Private Access Impacts: Yes. Residential (approx 6 MFDs), commercial (approx 10 businesses) and institutional.	
Environmental Impacts	3	Tree Clearing: Alignment is in existing ROW, however there are several mature trees in close proximity to road that may be impacted. ESAs (such as riparian): Within painted turtle critical habitat, however assume that work occurs in paved area and therefore no impact	4	Tree Clearing: There are a small number of mature trees at Leigh and Dunford in close proximity to road that may be impacted. Also current alignment cuts through where mature tree is at Dunford and Station Ave. ESAs (such as riparian): Within painted turtle critical habitat, however assume that work occurs in paved area and therefore no impact. Weedy, vegetated ditch and old railway ROW is crossed	5	Tree Clearing: Ornamental trees and a small number of mature trees may be impacted. Alignment is in existing ROW. ESAs (such as riparian): None. Other:	4	Tree Clearing: Potential impacts to mature trees in median and boulevards. Alignment is in existing ROW. ESAs (such as riparian): None	
Resiliency (Geotechnical, Seismic & Proximity to Other Mains)	3.75	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C	3.75	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C	3.75	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C	3.5	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain, Topography: Flat (0 - 5degrees) overall slope, Groundwater: Estimated to be Moderately deep (<5m) in dry season. Seismic Demand: Assumed Site Class C. Existing Main No. 4 in same corridor, assumed to be decommissioned following construction of replacement main.	
Constructability Impacts (including Third-Party Utility Impacts)	3	Pretty congested utility corridor with watermain, gravity mains, BCH conduit, larger fortis main.	4	Most utilities are present, but the road is wide enough to allow relocations. The businesses usually have driveways that will allows for flexible access.	4	Most utilities are present including larger fortis main, watermain, gravity mains, comms. The road is wide and could accommodate relocation if required. Most driveways have duplicate entrances or are wide.	1	Existing 1372 WM, also 300/400 DI, comms, gravity, larger fortis present. The existing 1372 would limit routing options for new main and any potential relocations. Would be very involved for a contractor to maintain business access along this route, productivity would likely suffer as the work zone would probably need to be kept tight. Mature trees in medians and boulevards could potentially be in the way.	
Property and Land Acquisition Impacts	4	Temporary rights-of-way: Collector road, 3 lanes widths + bike lane either side. Construction corridor maintained within road ROW. Residential driveway access will be impacted. Compound area opportunities appear limited along construction corridor. Potential options identified are: - 2814 Leigh Rd - Clear block on corner of Leigh Pl and Leigh Rd Permanent right-of-way: In existing road ROW. Third party utility proximity or crossing agreements: No new agreements anticipated.	4	Temporary rights-of-way: Collector road, 1 travel lane + bike lane each direction. Construction corridor maintained within road ROW. Compound area opportunities appear limited along construction corridor. Potential options identified are: - Clear block on corner of Leigh Pl and Leigh Rd - Part of the ICBC Victoria Rd salvage yard - East end, southern side of Dunford Ave, adjacent rail road tracks. Permanent right-of-way: In existing road ROW. Third party utility proximity or crossing agreements: No new agreements anticipated.	4.5	<u>Temporary rights-of-way</u>: Collector road, 3 lanes widths + bike lane either side. Construction corridor maintained within road ROW. Potential compound areas: - Rail corridor at Station Ave intersection - Carpark on the corner of Van Isle Way and Jacklin Rd - Shopping complex carpark on corner of Jacklin Rd and Goldstream Ave <u>Permanent right-of-way</u>: In existing road ROW. <u>Third party utility proximity or crossing agreements</u>: No new agreements anticipated.	4	Temporary rights-of-way: Arterial road in developed urban area.Generally 3 lanes widths + bike lane either side. Road widens at intersections and narrows in areas. Construction corridor maintained within road ROW. Compound area options within the road ROW appear limited. The are a number of commercial carparks along Goldstream Ave that may potentially be used as temporary compound areas. Permanent right-of-way: In existing road ROW. Third party utility proximity or crossing agreements: No new agreements anticipated.	
Capital Expenditure Impacts (adjudged as whole alignment, not in sections)		Length:310m Construction complexity: Moderate Utility impacts: Moderate. Utility coordination works required. Corridor has 1 water distribution line, 1 stormwater, and 1 sewer main running along corridor (200-400mm diameter). Water and sewer service connections and stormwater pipes cross the corridor frequently. U/G electrical primary and secondary lines running along corridor. 2 gas lines (42mm and 168mm) running along the corridor. Section of Telus lines at northern end of Leigh Rd. Roadway impacts: Moderate. Collector road, moderate traffic volumes expected. Single lane alternating traffic control likely required during construction. Residential driveway access will be impacted. Third party utility relocation: Need to relocate existing utilities running along the corridor considered unlikely.		Length:320m Construction complexity: Moderate Utility impacts: Moderate. Utility coordination works required. Corridor has 1 water distribution line (150mm) and 1 sewer main (450mm) running along corridor. Water and sewer service connections cross the corridor frequently. U/G electrical primary and secondary lines running along corridor, with 7 service and distribution line crossings. 88mm gas line running along the corridor and distribution network crossing. Telus lines along eastern half of corridor (from Carlow Rd going east) Roadway impacts: Moderate. Collector road, moderate traffic volumes expected. Single lane alternating traffic control during construction. Residential and commercial parking and driveway access will be impacted. Third party utility relocation: Need to relocate existing utilities running along the corridor considered unlikely.		<u>Length</u>:720m <u>Construction complexity</u>: Moderate <u>Utility impacts</u>: Low-Moderate. Utility coordination works required. 1 water distribution line, 1 sewer main (200mm) and sections of stormwater line along the corridor. Water and sewer service connections and stormwater pipes cross the corridor frequently. 168mm gas line along west side of corridor, 4 gas distribution line crossings. <u>Roadway impacts</u>: Moderate. Collector road, moderate traffic volumes expected. Single lane alternating traffic control likely required during construction. Potentially sections of 2 way with reduced speed where road widens to 4 lanes, pending installation location. Residential and commercial driveway access will be impacted. <u>Third party utility relocation</u>: None anticipated.	2.1	Length:830m Construction complexity: High (high commercial activity and traffic area) Utility impacts: Significant. Coordination with existing utilities may require significant works or limit opportunities to locate the new pipe. Corridor has water distribution line (400mm) sewer main(450mm), existing main No.4 (1370mm), stormwater. Water and sewer service connections and stormwater pipes cross the corridor frequently. Approx 6 U/G electrical crossings of primary and secondary lines, with short lengths of line running along the corridor. 168mm gas line along south side of corridor, 4 gas distribution line crossings. U/G Telus on along south side of corridor with crossings at road intersections. Roadway impacts: Significant. Minor arterial road with high traffic volumes to be managed during construction. Pipe will be under the road. Single lane alternating traffic control likely required during construction, with short periods of total road closure. Residential and commercial driveway access and parking be impacted. Third party utility relocation: Localised relocation of existing utilities may be required. The abandoned D900mm steel main running adjacent the existing Main	Length: 2680 Construction Complexity: Leigh Road (Goldstream Avenue to Dunford Avenue) - Mod Dunford Avenue - Mod Jacklin Road - Mod Goldstream Avenue (Jacklin Road to VMP) - High
Operation and Maintenance	3	Location of the permanent right-of-way (accessibility, traffic management/disruption): Pipe located within the road (under vehicle travel lane). Access for O&M will require a TMP with either single lane alternating traffic or 2-way traffic with reduced speed, pending location in the corridor.	3	Location of the permanent right-of-way (accessibility, traffic management/disruption): Pipe likely located within the road (under vehicle travel lane). Access for O&M will require a TMP with either 1-way alternating traffic or 2-way traffic with reduced speed, pending O&M works location and pipe installation location in the corridor.	3	<u>Location of the permanent right-of-way (accessibility, traffic management/disruption)</u>: Pipe located within the road (under vehicle travel lane). Access for O&M will require a TMP with either 1-way alternating traffic or 2-way traffic with reduced speed, pending location in the corridor.	2.5	Location of the permanent right-of-way (accessibility, traffic management/disruption): Pipe located within the road (under vehicle travel lane). Access for O&M will require a TMP likely specifying 1-way alternating traffic past the work zone.	
Connectivity and Project Synergies (adjudges as whole alignment, not in sections)	5	<u>Connectivity:</u> - Existing connection at Jacklin Road and VMP able to be retained. - Other potential connections to the JdF possible on all routes. - Additional connections to Main No. 1 and 3 possible at the intersection of Dunford and Jacklin which could increase the downstream redundancy of the system.							

C.9 Option 8 Detailed Scoring Results

Option	8A: Goldstream - Jacklin - Station									
Section	**Goldstream Avenue (Leigh Road to Spencer Road)**		**Goldstream Avenue (Spencer Road to Jacklin Road)**		**Jacklin Road**		**Station Avenue (E&N Rail Trail)**			
Assessment Category	**Technical Score**	**Justification**	**Technical Score**	**Justification**	**Technical Score**	**Justification**	**Technical Score**	**Justification**		
Archaeological and Cultural Impacts	3	interacts with area of archaeological potential but no previously recorded archaeological sites	3	interacts with area of archaeological potential but no previously recorded archaeological sites	5	Does not interact with areas of archaeological potential or previously recorded archaeological sites	5	Does not interact with areas of archaeological potential or previously recorded archaeological sites		
Social Impacts (Residential, Business and Traffic)	2	Vehicle Impacts: Yes, moderate. Goldstream Ave is high volume road, and has single lane traffic for each direction. Transit Impacts: Yes, transit route. Bicycle Impacts: Yes, bike lane. Private Access Impacts: Yes. Residential (approx 9 Single family homes (SFHs), 2 multi family dwellings (MFDs)), commercial (approx 5 businesses) and institutional, including one school (Spencer Middle School).	2	Vehicle Impacts: Yes, moderate. Goldstream Ave is high volume road, and has single lane traffic for each direction. Transit Impacts: Yes, transit route. Bicycle Impacts: Yes, bike lane. Private Access Impacts: Yes. Residential (approx 8 SFHs, 1 MFD), commercial (approx 3 businesses) and institutional, including one school (Ruth King Elementary).	4	Vehicle Impacts: Low. Transit Impacts: Yes . Bicycle Impacts: Yes. Private Access Impacts: approx. 25 SFHs, 5 MFDs, and a few businesses . Other: potential displacement of parking if using the parking area adjacent to rail corridor	5	Vehicle Impacts: Low. Transit Impacts: No . Bicycle Impacts: Yes. Private Access Impacts: Not expected to be impacted . Other: potential displacement of parking if using the parking area adjacent to rail corridor for a laydown area. Utilising the E&N rail trail is likely to mitigate vehicle, transit, and property impacts.		
Environmental Impacts	3	Tree Clearing: Minimal. Alignment is in existing ROW, however potential for trees to be impacted that are associated with the treed area at 1060 Goldstream Ave. ESAs (such as riparian): Yes, wetland/riparian area with associated species of conservation concern occurrences at 1060 Goldstream Ave	5	Tree Clearing: Not anticipated. Alignment is in existing ROW. ESAs (such as riparian): None	5	Tree Clearing: Ornamental trees and a small number of mature trees may be impacted. Alignment is in existing ROW. ESAs (such as riparian): None. Other:	2	Tree Clearing: Ornamental trees may be impacted. Alignment is in rail ROW. ESAs (such as riparian): None. Other: As this alignment is using rail land, it has been assumed that there will be some contaminated soil encountered on this alignment. This could have adverse environmental impacts.		
Resiliency (Geotechnical, Seismic & Proximity to Other Mains)	3.5	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain, Topography: Flat (0 - 5degrees) overall slope, Groundwater: Estimated to be Moderately deep (<5m) in dry season. Seismic Demand: Assumed Site Class C. Existing Main No. 4 in same corridor, assumed to be decommissioned	3.5	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain, Topography: Flat (0 - 5degrees) overall slope, Groundwater: Estimated to be Moderately deep (<5m) in dry season. Seismic Demand: Assumed Site Class C. Existing Main No. 4 in same corridor, assumed to be decommissioned	3.75	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C	3.75	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C Main No. 1 and 3 are also in the same Station Avenue corridor. However, it is expected that by using the rail trail there will be sufficient distance between the mains that seismic risk is mitigated.		
Constructability Impacts (including Third-Party Utility Impacts)	1.5	Existing 1372 WM, also 300/400 DI, comms, gravity present. The existing 1372 will limit routing options for new main and any potential relocations. From assessment of the current arrangement on Goldstream Ave, it appears the abandoned D900mm steel main will also need to be removed.	1.5	Existing 1372 WM, also 300/400 DI, comms, gavity present. The existing 1372 will limit routing options for new main and any potential relocations. From assessment of the current arrangement on Goldstream Ave, it appears the abandoned D900mm steel main will also need to be	4	Most utilities are present including larger fortis main, watermain, gravity mains, comms. The road is wide and could accommodate relocation if required. Most driveways have duplicate entrances or are wide.	4	Many utilities are present including two large CRD WMs, asbestos 150 watermain, BCH, gravity mains, smaller fortis, BCH, comms. Larger watermains and AC might complicate relocation and routing as initial investigations show there would only be ~1m clearance from the trench shoring to the existing mains in some sections. This increases risk of damage to existing mains during construction. Using the rail trail minimises the impacts with existing utilities. However, this is still a somewhat narrow corridor if the rail corridor is not able to be used for construction so there will still be some complexities in this area.		
Property and Land Acquisition Impacts	4.5	Temporary rights-of-way: Minor arterial road in developed urban area. Compound areas during construction may not fit in road ROW and require private carpark areas to be used temporarily. Permanent right-of-way: In existing road ROW. The CRD already have a ROW in Goldstream Avenue for the existing Main No. 4. Third party utility proximity or crossing agreements: No new agreements anticipated.	4.5	Temporary rights-of-way: Minor arterial road. 2-3 lanes widths + bike lane either side. Construction corridor maintained within road ROW. Permanent right-of-way: In existing road ROW. Third party utility proximity or crossing agreements: No new agreements anticipated.	4.5	Temporary rights-of-way: Collector road, 3 lanes widths + bike lane either side. Construction corridor maintained within road ROW. Potential compound areas: - Rail corridor at Station Ave intersection - Carpark on the corner of Van Isle Way and Jacklin Rd - Shopping complex carpark on corner of Jacklin Rd and Goldstream Ave Permanent right-of-way: In existing road ROW. Third party utility proximity or crossing agreements: No new agreements anticipated.	3.5	Assumed installation in the E&N rail trail. Rail corridor may be utilized as part of the construction corridor for compound/storage areas. Temporary rights-of-way: Collector road, 1 travel lane + bike lane each direction. Construction corridor overlays the road ROW and the rail corridor. Opportunity to use cleared sections in rail corridor for compound areas. Permanent right-of-way: In existing road ROW. No rail crossings will be required, however this option will require the a permanent ROW from the Island Rail Foundation. This is not expected to be a minor hold up for the project as the validity of this alignment will be based on initial correspondence with the Island Rail Foundation on the potential to use the trail alignment. Third party utility proximity or crossing agreements: No new permanents agreements anticipated. Temporary agreement with rail corridor owner for access during construction also anticipated.		
Capital Expenditure Impacts (adjudged as whole alignment, not in sections)		Length:490m Construction complexity: High Utility impacts: Significant coordination works required. Corridor has 4 water lines running along corridor, sewer, sections of stormwater. 88mm gas line along south side of corridor. Roadway impacts: Significant. Minor arterial road. Pipe will likely be under the road. 2-way traffic (1- lane each way) during construction should be achievable, except for the narrow elevated road section adjacent Rodney Rd (~120m), which may require single lane alternating traffic. Third party utility relocation: Localised relocation of existing utilities may be required. The abandoned D900mm steel main running adjacent the existing Main No. 4 will need to be removed.		Length:480m Construction complexity: High Utility impacts: Significant. Coordination with existing utilities may require significant works or limit opportunities to locate the new pipe. Corridor has 4 water lines (including main No.4-1370mm), 1 sewer main, and sections of stormwater. Water and sewer service connections/interconnections and stormwater pipes cross the corridor frequently. 1 U/G electrical crossing. 88mm gas line along south side of corridor. Roadway impacts: Significant. Minor arterial road. Due to the location of existing utilities, particularly main No.4 (based on GIS map location), the new main would be installed close to the middle of the road, resulting in single lane alternating traffic during construction, with short periods of total road closure. Residential and commercial driveway access and parking be impacted. Third party utility relocation: Localised relocation of existing utilities may be required. The abandoned D900mm steel main running adjacent the		Length:720m Construction complexity: Moderate Utility impacts: Low-Moderate. Utility coordination works required. 1 water distribution line, 1 sewer main (200mm) and sections of stormwater line along the corridor. Water and sewer service connections and stormwater pipes cross the corridor frequently. 168mm gas line along west side of corridor, 4 gas distribution line crossings. Roadway impacts: Moderate. Collector road, moderate traffic volumes expected. Single lane alternating traffic control likely required during construction. Potentially sections of 2 way with reduced speed where road widens to 4 lanes, pending installation location. Residential and commercial driveway access will be impacted. Third party utility relocation: None anticipated.		Length:1060m Construction complexity: Low Utility impacts: Limited space within the road corridor means this alignment has assumed the use of the E&N rail trail. There are no major utility conflicts expected in this area. Roadway impacts: Minimal roadway impacts expected due to using the E&N rail trail. There will be impacts to bikes and pedestrians using the trail. Third party utility relocation: Minor relocation works may be required depending on the available space. From drawings, there are no obvious major utilities in this corridor.	2.9	Length: 2750 Construction Complexity: Mod-High
Operation and Maintenance	2.5	Location of the permanent right-of-way (accessibility, traffic management/disruption): Within active road corridor. Traffic control likely required when accessing the main. Traffic disruption expected and traffic management plan likely required.	2.5	Location of the permanent right-of-way (accessibility, traffic management/disruption): Pipe located within the road (under vehicle travel lane). Access for O&M will require a TMP likely specifying 1-way alternating traffic at the work zone.	3	Location of the permanent right-of-way (accessibility, traffic management/disruption): Pipe located within the road (under vehicle travel lane). Access for O&M will require a TMP with either 1-way alternating traffic or 2-way traffic with reduced speed, pending location in the corridor.	5	Location of the permanent right-of-way (accessibility, traffic management/disruption): Using the rail trail should allow for O&M staff to access the main without vehicle traffic control and risks of working adjacent live traffic.		
Connectivity and Project Synergies (adjudges as whole alignment, not in sections)	5	Connectivity: - Existing connection at Jacklin Road able to be retained. - Connection to the JdF at VMP can be retained or reinstated without crossing busy intersection. - Other potential connections to the JdF possible on all routes.								

Appendix D
Archaeological Overview Assessments

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ARCHAEOLOGICAL AND HERITAGE CONSULTING

July 17, 2024 MR 2340-4

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Via email: Jennifer.edwards@jacobs.com

Re: A2.1 Main No. 4 Upgrade – Goldstream Avenue Alignment – Archaeological Overview Assessment

Dear Jennifer Edwards,

Millennia Research Limited (Millennia) was contract by Jacobs Consultancy Canada Inc. (Jacobs) on behalf of the Capital Regional District (CRD) to conduct an archaeological overview assessment (AOA) for the proposed Main No. 4 Upgrades Project, Goldstream Avenue Alignment (Figure 1). According to the Consultative Areas Database (CAD), the project area is within the area of interest of the Esquimalt, Malahat, Pauquachin, Songhees, Tsartlip, Tsawout, and Tseycum First Nations, as well as that of the Te'Mexw Treaty Association.

The work consisted of a desktop review of the proposed project area. The review is intended to assess the potential for archaeological sites within the proposed project area to facilitate compliance with the *Heritage Conservation Act (HCA)*. The *HCA* provides automatic protection for recorded an unrecorded pre-1846 archaeological sites located on public and private land. Specifically, the review is intended to:

- Identify and evaluate the potential for archaeological resources within the proposed project area;
- Identify and evaluate potential impacts to any archaeological resources that may result from the proposed developments; and,
- Provide recommendations for any further archaeological work necessary to mitigate potential impacts to any archaeological resources within areas subject to ground disturbance.

This AOA report has compiled geographic, archaeological, and historical data from across the project area, providing an in-depth background review used to rate and rank potential impacts on archaeological materials for the various alignment segments; this information can also provide the background for any AIAs, mitigation, and monitoring strategies completed for the project. Several datasets were reviewed to provide context for archaeological work within the project area. Environmental research focused on sea level history for the Greater Victoria area. Topographical analysis was conducted using LiDAR data. The Provincial Heritage Register was accessed to locate archaeological sites within 250 m of the Project and any previous archaeological studies related to the area. Ethnographic resources were consulted to identify broader land use patterns and traditional practices which may have contributed to the formation of archaeological sites. An assessment of the degree of land alteration and the resulting integrity of various landforms from historical development was completed principally by examining Google Earth satellite imagery and Google Street View, Capital Regional District orthophotos, and LiDAR Hillshade.

In keeping with professional best practices, this AOA was conducted to the standards of the British Columbia Archaeology Branch (1998a), as well as the reporting standards of the British Columbia Association of Professional Archaeologists (1999).

Project Description

Main No. 4 is a high-pressure transmission main that delivers bulk drinking water to customers in the Greater Victoria area, including the Saanich Peninsula. The proposed Main No. 4 upgrade extends from Leigh Road to Veteran's Memorial Parkway. The Main No. 4 Upgrade project is part of a larger scope of work by the CRD to maintain, reinforce, and increase the Regional Water Supply (RWS). This project in particular focuses on a critical section of the transmission main that currently has no redundancy for the RWS and is at risk for failure in a seismic event due to the pipe material and lack of pipe restraint. This section of transmission main was also recommended for future upgrading in a previous study for hydraulic capacity purposes. Anticipated impacts from the proposed work will include trenching excavations along the alignment of the existing mains, as well as a potential for impacts from trenching along the alternate alignment segments outlined below. The project is divided into eight segments (Table 1) that make up the alignments under consideration. The potential alignments generally follow the developed roadways. As the final alignment has not yet been defined, this report analyzes the potential impacts to archaeological resources within each segment alone and does not comment on the complete alignment as a whole.

Table 1. Segments by location and length.

Segment	Description	km
A2.1-1	Goldstream Ave	1.8
A2.1-2	Leigh Rd; Trans-Canada Highway south lane; Veteran's Memorial Pkwy	3.25
A2.1-3	Leigh Rd; Dunford Ave	1.11
A2.1-4	Jacklin Rd	0.72
A2.1-5	Station Ave	1.04
A2.1-7	Brock Ave; Trans-Canada Highway to Veteran's Memorial Pkwy	0.77
A2.1-8	Spencer Rd	0.36
A2.1-9	Goldstream Ave; Leigh Rd to Spencer Rd	0.47

Methodology

The project area was subject to desk-based review of sources available through the online services of the BC Archaeology Branch and the Millennia in-house library. The project area was checked for previously recorded archaeological sites and modelled potential for unrecorded archaeological sites through the Archaeology Branch's Remote Access to Archaeological Data (RAAD) database. Archaeological and historical site data was obtained from all sites recorded near the project area from the RAAD database. The BC Archaeology Branch's Provincial Archaeological Report Library (PARL) was searched for reports related to previous archaeological surveys in the vicinity of the project area. Terms searched while using PARL included but are not limited to "DcRu-577", "DcRv-91", DcRv-168", "DcRv-169", "Florence Lake", and "Goldstream Avenue". Historical records were reviewed to assess the integrity of various landforms and identify historical land-altering activities which had the potential to damage earlier archaeological sites or result in material remains that could be found in excavations. Publicly available LiDAR imagery was referenced for further detail defining landforms and terrain.

Structured Decision Matrix

The structured decision matrix was derived from the analysis of the key variables identified during the desktop review relating to the distribution and potential distribution of archaeological sites across the landscape. The variables were ranked in hierarchical order based on whether they represented likely impacts to known archaeological sites in the project area, possible impacts to known sites in the project area, or within areas of archaeological potential.

Proximity to known sites was weighted the highest in the assessment. Known sites directly crossed by certain segment have the most risk for archaeological impact. They also will almost certainly require permitting to work within or near. Each linear metre of the segment within a site was assigned a value of "0.5" and the total summed. Each linear metre of a segment within 100 m of but not overlapping with a site was assigned a value of "0.2". Archaeological potential was weighted much lower than proximity to known sites. If the length of the modelled potential in a segment was 100 m or less, it was assigned a value of "1"; if it was more than 100 m it rated as "1" per 100 m of potential. All values were rounded up to the nearest 100 m. However, where the landscape analysis indicated that landscape or modelled archaeological potential had likely been severely impact by development, the length of potential was removed from the total score. Finally, where previous field assessment downgraded archaeological potential, modelled and landscape archaeological potential was removed from the analysis for the nearest 100 m.

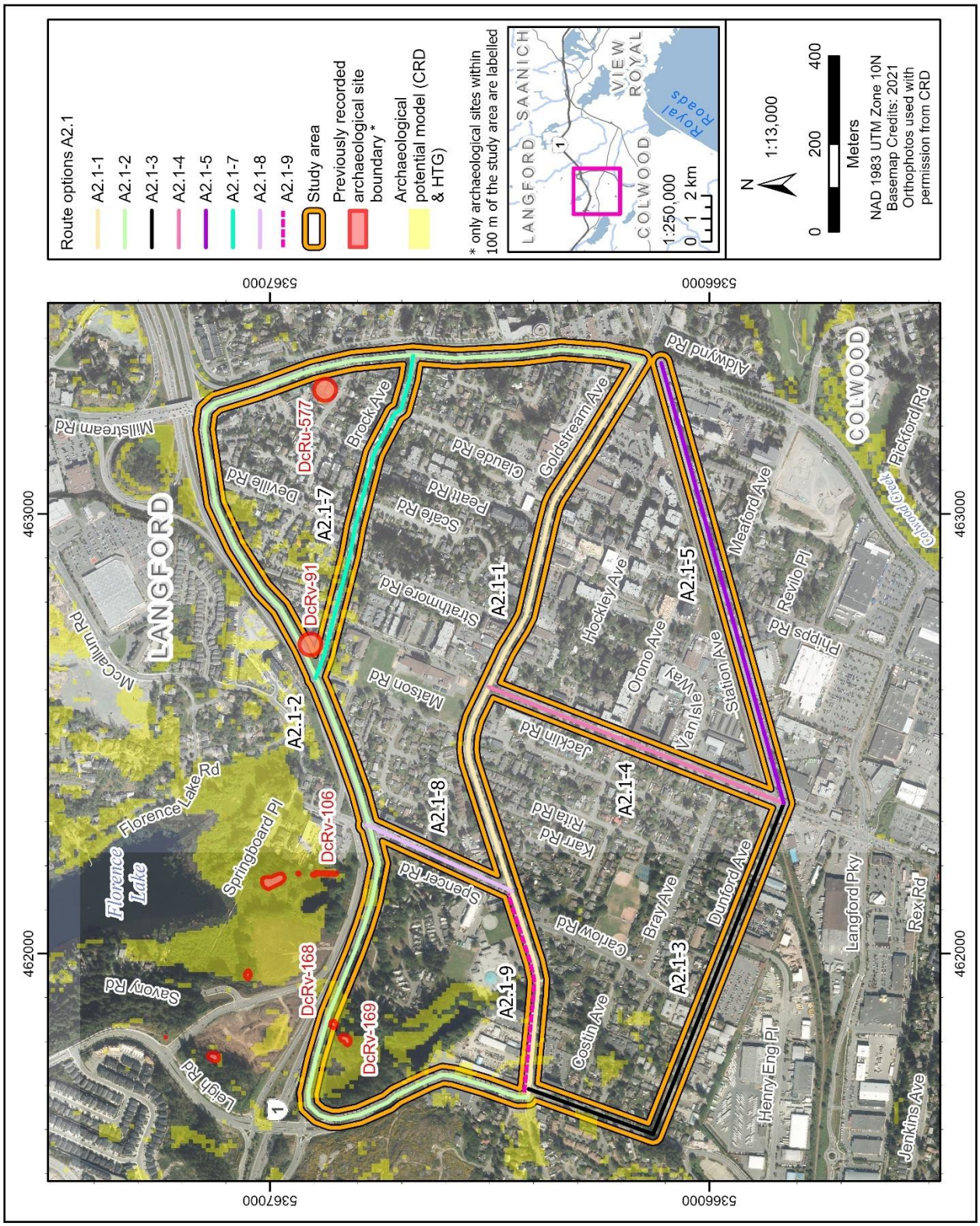


Figure 1. Project area map.

Study Area

Environment

Southeastern Vancouver Island, the Gulf Islands and a thin strip of the adjacent mainland of British Columbia fall into the Coastal Douglas-fir (CDF) biogeoclimatic zone as identified by Nuszdorfer *et al.* (1991). The islands of the zone have fewer wildlife species than mainland British Columbia. The CDF zone is characterized by warm, dry summers and mild, wet winters. Snowfall is minimal, with the region receiving the least amount for the shortest duration of any zone in British Columbia. Palaeoenvironmental studies of southern British Columbia indicate that although minor regional changes continued, relatively modern environmental conditions were established between 4,500-3,000 BP (Mathews 1985; Hebda 1995).

Sea Level History

Late Holocene sea level changes and tectonic events may have important implications for understanding the human and natural history of the Esquimalt Lagoon area. Hutchinson (1997:47) summarises the available evidence for relative sea level changes in the southern Strait of Georgia, the eastern Strait of Juan de Fuca and northern Puget Sound. About 13,000 years before present (BP) the relative sea level reached a maximum of 75 m above present-day sea level, then dropped to at least 10 m below present sea level between 12,000 and 11,000 years BP. The majority of the evidence indicates that relative sea levels stabilised at the present level by *ca*. 5,000 years BP.

Culture History

Archaeological sites are understood with reference to 'culture histories,' which are spatial and temporal frameworks established through archaeological research for the organization and analysis of material culture. The known culture history of the Salish Sea is comprised of at least six archaeological units, also known as phases or cultures (Table 1). In general, the more ancient the evidence, the more poorly understood it is, because the amount of data gets progressively smaller the more ancient the time period. The local archaeological cultures are reviewed in several sources, including Mitchell (1971, 1990), Matson and Coupland (1995) and Clark (2013), and a detailed summary of the closely-aligned Olympic Peninsula is provided in Morgan and Hartmann (1999). The various periods have been alternatively described as "Phases" which by definition should be confined to a relatively small area and short length of time, or the more widespread, long term, and potentially slow changing terms Culture Types or Traditions which seems more appropriate in this region (Abbott 1972). In practice, both sets of terms are used almost interchangeably. A portion of the Greater Victoria cultural sequence has been reviewed and revised (Clark 2000; Clark 2013), although not all Clark's revisions are consistent with the known record. The middle and later culture history periods are distinguished by mostly small changes and apparently gradual change between periods.

The oldest potential archaeological site in the Salish Sea region has been identified on the Olympic Peninsula, WA dating 13,800 calibrated years before present (cal. BP) (Waters, et al. 2011), and definite archaeological material occurs in Puget Sound at 12,500 cal. BP (Kopperl, et al. 2015). Two very early units present in the Puget Sound part of the Salish Sea (Clovis [13,200 – 12,800 cal. BP] and Western Stemmed [13,500 – 9,000 cal. BP]) have yet to be identified in the Strait of Georgia (Carlson and Magne 2008; Jenkins, et al. 2012). On the Strait of Georgia, the oldest published site is about 9,000 years old (Matson 1976). Sites dated significantly earlier have recently been found in the

northern Strait of Georgia. They are located at elevations associated with raised sea levels and the early postglacial period but to date, not publicly reported.

Table 2. Culture History Sequence of the Salish Sea Region.

Age (calibrated years Before Present)	Southernmost Vancouver Island and adjacent islands	Mainland/majority of Gulf Islands
Present–200 BP	Contact/Historic period	
200-1,100/1,500	Gulf of Georgia Culture Type	
1,100/1,500-2,000	Marpole Culture Type	Marpole Culture Type
2,000-2,400	Bowker Creek subphase of Locarno Beach	
2,400-3,300/3,500	Locarno Beach Culture Type	
3,300/3,500-5,000	Charles Culture Type	
5,000-9,000	Old Cordilleran/Cascade/Olcott Culture Type	
9,000-14,000+	Early traditions: Clovis, Western Stemmed	

There is considerable uncertainty regarding fundamental interpretations of the cultures that produced the record. For instance, the emergence of culture complexity in the form of an inherited stratified class society has been claimed for the Marpole (Matson and Coupland 1995), and the much earlier Charles (Coupland, et al. 2016) periods, while hints of it in the form of labrets and ear spools are also noted in the intermediate Locarno period (Cybulski 2010; Moss 2011). The development of cultural complexity was once seen as population replacement (Borden 1954; Borden 1968); then as a one-way evolution from simplicity to complexity (Fladmark 1982; Matson and Coupland 1995). Now cultural complexity is thought to be transitory, with wealth accumulation arising in the Charles/early Locarno periods, then returning to an egalitarian state during Locarno, then arising again part way through the Marpole period (Moss 2011; Coupland, et al. 2016). Carlson (2017) now suggests that the Locarno period was complex, with innovation and wealth and power demonstrated in art. The topic of status is complex with different lines of evidence suggesting status differentiation in most of the periods after about 5,000 BP (Schulting 1995; Burchell 2006; La Salle 2013).

Results

Previous Archaeology

Four previously recorded archaeological sites are located within the project area, and an additional five sites are within 250 m of the project area; however, three sites have been assigned legacy status. Legacy status indicates that all archaeological material has been removed and/or destroyed. All previously recorded sites in the vicinity of the project are outlined in Table 3.

Table 3. Previously recorded sites in vicinity of Project.

Site #	Within 50 m of Project	Status	Location/ Proximity to Project	Site Type

	Area (Y/N)			
DcRu-577	Y	Legacy	30 m west of Veteran's Memorial Pkwy; 152 m north of Larkhall Rd.	Shell midden
DcRv-91	Y	Legacy	4 m south of Trans-Canada Highway south lane; 8 m north of Brock Ave.	Lithics
DcRv-106	N	Protected	80 m north of Trans-Canada Highway south lane	Lithics, shell midden
DcRv-107	N	Protected	205 m north of Trans-Canada Highway south lane	Cairn, shell midden
DcRv-155	N	Protected	200 m north of Trans-Canada Highway south lane	Cairn, shell midden
DcRv-156	N	Protected	165 m north of Trans-Canada Highway south lane	Fire altered rock, lithics
DcRv-167	N	Protected	195 m north of Trans-Canada Highway south lane	Cairn
DcRv-168	Y	Protected	11 m south of Leigh Rd onramp to Trans-Canada Highway south	Lithics, shell midden
DcRv-169	Y	Protected	42 m south of Leigh Rd onramp to Trans-Canada Highway south	Lithics, shell midden

DcRu-577 is a subsurface shell midden located within the project area, 30 m west of Veteran's Memorial Parkway and 152 m north of Larkhall Road. The site measures 131 m north-south by 25 m east-west (Provincial Siteform, accessed July 11, 2024). The site was first recorded in 1995 by Millennia during archaeological testing and monitoring in support of the Vancouver Island Highway Project, Victoria Approaches. Evaluative shovel testing conducted by Millennia and backhoe trench excavations showed that the site had been extensively disturbed prior to work on the highway (Eldridge, et al. 1995). The site is considered to have been destroyed by highway construction following data recovery and has been assigned legacy status by the Archaeology Branch (Provincial Siteform, accessed July 11, 2024).

DcRv-91 is a surface and subsurface lithic scatter located within the project area, 4 m south of Trans-Canada Highway (south lane) and 8 m north of Brock Avenue. This site covers an estimated 4,500 m^2 area (Provincial Siteform, accessed July 11, 2024). DcRv-91 was first recorded in 1995 by Millennia during archaeological testing and monitoring in support of the Vancouver Island Highway Project, Victoria Approaches. Shovel tests and evaluative units excavated by Millennia recovered 18 flakes and one basalt projectile point preform from disturbed archaeological deposits. The site was recorded as severely disturbed by prior residential and highway development and is considered to have been destroyed by highway construction following testing; it has been assigned legacy status by the Archaeology Branch (Provincial Siteform, accessed July 11, 2024).

DcRv-106 is a surface and subsurface lithic scatter and inland shell midden located adjacent to the project area, 80 m north of Trans-Canada Highway (south lane) and east of a pond near the southern tip of Florence Lake. This site measures 58 m north-south by 5 m east-west. DcRv-106 was first recorded in 2000 as a chance find by Morley Eldridge of Millennia while "off duty" (Provincial Siteform, accessed July 12, 2024). Later shovel testing by Millennia recovered one piece of lithic debitage and fire-altered rock (Eldridge 2006). During a subsequent archaeological impact assessment (AIA) conducted by I.R. Wilson Consultants for residential/commercial development at two properties on Spencer Road and Savory Road, the site was recorded to be significantly disturbed, likely by land clearance during the construction of an adjacent gas station parking lot (Willows 2008). Shovel testing during this AIA resulted in the expansion of the site boundary 8 m northwest to

its current extent and determined that remaining cultural deposits (including shell, lithics, and faunal material) were mixed with historical debris to their maximum depth of 78 cm. The report for the 2008 AIA recommended no further archaeological work within DcRv-106 due to the displacement of remaining cultural deposits.

DcRv-107 is a shell midden site with an associated rock cairn located adjacent to the project area, 205 m north of Trans-Canada Highway south lane and southwest of Florence Lake. This site measures 13 m north-south by 21.8 m east-west (Provincial Siteform, accessed July 12, 2024). DcRv-107 was first recorded as a chance find by Michael Harvey and Pete Dady in 2000. While "off duty," Harvey and Dady recorded several exposures of shell midden material in a 5 m x 5 m area southwest of Florence Lake (Provincial Siteform, accessed July 12, 2024). A cairn, possibly associated with a burial, was identified during a subsequent AIA conducted by Millennia for the extension of Brock Ave to Savory Rd, during which the site boundary was expanded to its current extent (Brunsden 2006). Willows (2008) recommended site avoidance or monitoring under a Site Alteration Permit (SAP) if avoidance is not feasible.

DcRv-155 is a shell midden site with an associated cairn located near the project area, 200 m north of Trans-Canada Highway (south lane) and northeast of the aforementioned pond. This site measures 46 m north-south by 27 m east-west (Provincial Siteform, accessed July 12, 2024). DcRv-155 was first recorded during the 2006 AIA of the Brock Ave extension (Brunsden 2006). Shovel and augur tests during the 2006 AIA found degraded shell to 10 cm depth, as well as some surface lithics and FAR, and determined that the site was disturbed by bioturbation and by historical tree planting and levelling. Willows (2008) identified a cairn on the west side of Savory Rd during AIA work. The 2008 AIA report assessed the site significance as low due to disturbance but recommended monitoring of any ground-altering work under a SAP if site avoidance is not feasible.

DcRv-156 is a lithic scatter measuring approximately 5 m by 5 m and located near the project area, 165 m north of Trans-Canada Highway (south lane) and between DcRv-155 to the north and DcRv-106 to the south. DcRv-156 was first recorded during preliminary field reconnaissance in 2006 prior to the Brock Ave extension AIA (Brunsden 2006). A single flake and one piece of FAR were observed during the AIA. No further archaeological materials were identified during the 2008 Spencer Road-Savory Road AIA (Willows 2008), and no further archaeological work was recommended as the site is considered to be destroyed by road work. However, DcRv-156 is still listed as protected by the Archaeology Branch.

DcRv-167 comprises a group of three cairns within a site area of 20 m north-south by 15 m east-west. The cairns were first identified during the 2008 Spencer Road-Savory Road AIA (Willows 2008). No testing took place during the 2008 AIA. A summary of report findings on three evaluative excavations conducted by Stantec in 2013 (Permit 2013-0138) asserts that the cairns are non-archaeological due to the presence of historical debris under one cairn and the absence of archaeological materials in the excavations (Provincial Siteform, accessed July 12, 2024). The final permit report for this 2013 work is not available in PARL.

DcRv-168 is a shell midden scatter measuring approximately 15 m by 15 m. This site was first identified by surface shell and lithics during the 2008 Spencer Road-Savory Road AIA (Willows 2008). Shovel testing found subsurface deposits of midden to 20 cm below surface but noted significant disturbance. The site is considered to be of low significance, but Willows (2008) notes that a Site Alteration Permit will be required if further ground disturbance to the site is anticipated.

DcRv-169 is an inland shell midden measuring approximately 24 m north-south by 17 m east-west. This site was first identified during the 2008 Spencer Road-Savory Road AIA (Willows 2008) Midden deposits, some intact, were observed to 30 cm below surface and several pieces of faunal bone, some burnt, were recovered from evaluative units during the AIA. The site is considered to have moderate significance, but due to extensive shovel testing and mostly negative results during the 2008 AIA, Willows (2008) recommends only monitoring and raking under a SAP for further ground disturbance to the site.

Desktop Review

The proposed project area intersects areas of modelled archaeological potential along Leigh Road, Goldstream Avenue, and Brock Avenue, as well as along the Trans-Canada Highway between Skogstad Way and Deville Road. Modelled archaeological potential adjacent to the project area clusters around the pond south of Florence Lake, around the drainage running south from Florence Lake (see below), and around Langford Lake. Smaller pockets of modelled potential exist east of Veteran's Memorial Parkway from McCallum Road in the north to Atkins Avenue in the south, as well as south of Dunford Avenue and Station Avenue.

The LiDAR and aerial imagery of the area show a generally level to gently sloping terrain, except along the Trans-Canada Highway corridor, where the terrain has been substantially built up. Several bodies of water stand within and adjacent to the project area. A stream or creek can be seen running south from Florence Lake, crossing under McCallum Road, the Trans-Canada Highway, and Matson Road and then bending north and east to cross under Brock Avenue, Fergus Crescent, and Arncote Park before following the Trans-Canada east until it dips south and meets Mill Stream east of the project area (Figure 2). In addition to the pond south of Florence Lake and connected to it by a small drainage, another unnamed pond sits east of Leigh Road and north of Goldstream Avenue. The modelled archaeological potential surrounds the areas of these watercourses that have not been impacted by highway and road construction. Available fresh water tends to have a higher potential for archaeological material due to increased subsistence activities that water provides, such as fishing, hunting, and drinking water. Archaeological sites associated with these features could include lithic and faunal scatters or shell middens depending on the level of use and specific function.

The average relative sea-level of the project area ranges from approximately 65 m to 75 m above sea level (asl). As noted in the study area description, sea level was previously as high as 75 m more than the current relative sea level. This could place the project area either at or near the previous shoreline, which could explain some of the inland shell midden sites already identified in the general area. As with any coastal region, the archaeological potential is increased due to an increased presence of abundant subsistence resources and accessible transportation. Slightly raised landforms throughout the project area may have increase archaeological potential as they would provide ideal habitation locations with nearby fresh water from Florence Lake as well as the coastal resources.

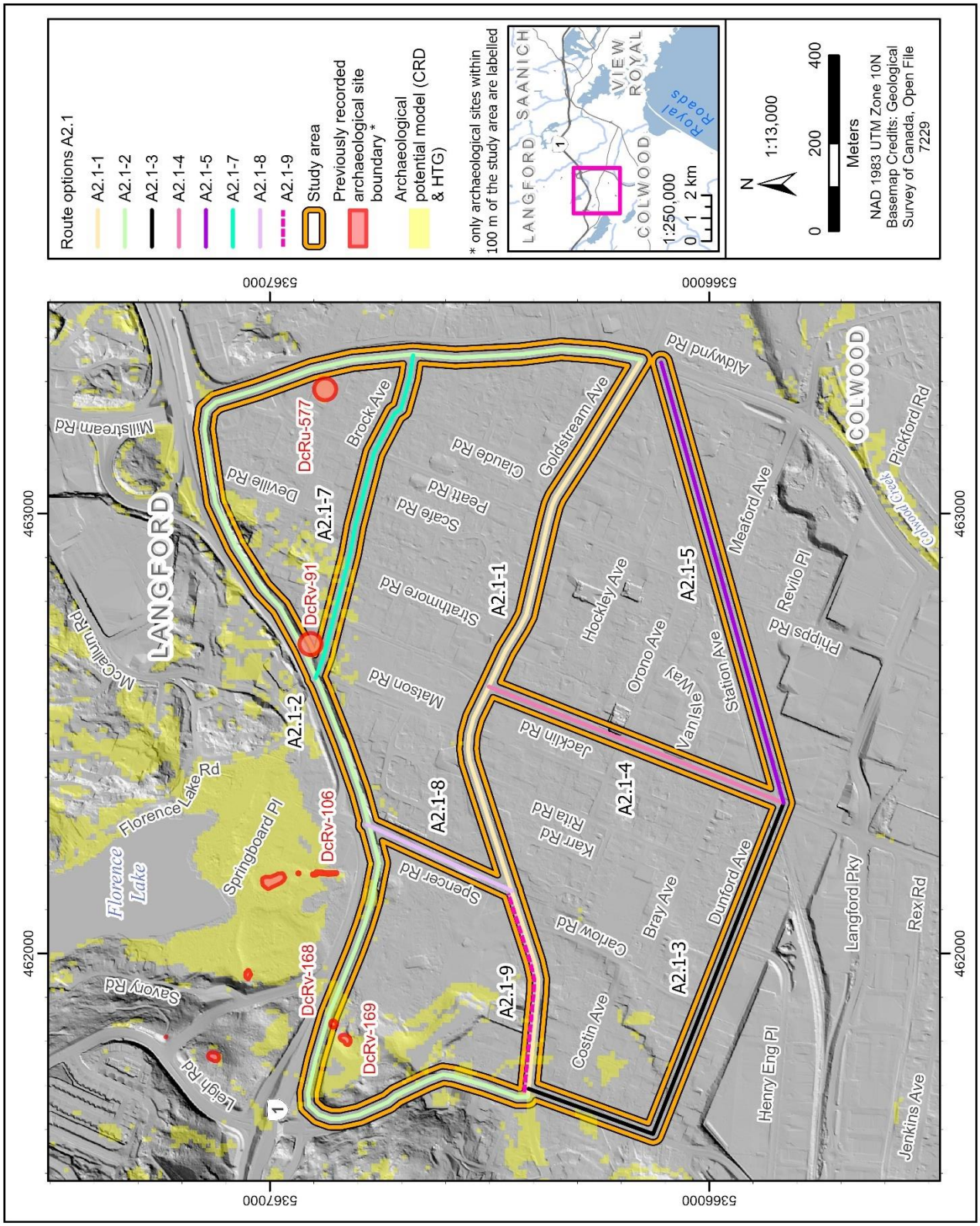


Figure 2. Project segment alignment with LiDAR.

Structured Decision Matrix

The eight segment options were analysed and weighed using the methodology discussed above and are shown in Figure 1. The results of each segment are presented in Table 4.

Table 4. Structured Decision Matrix by Segment.

Segment	Description	KM	Archaeological Assessment	Impact Rating
A2.1-1	Goldstream Ave	1.8	- 64.8 m of modelled archaeological potential	1
A2.1-2	Leigh Rd; Trans-Canada Highway south lane; Veteran's Memorial Pkwy	3.25	- 340.9 m within 100 m of an archaeological site (68.18) - 382.18 m of modelled archaeological potential (4)	72.18
A2.1-3	Leigh Rd; Dunford Ave	1.11	- Low potential impact	0
A2.1-4	Jacklin Rd	0.72	- Low potential impact	0
A2.1-5	Station Ave	1.04	- Low potential impact	0
A2.1-7	Brock Ave; Trans-Canada Highway to Veteran's Memorial Pkwy	0.77	- Low potential impact	0
A2.1-8	Spencer Rd	0.36	- Low potential impact	0
A2.1-9	Goldstream Ave; Leigh Rd to Spencer Rd	0.47	- 64.8 m of modelled archaeological potential	1

The majority of A2.1 alignment segment options contain a low potential to impact archaeological resources within the project area. Segments A2.1-3 to A2.1-8 do not traverse any modelled archaeological potential, nor do they pass close to or within the boundaries of any known archaeological sites. These routes generally fall within highly developed urban landscapes with no prominent landforms and otherwise level to gently sloping terrain which accounts for their low potential impact ratings.

Segments A2.1-1 and A2.1-9 each scored an impact rating of one as they both traverse less than 100 m of modelled archaeological potential but are not close to or within any known archaeological sites. The Goldstream Avenue segments both cross a small section of modelled archaeological potential towards the east near Leigh Road, which is likely due to be being near the base of the slopes and probably ephemeral water courses.

Segment A2.1-2 has the highest potential impact rating due to being within 382.18 m of modelled archaeological potential as well as being within 100 m of known archaeological sites for a total 340.09 m. This segment comes in close proximity to archaeological sites DcRv-91, DcRv-168, and DcRu-577; however, DcRv-91 and DcRu-577 have both been assigned legacy status and were therefore not included in the calculations, leaving only DcRv-168. Despite their legacy status, there does remain some potential for associated archaeological material to remain at DcRv-91 and DcRu-577, and although they are not included, they should not be considered to have zero risk.

Preliminary Potential Assessment and Recommendations

The desktop review and structured decision matrix have measured the degree of archaeological risk associated with each of the eight proposed project alignment options. The structured decision matrix was used to assign 'representative' values of risk to each route in order to identify which segment provides the least risk of impact to the archaeological record. Segment A2.1-

3 to A2.1-8 are the preferred segments from an archaeological perspective, followed by A2.1-1 and A2.1-9, with A2.1-2 being the least preferred segment.

General recommendations are presented with reference to segment options. As the project progresses and plans are refined, more specific recommendations can be made, upon segment selection.

- Refined project design plans should be reviewed by a professional archaeologist and applications should be made for a Section 12.2 Heritage Inspection Permit prior to subsurface investigations. Applying for the permit in advance allows for pre-construction archaeological testing and reduces the risk of extended delays if unanticipated archaeological resources are identified once construction begins.
- Upon project route selection, pre-construction testing, including shovel testing, geotechnical and environmental test monitoring, and mechanically assisted testing (where hand tools would be inadequate or deeply buried sediments are anticipated), of all areas of moderate or high modelled or assessed potential along the chosen alignment should be conducted under a Section 12.2 Heritage Inspection Permit.
- Archaeological construction monitoring should be conducted for all areas identified during the pre-construction testing containing archaeological material, suspected to contain archaeological material, or otherwise identified by the archaeological consultant, as per recommendations provided after pre-construction AIA testing assessments are completed.
- Archaeological awareness training should be provided for the contractor's crew members responsible for excavations and an archaeological chance find management plan should be developed. Cultural monitoring is recommended where appropriate and as requested by First Nations with an interest in the Project area.

Limitations

The current study is concerned with the management of archaeological sites which may be affected by the proposed development. As with any archaeological investigation involving a sampling strategy, unidentified cultural deposits may be present within the project area. On provincial land these deposits may be protected under the *Heritage Conservation Act* (*HCA*). If unanticipated archaeological remains (including but not limited to those identified as potential site types in this document) are encountered during construction or land-altering activity the developer is advised to halt work in the immediate area and contact a professional archaeologist and the appropriate regulatory agency.

The information contained in this report has been compiled specifically for the project as defined by the proponent and discussed herein. Any subsequent changes to the proposed project may not be addressed by the current archaeological study and additional studies may be appropriate.

Professional Statement

The information compiled in this report has been prepared in accordance with the standards of the BC Association of Professional Archaeologists and the BC Archaeological Impact Assessment Guidelines (British Columbia Archaeology Branch 1998). The report has been prepared by Millennia Research Limited staff and reviewed by a senior archaeologist (see signatories below).

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Per:





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Appendix E
Sensitivity Analysis Assessment Results

Appendix E. Sensitivity Analysis Assessment Results

E.1 Mains No. 1, 3, and 14 Supplementing Flows in Main No. 14

Project A2.1
High-Level Feasibility Alignment Review
Multi-Criteria Assessment

ASSESSMENT CRITERIA	WEIGHTING FACTOR	TECHNICAL SCORE								SCORING RATIONALE							
		OPT 1	OPT 2	OPT 3	OPT 4	OPT 5	OPT 6	OPT 7	OPT 8	OPT 1: Goldstream Avenue (1,800m Long)	OPT 2: Goldstream - Spencer - Hwy 1 (1,890m Long)	OPT 3: Goldstream - Spencer - Hwy 1 - Brock - Larkhall - VMP (2,500m Long)	OPT 4: Leigh - Hwy 1 (2,250m Long)	OPT 5: Leigh - Hwy 1 - Brock - Larkhall - VMP (2,850m Long)	OPT 6: Leigh - Dunford - Station (2,190m Long)	OPT 7: Leigh - Dunford - Jacklin - Goldstream (2,680m Long)	OPT 8: Goldstream - Jacklin - Station (2,750m Long)
Archaeological and Cultural Impacts	8%	3.9	3.9	2.7	3.7	2.4	4.3	4.5	4.5	Interacts with areas of archaeological potential on Goldstream Avenue (Leigh Rd to Jacklin Rd)but does not have any previously recorded sites. The section of Goldstream Avenue east of Jacklin Road does not have any areas with identified archaeological potential. There are no previously recorded sites on this alignment.	This alignment interacts with areas of archaeological potential and a previously recorded site on Highway 1 (near Brock Avenue) and near Veterans Memorial Parkway (north of Brock Avenue). There are also areas of archaeological potential on Goldstream Avenue and Spencer Road.	This alignment interacts with a previously recorded site and area of archaeologists potential near Highway 1 and Brock Avenue. Larkhall Road and Veterans Memorial Parkway (south of Larkhall Road) do not have any identified areas of archaeological potential or previously recorded sites.	This alignment interacts with areas of archaeological potential and a previously recorded site on Highway 1 (near Brock Avenue) and near Veterans Memorial Parkway (north of Brock Avenue). There are also areas of archaeological potential on Goldstream Avenue.	This alignment interacts with a previously recorded site and area of archaeologists potential near Highway 1 and Brock Avenue. Larkhall Road and Veterans Memorial Parkway (south of Larkhall Road) do not have any identified areas of archaeological potential or previously recorded sites.	There is an area of archaeological potential identified on Leigh Road, however this alignment option does not interact with any other archaeological areas of potential or previously recorded sites.	There is an area of archaeological potential identified on Leigh Road, however this alignment option does not interact with any other archaeological areas of potential or previously recorded sites.	There is an area of archaeological potential identified on Goldstream Avenue, however this alignment option does not interact with any other archaeological areas of potential or previously recorded sites.
Social Impacts (Residential, Business and Traffic)	10%	1.5	2.4	2.4	2.7	2.6	3.1	1.9	3.7	Goldstream Avenue is a high volume transit corridor. Construction is expected to result in a lane closure which will impact vehicles, buses, and bike traffic to a number of properties along the mixed-use corridor which include residential, commercial, and two schools. Particularly, the section of Goldstream Avenue east of Jacklin Road is particularly congested and social impacts are expected to be significant.	Social impacts are expected to be major for this route. Goldstream Avenue, Highway 1 and Veterans Memorial Parkway are major traffic routes in the area and, while there are no lane closures expected on Highway 1 due to construction, impacts are still expected to be significant. Spencer Road is a dead-end corridor with limited residential and commercial use, reduction to single lane for this corridor is not expected to be a significant issue.	Social impacts are expected to be moderate for this route. While the impacts on Goldstream Avenue and Veterans Memorial Parkway are expected to be significant, this is for short distances. Construction on Highway 1 is also expected to be able to be completed without lane closures. Spencer Road, Brock Avenue, and Larkhall Road have low traffic volumes and lane closures on these roads is not expected to be significant. However, Brock Avenue and Larkhall Road are residential streets and the increased noise during construction may have adverse effects.	Social impacts are expected to be major for this route. While no lane closures are expected for Leigh Road or Highway 1, there is expected to be a longer duration of speed reduction on the highway due to construction being completed from Leigh Road to Veterans Memorial Parkway. Impacts on Veterans Memorial Parkway are expected to be significant as this will result in lane closures on a congested corridor.	Social impacts are expected to be moderate to low for this alignment. While the impact on Veterans Memorial Parkway is expected to be significant, this is for a short distance. Construction on Leigh road and Highway 1 is also expected to be able to be completed without lane closures. Brock Avenue and Larkhall Road have low traffic volumes and lane closures are not expected to have significant impacts. However, Brock Avenue and Larkhall Road are residential streets and the increased noise during construction may have adverse effects.	Social impacts are expected to be minor. While the reduced width of the Leigh Road corridor will likely result in single lane alternating traffic during construction, both Dunford Avenue and Station Avenue have lower volumes of traffic and the impacts are not expected to be significant. However, the section of Goldstream Avenue in this alignment is the busiest part of Goldstream Avenue and the impacts there are expected to be major.	Social impacts are expected to be moderate to low for this alignment. While the route goes down Goldstream Avenue to Jacklin Road, this section of Goldstream Avenue is less busy than the section to the east of Jacklin Road. Both Jacklin Road and Station Avenue have low volumes of traffic and impacts are not expected to be major.	Social impacts are expected to be moderate to low for this alignment. While the route goes down Goldstream Avenue to Jacklin Road, this section of Goldstream Avenue is less busy than the section to the east of Jacklin Road. Both Jacklin Road and Station Avenue have low volumes of traffic and impacts are not expected to be major.
Environmental Impacts	8%	4.0	3.4	3.8	2.3	3.0	2.9	4.2	3.1	Potential tree impacts around 1060 Goldstream Avenue which may be associated with the wetland/riparian area adjacent to this. East of this location, no tree clearing or vegetation impacts are expected.	Potential tree impacts around 1060 Goldstream Avenue which may be associated with the wetland/riparian area adjacent to this. East of this location, no tree clearing or vegetation impacts are expected. This option has accounted the gas station at the intersection of Goldstream Avenue and Veterans Memorial Parkway, however this may change with the alignment of the median. There are also potential environmental risks associated with rock excavation (and potential blasting) for construction on Highway 1.	Potential tree impacts around 1060 Goldstream Avenue which may be associated with the wetland/riparian area adjacent to this. There are also potential ornamental trees which may be impacted on Brock Avenue. Other than these two areas, there is no tree clearing anticipated and all remaining trees appear to be columnted. There are also potential environmental risks associated with rock excavation (and potential blasting) for construction on Highway 1.	Wetland complex on Leigh Road (Spencer's Pond Park) contains environmentally sensitive plants, frogs, butterfly, and a critical habitat for the painted turtle. There's also a steep slope towards this completed. Ornamental tree clearing also expected on Brock Avenue. No major impacts are anticipated on Highway 1 or Veterans Memorial Parkway. There are also potential environmental risks associated with rock excavation (and potential blasting) for construction on Highway 1.	Wetland complex on Leigh Road (Spencer's Pond Park) contains environmentally sensitive plants, frogs, butterfly, and a critical habitat for the painted turtle. There's also a steep slope towards this completed. Completed Highway 1 or Veterans Memorial Parkway. There are also potential environmental risks associated with rock excavation (and potential blasting) for construction on Highway 1.	There are several trees in close proximity to Leigh Road which may be impacted, however it is assumed that work will occur in the existing paved areas. There are also a small number of mature trees at the intersection of Dunford Avenue and Station Avenue which may be impacted.	There are several trees in close proximity to Leigh Road which may be impacted, however it is assumed that work will occur in the existing paved areas. There are also a small number of mature trees at the intersection of Dunford Avenue and Station Avenue which may be impacted.	Potential tree impacts around 1060 Goldstream Avenue which may be associated with the wetland/riparian area adjacent to this.
Resiliency (Geotechnical, Seismic & Proximity to Other Mains)	10%	3.5	3.1	3.4	3.2	3.6	3.8	3.7	3.7	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain, Topography: Flat (0 - 5degrees) overall slope, Groundwater: Estimated to be Moderately deep (>5m) in dry season. Seismic Demand: Assumed Site Class C. No other major transmission mains identified in this corridor other than the existing Main No. 4 which is expected to be decommissioned.	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain and possible (D3) Peat over Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees), Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C. No other major transmission mains identified in these corridors other than Main No. 14 on Veterans Memorial Parkway. The existing Main No. 4 is expected to be decommissioned. The presence of the existing main is not expected to significantly increase the seismic risk.	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain and possible (D3) Peat over Sand and Gravel of the Colwood Delta and Outwash Plain. There are also sections with possible thin soil or bedrock outcrops. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C. No other major transmission mains identified in these corridors other than Main No. 14 on Veterans Memorial Parkway. The presence of the existing main is not expected to significantly increase the seismic risk.	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain and possible (D3) Peat over Sand and Gravel of the Colwood Delta and Outwash Plain. There are also sections with possible thin soil or bedrock outcrops. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C. No other major transmission mains identified in these corridors other than Main No. 14 on Veterans Memorial Parkway. The presence of the existing main is not expected to significantly increase the seismic risk.	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain and possible (D3) Peat over Sand and Gravel of the Colwood Delta and Outwash Plain. There are also sections with possible thin soil or bedrock outcrops. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C. No other major transmission mains identified in these corridors other than Main No. 14 on Veterans Memorial Parkway. The presence of the existing main is not expected to significantly increase the seismic risk.	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain: Topography: Flat (0-5 degrees), Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C. Main No. 1 and Main No. 3 are also present on Station Avenue. The presence of the existing mains is not expected to significantly increase the seismic risk as it is expected that the new main will be seismically resilient and able to span a crater created by an adjacent main break.	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Potentially some shallowed groundwater on Goldstream Avenue section. Seismic Demand: Assumed Site Class C. No other major transmission mains are identified in these corridors. The existing Main No. 4 is expected to be decommissioned.	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Potentially some shallowed groundwater on Goldstream Avenue section. Seismic Demand: Assumed Site Class C. Main No. 1 and Main No. 3 are also present on Station Avenue. The existing Main No. 4 is expected to be decommissioned.The presence of the existing mains is not expected to significantly increase the seismic risk as it is expected that the new main will be seismically resilient and able to span a crater created by an adjacent main break.
Constructability Impacts (Including Third-Party Utility Impacts)	10%	1.3	2.1	2.6	2.3	2.7	3.9	3.0	3.1	Existing utilities including Main No.4 will limit routing options for the new main. Traversing a large number of storm and sewer laterals along the entire section of Goldstream Avenue also perceived as an added complexity. Would be very involved for a contractor to maintain business access along this route, productivity would likely suffer as the work zone would probably need to be kept tight. Mature trees in medians and boulevards could potentially be in the way.	Existing utilities including Main No.4 along Goldstream will limit routing options for the new main. Maintaining access along Spencer Rd will be a challenge as this is a dead-end narrow road with existing utilities to work around. Consideration also required for emergency services and alternate parking options. TCH will require significant coordination with MoTI. If routing along southern boulevard, about 60% the alignment might need to be cut down (including in rock) and another 20% built up.	Existing utilities including Main No.4 along Goldstream will limit routing options for the new main. Maintaining access along Spencer Rd will be a challenge as this is a dead-end narrow road with existing utilities to work around. Consideration also required for emergency services and alternate parking options. TCH will require significant coordination with MoTI. If routing along southern boulevard, about half the alignment might need to be cut down (including in rock) and another 20% built up. Multi-residential complexes along Brock and Larkhall may only have access from one driveway. Consider opportunity to widen driveway and/or locate pipe joints to maintain access to this properties.	Leigh Rd: municipal WM, gravity mains, larger forts main and 8CH ducts. The road is narrow and there are options to relocate utilities if required. Businesses typically have 2 driveways. TCH: It appears the area for the Leigh road on-ramp would need to be built up significantly which is ~150% of alignment. Another 10% might need to be built up, with ~80% needing to be cut down including rock. Access would mainly be from HWY1 and we would need to consider several utility crossings near Spencer. There is also some type of headwall west of Spencer. Site access would probably be limited to HWY1. Coordination with MoTI will be required. Multi-residential complexes along Brock and Larkhall may only have access from one driveway. Consider opportunity to widen driveway and/or locate pipe joints to maintain access to this properties. Some larger utilities present in VMP. Relocations may be required. Parkway is wide which give options for relocation if required.	Leigh Rd: municipal WM, gravity mains, larger forts main and 8CH ducts. The road is narrow and there are options to relocate utilities if required. Businesses typically have 2 driveways. TCH: It appears the area for the Leigh road on-ramp would need to be built up significantly which is ~150% of alignment. ~50% needing to be cut down. Access would probably be from HWY1 and we would need to consider several utility crossings near Spencer. Site access would probably be limited to HWY1. Coordination with MoTI will be significant. Multi-residential complexes along Brock and Larkhall may only have access from one driveway. Consider opportunity to widen driveway and/or locate pipe joints to maintain access to this properties. Some larger utilities present in VMP. Relocations may be required. Parkway is wide which give options for relocation if required.	Leigh Rd: Relatively congested utility corridor with watermain, gravity mains, 8CH conduit, larger forts main. Dunford Rd: Most utilities are present, but the road is wide enough to allow relocations. The businesses usually have driveways that will allows for flexible access. Station Ave: Many utilities present including 150 WM, asbestos 150 watermain, 8CH, gravity mains, smaller forts, 8CH, comms. Larger watermain and AC might complicate relocation and routing. Transit hub may be difficult to work around and might need to be relocated. Businesses generally have wide or double driveways.	Leigh Rd: Relatively congested utility corridor with watermain, gravity mains, 8CH conduit, larger forts main. Dunford Rd: Most utilities are present, but the road is wide enough to allow relocations. The businesses usually have driveways that will allows for flexible access. Jacklin: Most utilities are present including larger forts main, watermain, gravity mains, comms. The road is wide and could accomodate relocation if required. Most driveways have duplicate entrances or are wide. Goldstream: Existing 1372 WM, also 350/400 DI, comms, gravity, larger forts present. The existing 1372 would limit routing options for the new main as any potential relocations, although likely very involved for a contractor to maintain business access along this route, productivity would likely suffer as the work zone would probably need to be kept tight. Mature trees in medians and boulevards could potentially be in the way.	Leigh Rd: Relatively congested utility corridor with watermain, gravity mains, 8CH conduit, larger forts main. Dunford Rd: Most utilities are present, but the road is wide enough to allow relocations. The businesses usually have driveways that will allows for flexible access. Jacklin: Most utilities are present including larger forts main, watermain, gravity mains, comms. The road is wide and could accomodate relocation if required. Most driveways have duplicate entrances or are wide. Goldstream: Existing 1372 WM, also 350/400 DI, comms, gravity, larger forts present. The existing 1372 would limit routing options for the new main as any potential relocations, although likely very involved for a contractor to maintain business access along this route, productivity would likely suffer as the work zone would probably need to be kept tight. Mature trees in medians and boulevards could potentially be in the way.
Property and Land Acquisition Impacts	5%	4.3	3.7	3.8	3.5	3.7	3.8	4.1	4.1	Temporary rights-of-way (ROW): Construction corridor within road ROW. Compound areas opportunities along route: Limited (private land). Permanent ROW: In existing road ROW on Goldstream Avenue where the CRD already have a ROW for the existing Main No. 4.	Temporary ROW: Construction corridor within road ROW. Compound areas opportunities along route: Combination of private and public land Permanent ROW: In existing road ROW. However, the CRD will likely need to obtain a ROW from MoTI for the sections of the main on Hwy 1 so that they are able to do future work on their main without the need for obtaining additional permits (notification would suffice).	Temporary ROW: Construction corridor within road ROW. Compound areas opportunities along route: Combination of private and public land Permanent ROW: In existing road ROW. However, the CRD will likely need to obtain a ROW from MoTI for the sections of the main on Hwy 1 so that they are able to do future work on their main without the need for obtaining additional permits (notification would suffice).	Temporary ROW: Construction corridor within road ROW. Compound areas opportunities along route: Combination of private and public land Permanent ROW: In existing road ROW. However, the CRD will likely need to obtain a ROW from MoTI for the sections of the main on Hwy 1 so that they are able to do future work on their main without the need for obtaining additional permits (notification would suffice).	Temporary ROW: Construction corridor within road ROW. Compound areas opportunities along route: Combination of private and public land Permanent ROW: In existing road ROW. However, the CRD will likely need to obtain a ROW from MoTI for the sections of the main on Hwy 1 so that they are able to do future work on their main without the need for obtaining additional permits (notification would suffice).	Temporary ROW: Construction corridor within road ROW. Compound areas opportunities along route: Limited (mostly private land) Permanent ROW: In existing road ROW.	Temporary ROW: Construction corridor within road ROW. Compound areas opportunities along route: Limited (mostly private land) Permanent ROW: In existing road ROW. However, based on the assumed alignment down the centre of Station Avenue, there would need to be two crossings of the existing rail line. While this line is not currently used, it is understood that a ROW will still be required for this.	Temporary ROW: Construction corridor within road ROW. Compound areas opportunities along route: Limited (mostly private land). Rail corridor along Station Ave. Permanent ROW: In existing road ROW. However, based on the assumed alignment down the centre of Station Avenue, there would need to be two crossings of the existing rail line. While this line is not currently used, it is understood that a ROW will still be required for this.
Capital Expenditure Impacts	35%	2.1	3.9	1.5	3.9	1.5	3.9	1.0	2.1	- Construction complexity: High - Utility impacts: Significant. Corridor is heavily congested with existing utilities (water, sewer, stormwater, sections of GJG electrical and gas) and existing water main No.4 (1370mm). The abandoned D900mm steel main on Goldstream Avenue would also be required for removal to allow adequate space for constructing the new main. - Roadway impacts: Significant. High traffic volumes in an active commercial area. Pipe will likely be constructed under pavement. - Third party utility relocation: May be required. (- High CAPEX impacts score due to short length)	Construction complexity: High Utility impacts: Significant coordination works required along Goldstream Ave. Large number of distribution lines for water, sewer, gas, electrical. Main No.4 on Goldstream. The abandoned D900mm steel main on Goldstream Avenue would also be required for removal to allow adequate space for constructing the new main. Roadway impacts: Moderate - Significant. High traffic volumes on Goldstream, TCH. Traffic impacts to Goldstream Ave are subject to the location of existing utilities and available space for the new main. On TCH, 2 lanes east bound could potentially remain open (with speed reduction and localised realignment (and work zone) during works, subject to alignment frustration and discussions with MoTI. Third party utility relocation: Potentially significant relocation works, depending on the available space and preference of service relocation or construction in travel lanes. (- Low CAPEX impacts score due to long length combined with construction complexity)	Construction complexity: Moderate - High Utility impacts: Significant coordination works required along Goldstream Ave and VMP. Large number of distribution lines for water, sewer, gas, electrical. Main No.4 on Goldstream. The abandoned D900mm steel main on Goldstream Avenue would also be required for removal to allow adequate space for constructing the new main. New main would likely be located under roadway unless significant utility relocation is undertaken. Roadway impacts: Moderate - Significant. High traffic volumes on Goldstream, TCH and VMP. Traffic impacts to Goldstream Ave are subject to the location of existing utilities and available space for the new main. On TCH, 2 lanes east bound could potentially remain open (with speed reduction and localised realignment (and work zone) during works, subject to alignment frustration and discussions with MoTI. Spencer, Brock and Larkhall are local roads. Brock and Larkhall in particular are likely to require full closure during construction. Third party utility relocation: Potentially significant relocation works, particularly along Goldstream and VMP	Construction complexity: Moderate Utility impacts: Moderate. Minor coordination works required for Leigh, TCH, Larkhall and VMP. Roadway impacts: Moderate - Significant. High traffic volumes on TCH and VMP. Traffic impacts to VMP are subject to the location of existing utilities and available space for the new main. On TCH, 2 lanes east bound could potentially remain open (with speed reduction and localised realignment (and work zone) during works, subject to alignment frustration and discussions with MoTI. Maintaining 2-way traffic on Leigh Rd should be achievable during construction. Spencer, Brock and Larkhall are local roads. Brock and Larkhall in particular are likely to require full closure during construction. Third party utility relocation: Potentially significant relocation works, particularly along VMP.	Construction complexity: Moderate Utility impacts: Moderate. Minor coordination works required for Leigh, TCH, Larkhall and VMP. Roadway impacts: Moderate - Significant. High traffic volumes on TCH and VMP. Traffic impacts to VMP are subject to the location of existing utilities and available space for the new main. On TCH, 2 lanes east bound could potentially remain open (with speed reduction and localised realignment (and work zone) during works, subject to alignment frustration and discussions with MoTI. Maintaining 2-way traffic on Leigh Rd should be achievable during construction. Spencer, Brock and Larkhall are local roads. Brock and Larkhall in particular are likely to require full closure during construction. Third party utility relocation: Potentially significant relocation works, particularly along VMP.	Construction complexity: Moderate-High - Utility impacts: Significant along Station Ave - Corridor has Main No.1 (1067mm), Main No.3 (991mm), water, sewer, gas, electrical and telus. Limited space between rail corridor boundary, and existing mains to locate the new main off the road. Potentially inadequate space for the new main in corridor without significant utility relocation works or installation in the centre of the road. Typical utility (distribution network) coordination works required for Leigh and Dunford. Significant utility relocation works required along Leigh and Dunford. Potentially telus crossing for Station Ave pending pipe location within road corridor. Third party utility relocation: Minor up to significant relocations may be required along Station Ave depending on the available space and preference of utility relocation vs installation in the road.	Construction complexity: Moderate-High - Utility impacts: Significant along Goldstream - Corridor is heavily congested with existing utilities (water, sewer, stormwater, sections of GJG electrical and gas) and existing water main No.4 (1370mm). Limited space between rail corridor boundary, and existing mains to locate the new main off the road. Potentially inadequate space for the new main in corridor without significant relocation works or installation in the centre of the road. - Roadway impacts: Significant along Goldstream, high traffic volumes in an active commercial area. Pipe will likely be constructed under pavement. - Roadway impacts: Moderate-Significant. High traffic volumes in an active commercial area along Goldstream. Goldstream has moderate traffic volumes but may require total road closure pending available space and pipe location within road corridor. - Third party utility relocation: Minor up to significant relocation works may be required along Goldstream and Station Ave depending on the available space and preference of utility relocation vs installation in the road.	Construction complexity: Moderate - High Utility impacts: Significant along Goldstream and Station Ave. The abandoned D900mm steel main on Goldstream Avenue would also be required for removal to allow adequate space for constructing the new main. Goldstream corridor is heavily congested with existing utilities (water, sewer, stormwater, electrical, gas) and existing water main No.4 (1370mm). Station Ave has Main No.1 (1067mm), Main No.3 (991mm), water, sewer, gas, electrical and telus. Limited space between rail corridor boundary, and existing mains to locate the new main off the road. Potentially inadequate space for the new main in corridor without significant relocation works or installation in the centre of the road. Roadway impacts: Moderate-Significant. High traffic volumes in an active commercial area along Goldstream. Station Ave has moderate traffic volumes but may require total road closure pending available space and pipe location within road corridor. SLAT during construction along Jacklin. Third party utility relocation: Minor up to significant relocation works may be required along Goldstream and Station Ave depending on the available space and preference of utility relocation vs installation in the road.
Operation and Maintenance	8%	2.5	1.8	2.6	1.8	2.5	4.0	2.8	3.2	Pipe located within the road (under vehicle travel lane). Access will require a TMP likely specifying 1-way alternating traffic past the work zone.	Pipe located within road corridor (and under road in sections). Access will require a TMP likely specifying the following arrangement: - Goldstream and Spencer Ave: SLAT TCH: Speed reduction past work zone, subject to pipe location in the corridor, location of the permanent jersey barrier, access methodology, agreements with MoTI, and scale of works required. This will require O&M staff to park on the highway as there is not sufficient space for maintenance bays. Access agreements will MoTI will be required for the length along TCH.	Pipe located within road corridor (and under road in sections). Access will require a TMP likely specifying the following arrangement: - Goldstream, Spencer Ave, Brock, Larkhall: SLAT TCH: Speed reduction past work zone, subject to pipe location in the corridor, location of the permanent jersey barrier, access methodology, agreements with MoTI, and scale of works required. This will require O&M staff to park on the highway as there is not sufficient space for maintenance bays. Access agreements will MoTI will be required for the length along TCH.	Pipe located within road corridor (and under road in sections). Access will require a TMP likely specifying the following arrangement: - Leigh Rd: SLAT or 2-way with speed reduction for southern portion under the road. - Brock and Larkhall: SLAT TCH: Speed reduction past work zone, subject to pipe location in the corridor, location of the permanent jersey barrier, access methodology, agreements with MoTI, and scale of works required. This will require O&M staff to park on the highway as there is not sufficient space for maintenance bays. Access agreements will MoTI will be required for the length along TCH.	Pipe located within road corridor (and under road in sections). Access will require a TMP likely specifying the following arrangement: - Leigh Rd: SLAT or 2-way with speed reduction for southern portion under the road. - Brock and Larkhall: SLAT TCH: Speed reduction past work zone, subject to pipe location in the corridor, location of the permanent jersey barrier, access methodology, agreements with MoTI, and scale of works required. Access agreements will MoTI will be required for the length along TCH.	Pipe located within the road (under vehicle travel lane). Access will require a TMP likely specifying the following arrangement: - Leigh and Dunford: SLAT - Station Ave: SLAT or full road closure depending on location of pipe within road corridor	Pipe located within the road (under vehicle travel lane). Access will require a TMP likely specifying the following arrangement: - Leigh and Dunford: SLAT - Station Ave: SLAT or full road closure depending on location of pipe within road corridor	Pipe located within the road (under vehicle travel lane). Access will require a TMP likely specifying the following arrangement: - Goldstream and Jacklin: SLAT - Station Ave: SLAT or full road closure depending on location of pipe within road corridor
Connectivity	10%	4.0	2.5	3.0	1.0	2.5	4.5	5.0	5.0	- Follows the existing alignment, which allows for maintaining existing network connections and operational arrangement to service existing branch connections at both Jacklin Rd and VMP. - Limited opportunity for additional diff connections. - Limited opportunity for additional connections to Mains 1 or 3	- Existing connection at Jacklin Road no longer possible. However, there is the potential to re-instate the connections at Spencer Rd - Intersection works would also be required to reinstate the connection to Main No. 1 as the alignment of the new Main No. 4 would be on the western side of VMP. - Limited opportunity to connect to the Jdf on Hwy 1 without connecting to the south through the road batter or by constructing a connection underneath the highway to the north.	- Existing connection at Jacklin Road no longer possible. However, there is the potential to re-instate the connections at Spencer Rd - Intersection works would also be required to reinstate the connection to Main No. 1 as the alignment of the new Main No. 4 would be on the western side of VMP. - Limited opportunity to connect to the Jdf on Hwy 1 without connecting to the south through the road batter or by constructing a connection underneath the highway to the north. - Some opportunity for additional connections to the Jdf on Brock or Larkhall Rd.	- Existing connection at Jacklin Road no longer possible. - Limited connections possible on Leigh Rd as the main terminates south of Highway 1. - Intersection works would also be required to reinstate the connection to Main No. 1 as the alignment of the new Main No. 4 would be on the western side of VMP. - Limited opportunity to connect to the Jdf on Hwy 1 without connecting to the south through the road batter or by constructing a connection underneath the highway to the north. - Some opportunity for additional connections to the Jdf on Brock or Larkhall Rd.	- Existing connection at Jacklin Road no longer possible. - Limited connections possible on Leigh Rd as the main terminates south of Highway 1. - Intersection works would also be required to reinstate the connection to Main No. 1 as the alignment of the new Main No. 4 would be on the western side of VMP. - Limited opportunity to connect to the Jdf on Hwy 1 without connecting to the south through the road batter or by constructing a connection underneath the highway to the north. - Some opportunity for additional connections to the Jdf on Brock or Larkhall Rd.	- Existing connection at Jacklin Road no longer possible. however there is the potential to reinstate this at the intersection of Jacklin Rd with Dunford/Station. - Other potential connections to the Jdf possible on all routes. -Connection to Main No. 1 and 3 able to be reinstated on Station Ave or Goldstream. Additional connections to Main No. 4 also possible here which could increase the downstream redundancy of the system. - Connection to the Jdf at VMP can be retained or reinstated without crossing busy intersection.	- Existing connection at Jacklin Road able to be retained. - Other potential connections to the Jdf possible on all routes. -Additional connections to Main No. 1 and 3 possible at the intersection of Dunford and Jacklin which could increase the downstream redundancy of the system.	- Existing connection at Jacklin Road able to be retained. - Connection to the Jdf at VMP can be retained or reinstated without crossing busy intersection. - Other potential connections to the Jdf possible on all routes. -Connection to Main No. 1 and 3 able to be reinstated on Station Ave or Goldstream. Additional connections to Main No. 4 also possible here which could increase the downstream redundancy of the system.
Sub Total		**2.7**	**3.0**	**2.5**	**2.9**	**2.4**	**4.2**	**2.7**	**3.2**								

E.2 Station Avenue Road Corridor Assessment Results

Project A2.1
High-Level Feasibility Alignment Review
Multi-Criteria Assessment

ASSESSMENT CRITERIA	WEIGHTING FACTOR	TECHNICAL SCORE								SCORING RATIONALE							
		OPT 1	OPT 2	OPT 3	OPT 4	OPT 5	OPT 6	OPT 7	OPT 8	OPT 1: Goldstream Avenue (1,800m Long)	OPT 2: Goldstream - Spencer - Hwy 1 - VMP (2,950m Long)	OPT 3: Goldstream - Spencer - Hwy 1 - Brock - Larkhall - VMP (2,500m Long)	OPT 4: Leigh - Hwy 1 - VMP (3,310m Long)	OPT 5: Leigh - Hwy 1 - Brock - Larkhall - VMP (2,850m Long)	OPT 6: Leigh - Dunford - Station (2,190m Long)	OPT 7: Leigh - Dunford - Jacklin - Goldstream (2,680m Long)	OPT 8: Goldstream - Jacklin - Station (2,750m Long)
Archaeological and Cultural Impacts	6%	3.9	1.6	2.7	1.5	2.4	4.3	4.5	4.1	Interacts with areas of archaeological potential on Goldstream Avenue (Leigh Rd to Jacklin Rd)but does not have any previously recorded sites. The section of Goldstream Avenue east of Jacklin Road does not have any areas with identified archaeological potential. There are no previously recorded sites on this alignment.	This alignment interacts with areas of archaeological potential and a previously recorded site on Highway 1 (near Brock Avenue) and near Veterans Memorial Parkway (north of Jacklin Road does not have any areas with identified archaeological potential. There are no previously recorded sites on this alignment.	This alignment interacts with a previously recorded site and area of archaeological potential near Highway 1 and Brock Avenue. Larkhall Road and Veterans Memorial Parkway (south of Larkhall Road) do not have any identified areas of archaeological potential or previously recorded sites.	This alignment interacts with areas of archaeological potential and a previously recorded site on Highway 1 (near Brock Avenue) and near Veterans Memorial Parkway (north of Brock Avenue). There are also areas of archaeological potential on Goldstream Avenue.	This alignment interacts with a previously recorded site and area of archaeological potential near Highway 1 and Brock Avenue. Larkhall Road and Veterans Memorial Parkway (south of Larkhall Road) do not have any identified areas of archaeological potential or previously recorded sites.	There is an area of archaeological potential identified on Leigh Road, however this alignment option does not interact with any other archaeological areas of potential or previously recorded sites.	There is an area of archaeological potential identified on Leigh Road, however this alignment option does not interact with any other archaeological areas of potential or previously recorded sites.	There is an area of archaeological potential identified on Goldstream Avenue, however this alignment option does not interact with any other archaeological areas of potential or previously recorded sites.
Social Impacts (Residential, Business and Traffic)	10%	1.5	1.9	2.4	2.1	2.6	2.1	1.9	2.9	Goldstream Avenue is a high volume transit corridor. Construction is expected to result in a lane closure which will impact vehicles, buses, and bike traffic to a number of properties along the mixed-use corridor which include residential, commercial, and two schools. Particularly, the section of Goldstream Avenue east of Jacklin Road is particularly congested and social impacts are expected to be significant.	Social impacts are expected to be major for this route. Goldstream Avenue, Highway 1 and Veterans Memorial Parkway are major traffic routes in the area and, while there are no lane closures expected on Highway 1 due to construction, impacts are still expected to be significant. Spencer Road is a dead-end corridor with limited residential and commercial use, reduction to single lane for this corridor is not expected to be a significant issue.	Social impacts are expected to be moderate for this route. While the impacts on Goldstream Avenue and Veterans Memorial Parkway are expected to be significant, this is for short distances. Construction on Highway 1 is also expected to be able to be completed without lane closure. Spencer Road, Brock Avenue, and Larkhall Road have low traffic volumes and lane closures on these roads is not expected to be significant. However, Brock Avenue and Larkhall Road are residential streets and the increased noise during construction may have adverse effects.	Social impacts are expected to be major for this route. While no lane closures are expected for Leigh Road or Highway 1, there is expected to be a longer duration of speed reduction on the highway due to construction being completed from Leigh Road to Veterans Memorial Parkway. Impacts on Veterans Memorial Parkway are expected to be significant as this will result in lane closures on a congested corridor.	Social impacts are expected to be moderate to low for this alignment. While the impact on Veterans Memorial Parkway is expected to be significant, this is for a short distance. Construction on Leigh road and Highway 1 is also expected to be able to be completed without lane closures. Brock Avenue and Larkhall Road have low traffic volumes and lane closures are not expected to have significant impacts. However, Brock Avenue and Larkhall Road are residential streets and the increased noise during construction may have adverse effects.	Social impacts are expected to be minor. While the reduced width of the of the Leigh Road corridor will likely result in single lane alternating traffic during construction, both Dunford Avenue and Station Avenue have lower volumes of traffic and the impacts are not expected to be significant.	Social impacts are expected to be moderate. While the reduced width of the Leigh Road corridor will likely result in single lane alternating traffic during construction, both Dunford Avenue and Station Avenue have lower volumes of traffic and the impacts are not expected to be major. However, this section of Goldstream Avenue in this alignment is the busiest part of Goldstream Avenue and the impacts there are expected to be major.	Social impacts are expected to be moderate to low for this alignment. While the route goes down Goldstream Avenue to Jacklin Road, this section of Goldstream Avenue is less busy than the section to the east of Jacklin Road. Both Jacklin Road and Station Avenue have low volumes of traffic and impacts are not expected to be major.
Environmental Impacts	6%	4.0	3.6	3.8	2.9	3.0	4.3	4.2	4.6	Potential tree impacts around 1060 Goldstream Avenue which may be associated with the wetland/riparian area adjacent to this. East of this location, no tree clearing or vegetation impacts are expected.	Potential tree impacts around 1060 Goldstream Avenue which may be associated with the wetland/riparian area adjacent to this. There are also potential ornamental trees which may be impacted on Brock Avenue. Other than these two areas, there is no tree clearing anticipated and all stream crossings appear to be culverted. This option has assumed the gas station at the intersection of Goldstream Avenue and Veterans Memorial Parkway will not conflict with the new alignment of the main. There are also potential environmental risks associated with rock excavation (and potential blasting) for construction on Highway 1.	Potential tree impacts around 1060 Goldstream Avenue which may be associated with the wetland/riparian area adjacent to this. There are also potential ornamental trees which may be impacted on Brock Avenue. Other than these two areas, there is no tree clearing anticipated and all stream crossings appear to be culverted. There are also potential environmental risks associated with rock excavation (and potential blasting) for construction on Highway 1.	Wetland complex on Leigh Road (Spencer's Pond Park) contains environmentally sensitive plants, frogs, butterfly, and is critical habitat for the painted turtle. There is also a steep slope towards this completed. No major impacts are anticipated on Highway 1 or Veterans Memorial Parkway. There are also potential environmental risks associated with rock excavation (and potential blasting) for construction on Highway 1.	Wetland cogmbss on Leigh Road (Spencer's Pond Park) contains environmentally sensitive plants, frogs, butterfly, and is critical habitat for the painted turtle. There is also a steep slope towards this completed. Ornamental tree clearing also expected on Brock Avenue. No major impacts are anticipated on Highway 1 or Veterans Memorial Parkway. There are also potential environmental risks associated with rock excavation (and potential blasting) for construction on Highway 1.	There are several trees in close proximity to Leigh Road which may be impacted, however it is assumed that work will occur in the existing paved areas. There are also a small number of mature trees at the intersection of Dunford Avenue and Station Avenue which may be impacted.	There are several trees in close proximity to Leigh Road which may be impacted, however it is assumed that work will occur in the existing paved areas. There are also a small number of mature trees at the intersection of Dunford Avenue and Station Avenue which may be impacted.	There are several trees in close proximity to Leigh Road which may be impacted, however it is assumed that work will occur in the existing paved areas. There are also a small number of mature trees at the intersection of Dunford Avenue and Station Avenue which may be impacted.
Resiliency (Geotechnical, Seismic & Proximity to Other Mains)	10%	3.5	3.1	3.4	3.2	3.6	3.8	3.7	3.7	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain, Topography: Flat (0-5degrees) overall slope, Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C. No other major transmission mains identified in this corridor other than the existing Main No. 4 which is expected to be decommissioned.	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain and possible (D3) Peat over Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C No other major transmission mains identified in these corridors other than Main No. 14 on Veterans Memorial Parkway. The existing Main No. 4 is expected to be decommissioned. The presence of the existing main is not expected to significantly increase the seismic risk.	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain and possible (D3) Peat over Sand and Gravel of the Colwood Delta and Outwash Plain. There are also sections with possible thin soil or bedrock outcrops. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C. No other major transmission mains identified in these corridors other than Main No. 14 on Veterans Memorial Parkway. The existing Main No. 4 is expected to be decommissioned. The presence of the existing main is not expected to significantly increase the seismic risk.	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain and possible (D3) Peat over Sand and Gravel of the Colwood Delta and Outwash Plain. There are also sections with possible thin soil or bedrock outcrops. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C. No other major transmission mains identified in these corridors other than Main No. 14 on Veterans Memorial Parkway. The presence of the existing main is not expected to significantly increase the seismic risk.	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain and possible (D3) Peat over Sand and Gravel of the Colwood Delta and Outwash Plain. There are also sections with possible thin soil or bedrock outcrops. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C. No other major transmission mains identified in these corridors other than Main No. 14 on Veterans Memorial Parkway. The presence of the existing main is not expected to significantly increase the seismic risk.	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C Main No. 1 and Main No. 3 are also present on Station Avenue. The existing Main No. 4 is expected to be decommissioned. The presence of the existing mains is not expected to significantly increase the seismic risk as it is expected that the new main will be seismically resilient and able to span a crater created by an adjacent main break.	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Potentially some shallowed groundwater on Goldstream Avenue section. Seismic Demand: Assumed Site Class C Main No. 1 and Main No. 3 are also present on Station Avenue. The existing Main No. 4 is expected to be decommissioned. The presence of the existing mains is not expected to significantly increase the seismic risk as it is expected that the new main will be seismically resilient and able to span a crater created by an adjacent main break.
Constructability Impacts (Including Third-Party Utility Impacts)	10%	1.3	2.4	2.6	2.6	2.7	2.9	3.0	2.3	Existing utilities including Main No.4 along Goldstream will limit routing options for the new main. Maintaining access along Spencer Rd will be a challenge as this is a dead-end narrow road with existing utilities to work around. Consideration also required for emergency services and alternate parking options. TCH will require significant coordination with MoTI. If routing along southern boulevard, about 60% the alignment might need to be cut down (including in rock) and another 20% built up. Mature trees in medians and boulevards could potentially be in the way.	Existing utilities including Main No.4 along Goldstream will limit routing options for the new main. Maintaining access along Spencer Rd will be a challenge as this is a dead-end narrow road with existing utilities to work around. Consideration also required for emergency services and alternate parking options. TCH will require significant coordination with MoTI. If routing along southern boulevard, about 60% the alignment might need to be cut down (including in rock) and the other half built up. Multi-residential complexes along Brock and Larkhall may only have access from one driveway. Consider opportunity to widen driveway and/or locate pipe joints to maintain access to this properties. Some larger utilities present in VMP. Relocations may be required. Parkway is wide which give options for relocation if required.	Existing utilities including Main No.4 along Goldstream will limit routing options for the new main. Maintaining access along Spencer Rd will be a challenge as this is a dead-end narrow road with existing utilities to work around. Consideration also required for emergency services and alternate parking options. TCH will require significant coordination with MoTI. If routing along southern boulevard, about 60% the alignment might need to be cut down (including in rock) and the other half built up. Multi-residential complexes along Brock and Larkhall may only have access from one driveway. Consider opportunity to widen driveway and/or locate pipe joints to maintain access to this properties. Some larger utilities present in VMP. Relocations may be required. Parkway is wide which give options for relocation if required.	Leigh Rd: municipal WM, gravity mains, large forts main and BCH ducts. The road is wide and there are options to relocate utilities if required. Businesses typically have 2 driveways. TCH: It appears the area for the Leigh road on-ramp would need to be built up significantly which is ~15% of alignment. ~70% needing to be cut down. Access would mainly be from HWY1 and we would need to coordinate with MoTI will be significant. Some larger utilities present in VMP. Relocations may be required. Parkway is wide which give options for relocation if required.	Leigh Rd: municipal WM, gravity mains, larger forts main and BCH ducts. The road is wide and there are options to relocate utilities if required. Businesses typically have 2 driveways. TCH: It appears the area for the Leigh road on-ramp would need to be built up significantly which is ~15% of alignment. ~70% needing to be cut down. Access would mainly be from HWY1 and we would need to coordinate with MoTI will be significant. Multi-residential complexes along Brock and Larkhall may only have access from one driveway. Consider opportunity to widen driveway and/or locate pipe joints to maintain access to this properties. Some larger utilities present in VMP. Relocations may be required. Parkway is wide which give options for relocation if required.	Leigh Rd: Relatively congested utility corridor with watermain, gravity mains, BCH conduit, larger forts main. Dunford Rd: Most utilities are present, but the road is wide enough to allow relocations. The businesses usually have driveways that will allows for flexible access. Station Ave: Many utilities present including 1067 WM, asbestos 150 watermain, BCH, gravity mains, smaller forts, BCH, comms. Larger watermain and AC might complicate relocation and routing. Transit hub may be difficult to work around and might need to be relocated. Businesses generally have wide or double driveways.	Leigh Rd: Relatively congested utility corridor with watermain, gravity mains, BCH conduit, larger forts main. Dunford Rd: Most utilities are present, but the road is wide enough to allow relocations. The businesses usually have driveways that will allows for flexible access. Jacklin: Most utilities are present including larger forts main, watermain, gravity mains, comms. The road is wide and could accomodate relocation if required. Most driveways have duplicate entrances or are wide. Station Ave: Many utilities present including 1067 WM, asbestos 150 watermain, BCH, gravity mains, smaller forts, BCH, comms. Larger watermain and AC might complicate relocation and routing. Transit hub may be difficult to work around and might need to be relocated. Businesses generally have wide or double driveways. Goldstream: Existing 1372 WM, also 300/400 DI, comms, gravity present. The existing 1372 will limit routing options for new main and any potential relocations. Would be very involved for a contractor to maintain business access along this route, productivity would likely suffer as the work zone would probably need to be kept tight. Mature trees in medians and boulevards could potentially be in the way.	Leigh Rd: Relatively congested utility corridor with watermain, gravity mains, BCH conduit, larger forts main. Dunford Rd: Most utilities are present, but the road is wide enough to allow relocations. The businesses usually have driveways that will allows for flexible access. Jacklin: Most utilities are present including larger forts main, watermain, gravity mains, comms. The road is wide and could accomodate relocation if required. Most driveways have duplicate entrances or are wide. Station Ave: Many utilities present including 1067 WM, asbestos 150 watermain, BCH, gravity mains, smaller forts, BCH, comms. Larger watermain and AC might complicate relocation and routing. Transit hub may be difficult to work around and might need to be relocated. Businesses generally have wide or double driveways. Goldstream: Existing 1372 WM, also 300/400 DI, comms, gravity present. The existing 1372 will limit routing options for new main and any potential relocations. Jacklin: Most utilities are present including larger forts main, watermain, gravity mains, comms. The road is wide and could accomodate relocation if required. Most driveways have duplicate entrances or are wide. Station Ave: Many utilities present including 1067 WM, asbestos 150 watermain, BCH, gravity mains, smaller forts, BCH, comms. Larger watermain and AC might complicate relocation and routing. Transit hub may be difficult to work around and might need to be relocated. Businesses generally have wide or double driveways. Goldstream: Existing 1372 WM, also 300/400 DI, comms, gravity present. The existing 1372 will limit routing options for new main and any potential relocations. Jacklin: Most utilities are present including larger forts main, watermain, gravity mains, comms. The road is wide and could accomodate relocation if required. Most driveways have duplicate entrances or are wide. Station Ave: Many utilities present including 1067 WM, asbestos 150 watermain, BCH, gravity mains, smaller forts, BCH, comms. Larger watermain and AC might complicate relocation and routing. Transit hub may be difficult to work around and might need to be relocated. Businesses generally have wide or double driveways.
Property and Land Acquisition Impacts	5%	4.3	3.2	3.8	3.2	3.7	3.3	4.1	3.7	Temporary rights-of-way (ROW): Construction corridor within road ROW. Compound areas opportunities along route: Limited (private land) Permanent ROW: In existing road ROW on Goldstream Avenue where the CRD already have a ROW for the existing Main No. 4.	Temporary ROW: Construction corridor within road ROW. Compound areas opportunities along route: Combination of private and public land Permanent ROW: In existing road ROW. However, the CRD will likely need to obtain a ROW from MoTI for the sections of the main on Hwy 1 and VMP so that they are able to do future work on their main without the need for obtaining additional permits (notification would suffice).	Temporary ROW: Construction corridor within road ROW. Compound areas opportunities along route: Combination of private and public land Permanent ROW: In existing road ROW.However, the CRD will likely need to obtain a ROW from MoTI for the sections of the main on Hwy 1 and VMP so that they are able to do future work on their main without the need for obtaining additional permits (notification would suffice).	Temporary ROW: Construction corridor within road ROW. Compound areas opportunities along route: Combination of private and public land Permanent ROW: In existing road ROW. However, the CRD will likely need to obtain a ROW from MoTI for the sections of the main on Hwy 1 and VMP so that they are able to do future work on their main without the need for obtaining additional permits (notification would suffice).	Temporary ROW: Construction corridor within road ROW. Compound areas opportunities along route: Combination of private and public land Permanent ROW: However, the CRD will likely need to obtain a ROW from MoTI for the sections of the main on Hwy 1 and VMP so that they are able to do future work on their main without the need for obtaining additional permits (notification would suffice).	Temporary ROW: Construction corridor within road ROW. Compound areas opportunities along route: Combination of private and public land Permanent ROW: In existing road ROW for the majority. However, based on the assumed alignment down the centre of Station Avenue, there would need to be two crossings of the existing rail line. While this line is not currently used, it is understood that a ROW will still be required for this. If main is located in rail corridor along Station Ave, new access agreements with rail authority would be required.	Temporary ROW: Construction corridor within road ROW. Compound areas opportunities along route: Limited (mostly private land) Permanent ROW: In existing road ROW.	Temporary ROW: Construction corridor within road ROW. Compound areas opportunities along route: Limited (along Goldstream and Jacklin (private land). Rail corridor along Station Ave. Permanent ROW: In existing road ROW. However, based on the assumed alignment down the centre of Station Avenue, there would need to be two crossings of the existing rail line. While this line is not currently used, it is understood that a ROW will still be required for this. If main is located in rail corridor along Station Ave, new access agreements with rail authority would be required.
Capital Expenditure Impacts	35%	5.0	1.5	4.2	1.4	4.2	4.9	3.5	1.0	- Construction complexity: High - Utility impacts: Significant. Corridor is heavily congested with existing utilities (water, sewer, stormwater, sections of U/G electrical and gas) and existing water main No.4 (1370mm). The abandoned D900mm steel main on Goldstream Avenue would also be required for removal to allow adequate space for constructing the new main. - Roadway impacts: Significant. High traffic volumes in an active commercial area. Pipe will likely be constructed under pavement. - Third party utility relocation: May be required. (- High CAPEX impacts score due to short length)	Construction complexity: High Utility impacts: Significant coordination works required along Goldstream Ave and VMP. Large number of distribution lines for water, sewer, gas, electrical. Main No.4 on Goldstream and Main No.14 on VMP. The abandoned D900mm steel main on Goldstream Avenue would also be required for removal to allow adequate space for constructing the new main. New main location may be forced in the VMP roadway unless significant utility relocation is undertaken. Roadway impacts: Moderate - Significant. High traffic volumes on Goldstream, TCH and VMP. Traffic impacts to Goldstream Ave and VMP are subject to the location of existing utilities and available space for the new main. On TCH, 2-lanes east bound could potentially remain open (with speed reduction and localised realignment past work zone) during works, subject to alignment finalisation and discussions with MoTI. Third party utility relocation: Potentially significant relocation works, depending on the available space and preference of service relocation vs construction in the VMP travel lanes. (- Low CAPEX impacts score due to long length combined with construction complexity)	Construction complexity: Moderate - High Utility impacts: Significant coordination works required along Goldstream Ave and VMP. Large number of distribution lines for water, sewer, gas, electrical. Main No.4 on Goldstream and Main No.14 on VMP. The abandoned D900mm steel main on Goldstream Avenue would also be required for removal to allow adequate space for constructing the new main. New main location may be forced in the VMP roadway unless significant utility relocation is undertaken. Roadway impacts: Moderate - Significant. High traffic volumes on Goldstream, TCH and VMP. Traffic impacts to Goldstream Ave and VMP are subject to the location of existing utilities and available space for the new main. On TCH, 2-lanes east bound could potentially remain open (with speed reduction and localised realignment past work zone) during works, subject to alignment finalisation and discussions with MoTI. Spencer, Brock and Larkhall are local roads. Brock and Larkhall in particular are likely to require full closure during construction. Third party utility relocation: Potentially significant relocation works, particularly along Goldstream and VMP	Construction complexity: Moderate-High Utility impacts: Significant coordination works required along VMP - existing water, sewer, gas, electrical and Water Main No.14. New main location may be forced in the VMP roadway unless significant utility relocation is undertaken. Minor coordination works required for Leigh and TCH. Roadway impacts: Moderate - Significant. High traffic volumes on TCH and VMP. Traffic impacts to VMP are subject to the location of existing utilities and available space for the new main. On TCH, 2-lanes east bound could potentially remain open (with speed reduction and localised realignment past work zone) during works, subject to alignment finalisation and discussions with MoTI. Third party utility relocation: Potentially significant relocation works, particularly along VMP.	Construction complexity: Moderate Utility impacts: Moderate. Minor coordination works required for Leigh, TCH, Larkhail and VMP. Significant coordination works required along VMP - existing water, sewer, gas, electrical and Water Main No.14. New main location may be forced in the VMP roadway unless significant utility relocation is undertaken. Roadway impacts: Moderate - Significant. High traffic volumes on TCH and VMP. Traffic impacts to VMP are subject to the location of existing utilities and available space for the new main. On TCH, 2-lanes east bound could potentially remain open (with speed reduction and localised realignment past work zone) during works, subject to alignment finalisation and discussions with MoTI. Maintaining 2-way traffic on Leigh Rd should be achievable during construction. Spencer, Brock and Larkhall are local roads. Brock and Larkhall in particular are likely to require full closure during construction. Third party utility relocation: Potentially significant relocation works, particularly along VMP.	Construction complexity: Moderate Utility impacts: Significant along Station Ave - Corridor has Main No.1 (1067mm), Main No.3 (391mm), 1250mm width hydro duct bank water, gas, and telus. Significant coordination with current utility arrangement to locate main in Station Ave road corridor. Options are to either relocate the hydro duct into the rail corridor (and install the new main in this location) or install the new main in the rail corridor. (Under the E&N rail trail expected to have the highest likelihood of acceptance.) Existing hydro duct runs from Jacklin Rd intersection to Meaford Ave intersection (500m). Typical utility (distribution network) coordination works required for Leigh and Dunford. Roadway impacts: Moderate. Collector roads with moderate traffic volumes. SLAT during construction along Leigh and Dunford. Road closure anticipated for Station Ave pending if the main is installed in the road and the hydro duct is relocated. Minor road impacts if installed completely in the rail corridor. Third party utility relocation: Minor up to significant relocation works may be required along Station Ave depending on the chosen location in road/rail corridor.	- Construction complexity: Moderate-High - Utility impacts: Significant along Goldstream - Corridor is heavily congested with existing utilities (water, sewer, stormwater, sections of U/G electrical and gas) and existing water main No.4 (1370mm). Typical utility (distribution network) coordination works required for Leigh, Dunford and Jacklin. Roadway impacts: Significant along Goldstream, high traffic volumes in an active commercial area. Pipe will likely be constructed under pavement. Moderate traffic volumes with SLAT along Leigh, Dunford and Jacklin during construction. - Third party utility relocation: Localised relocations may be required.	Construction complexity: Moderate - High Utility impacts: Significant along Goldstream and Station Ave. The abandoned D900mm steel main on Goldstream Avenue would also be required for removal to allow adequate space for constructing the new main. Goldstream corridor is heavily congested with existing utilities (water, sewer, stormwater, electrical, gas) and existing water main No.4 (1370mm). Station Ave has Main No.1 (1067mm), Main No.3 (391mm), 1250mm width hydro duct bank water, sewer, gas and telus. Insufficient space with current utility arrangement to locate main in Station Ave road corridor. Options are to either relocate the hydro duct into the rail corridor (and install the new main in this location) or install the new main in the rail corridor. (Under the E&N rail trail expected to have the highest likelihood of acceptance.) Existing hydro duct runs from Jacklin Rd intersection to Meaford Ave intersection (500m). Roadway impacts: Moderate-Significant. High traffic volumes in an active commercial area along Goldstream. Station Ave has moderate traffic volumes and road closure is anticipated for if the main is installed in the road and the hydro duct is relocated. Minor road impacts if installed completely in the rail corridor. SLAT during construction along Jacklin. Third party utility relocation: Minor up to significant relocation works may be required along Goldstream and Station Ave depending on the available space and preference of utility relocation vs installation in the road.
Operation and Maintenance	8%	2.5	1.9	2.6	1.9	2.5	3.0	2.8	2.8	Pipe located within road corridor (and under road in sections). Access will require a TMP likely specifying the following arrangement: - Goldstream and Spencer Ave: SLAT - TCH: Speed reduction past work zone, subject to: pipe location in the corridor, location of the permanent jersey barrier, access methodology, agreements with MoTI, and scale of works required. This will require O&M staff to park on the highway as there is not sufficient space for maintenance bays. - VMP: Reduce to a single travel lane on the impacted side of corridor. Access agreements will MoTI will be required for the length along TCH.	Pipe located within road corridor (and under road in sections). Access will require a TMP likely specifying the following arrangement: - Goldstream, Spencer Ave, Brock, Larkhall: SLAT - TCH: Speed reduction past work zone, subject to: pipe location in the corridor, location of the permanent jersey barrier, access methodology, agreements with MoTI, and scale of works required. This will require O&M staff to park on the highway as there is not sufficient space for maintenance bays. - VMP: Reduce to a single travel lane on the impacted side of corridor. Access agreements will MoTI will be required for the length along TCH.	Pipe located within road corridor (and under road in sections). Access will require a TMP likely specifying the following arrangement: - Leigh Rd: SLAT or 2-way with speed reduction for southern portion under the road. - TCH: Speed reduction past work zone, subject to: pipe location in the corridor, location of the permanent jersey barrier, access methodology, agreements with MoTI, and scale of works required. This will require O&M staff to park on the highway as there is not sufficient space for maintenance bays. - VMP: Reduce to a single travel lane on the impacted side of corridor. Access agreements will MoTI will be required for the length along TCH.	Pipe located within road corridor (and under road in sections). Access will require a TMP likely specifying the following arrangement: - Leigh Rd: SLAT or 2-way with speed reduction for southern portion under the road. - Brock and Larkhall: SLAT - TCH: Speed reduction past work zone, subject to: pipe location in the corridor, location of the permanent jersey barrier, access methodology, agreements with MoTI, and scale of works required. - VMP: Reduce to a single travel lane on the impacted side of corridor. This will require O&M staff to park on the highway as there is not sufficient space for maintenance bays. Access agreements will MoTI will be required for the length along TCH.	Pipe located within the road (under vehicle travel lane). Access will require a TMP likely specifying the following arrangement: - Leigh and Dunford: SLAT - Station Ave: SLAT or full road closure depending on location of pipe within road corridor	Pipe located within the road (under vehicle travel lane). Access will require a TMP likely specifying SLAT traffic (for Leigh, Dunford, Jacklin and Goldstream)	Pipe located within the road (under vehicle travel lane). Access will require a TMP likely specifying the following arrangement: - Goldstream and Jacklin: SLAT - Station Ave: SLAT or full road closure depending on location of pipe within road corridor
Connectivity	10%	4.0	2.5	3.0	1.0	2.5	4.0	5.0	5.0	- Follows the existing alignment, which allows for maintaining existing network connections and operational arrangement to service existing branch connections at both Jacklin Rd and VMP. - Limited opportunity for additional JdF connections. - Limited opportunity for additional connections to Mains 1 or 3	- Existing connection at Jacklin Road no longer possible. However, there is the potential to re-instate the connections at Spencer Rd - Intersection works would also be required to reinstate the connection to Main No. 1 as the alignment of the new Main No. 4 would be on the eastern side of VMP. - Limited opportunity to connect to the JdF on Hwy 1 without connecting to the south through the road batter or by constructing a connection underneath the highway to the north.	- Existing connection at Jacklin Road no longer possible. However, there is the potential to re-instate the connections at Spencer Rd - Intersection works would also be required to reinstate the connection to Main No. 1 as the alignment of the new Main No. 4 would be on the eastern side of VMP. - Limited opportunity to connect to the JdF on Hwy 1 without connecting to the south through the road batter or by constructing a connection underneath the highway to the north. - Some opportunity for additional connections to the JdF on Brock or Larkhall Rd.	- Existing connection at Jacklin Road no longer possible. - Limited connections possible on Leigh Rd as the main terminates south of Highway 1. - Intersection works would also be required to reinstate the connection to Main No. 1 as the alignment of the new Main No. 4 would be on the eastern side of VMP. - Limited opportunity to connect to the JdF on Hwy 1 without connecting to the south through the road batter or by constructing a connection underneath the highway to the north.	- Existing connection at Jacklin Road no longer possible. - Limited connections possible on Leigh Rd as the main terminates south of Highway 1. - Intersection works would also be required to reinstate the connection to Main No. 1 as the alignment of the new Main No. 4 would be on the eastern side of VMP. - Limited opportunity to connect to the JdF on Hwy 1 without connecting to the south through the road batter or by constructing a connection underneath the highway to the north. - Some opportunity for additional connections to the JdF on Brock or Larkhall Rd.	- Existing connection at Jacklin Road no longer possible. However there is the potential to reinstate this at the intersection of Jacklin Rd with Dunford/Station. - Other potential connections to the JdF possible on all routes. - Connection to Main No. 1 and 3 able to be reinstated on Station Ave or Goldstream. Additional connections to Main No. 4 also possible here which could increase the downstream redundancy of the system. - Connection to the JdF at VMP can be retained or reinstated without crossing busy intersection.	- Existing connection at Jacklin Road and VMP able to be retained. - Other potential connections to the JdF possible on all routes. - Additional connections to Main No. 1 and 3 possible at the intersection of Dunford and Jacklin which could increase the downstream redundancy of the system.	- Existing connection at Jacklin Road able to be retained. - Connection to the JdF at VMP can be retained or reinstated without crossing busy intersection. - Other potential connections to the JdF possible on all routes. - Connection to Main No. 1 and 3 able to be reinstated on Station Ave or Goldstream. Additional connections to Main No. 4 also possible here which could increase the downstream redundancy of the system.
Sub Total		**3.7**	**2.1**	**3.4**	**2.0**	**3.3**	**3.9**	**3.5**	**2.7**								

E.3 Additional Rail Corridor Usage Alignment Results

Jacobs

Project A2.1
High-Level Feasibility Alignment Review
Multi-Criteria Assessment

ASSESSMENT CRITERIA	WEIGHTING FACTOR	TECHNICAL SCORE									SCORING RATIONALE					
		OPT 1	OPT 2	OPT 3	OPT 4	OPT 5	OPT 6	OPT 6A	OPT 7	OPT 8	OPT 1: Goldstream Avenue (1,800m Long)	OPT 2: Goldstream - Spencer - Hwy 1 - VMP (2,950m Long)	OPT 3: Goldstream - Spencer - Hwy 1 - Brock - Larkhall - VMP (2,500m Long)	OPT 4: Leigh - Hwy 1 - VMP (3,310m Long)	OPT 5: Leigh - Hwy 1 - Brock - Larkhall - VMP (2,850m Long)	OPT 6: Leigh - Dunford - Station (E&N Rail) (2,190m Long)	OPT 6A: Leigh - Langford Pkwy (E&N) - Station (E&N) (2,680m Long)	OPT 7: Leigh - Dunford - Jacklin - Goldstream (2,680m Long)	OPT 8A: Goldstream - Jacklin - Station (E&N Rail) (2,750m Long)
Archaeological and Cultural Impacts	6%	3.9	1.6	2.7	1.5	2.4	4.3	4.5	4.5	4.7	Interacts with areas of archaeological potential on Goldstream Avenue (Leigh Rd to Jacklin Rd)but does not have any previously recorded sites. The section of Goldstream Avenue east of Jacklin Road does not have any areas with identified archaeological potential. There are no previously recorded sites on this alignment.	This alignment interacts with areas of archaeological potential and a previously recorded site on Highway 1 (near Brock Avenue) and near Veterans Memorial Parkway (north of Brock Avenue). There are also areas of archaeological potential on Goldstream Avenue and Spencer Road.	This alignment interacts with areas of archaeological potential and a previously recorded site on Highway 1 (near Brock Avenue) and near Veterans Memorial Parkway (south of Larkhall Road). There are also areas of archaeological potential on Goldstream Avenue.	This alignment interacts with areas of archaeological potential and a previously recorded site on Highway 1 and Brock Avenue. Larkhall Road and Veterans Memorial Parkway (south of Larkhall Road) do not have any identified areas of archaeological potential or previously recorded sites.	This alignment interacts with areas of archaeological potential and a previously recorded site on Highway 1 and Brock Avenue. Larkhall Road and Veterans Memorial Parkway (south of Larkhall Road) do not have any identified areas of archaeological potential or previously recorded sites.	There is an area of archaeological potential identified on Leigh Road, however this alignment option does not interact with any other archaeological areas of potential or previously recorded sites.	There is an area of archaeological potential identified on Leigh Road, however this alignment option does not interact with any other archaeological areas of potential or previously recorded sites.	There is an area of archaeological potential identified on Leigh Road, however this alignment option does not interact with any other archaeological areas of potential or previously recorded sites.	There is an area of archaeological potential identified on Goldstream Avenue, however this alignment option does not interact with any other archaeological areas of potential or previously recorded sites.
Social Impacts (Residential, Business and Traffic)	10%	1.5	1.9	2.4	2.1	2.6	3.1	4.2	1.9	3.7	Goldstream Avenue is a high volume transit corridor. Construction is expected to result in a lane closure which will impact vehicles, buses, and bike traffic to a number of properties along the mixed-use corridor which include residential, commercial, and two schools. Particularly, the section of Goldstream Avenue east of Jacklin Road is particularly congested and social impacts are expected to be significant.	Social impacts are expected to be major for this route. Goldstream Avenue, Highway 1 and Veterans Memorial Parkway are major traffic routes in the area and, while there are no lane closures expected on Highway 1 due to construction, impacts are still expected to be significant. Spencer Road is a dead-end corridor with limited residential and commercial use, reduction to single lane for this corridor is not expected to be a significant issue.	Social impacts are expected to be moderate for this route. While the impacts on Goldstream Avenue and Veterans Memorial Parkway are expected to be significant, this is for short distance. Construction on Highway 1 is also expected to be able to be completed without lane closures. Spencer Road, Brock Avenue, and Larkhall Road have low traffic volumes and lane closures on these roads is not expected to be significant. However, Brock Avenue and Larkhall Road are residential streets and the increased noise during construction may have adverse effects.	Social impacts are expected to be major for this route. While no lane closures are expected for Leigh Road or Highway 1, there is expected to be a longer duration of speed reduction on the highway due to construction being completed from Leigh Road to Veterans Memorial Parkway. Impacts on Veterans Memorial Parkway are expected to be significant as this will result in lane closures on a congested corridor.	Social impacts are expected to be moderate for this alignment. While the impact on Veterans Memorial Parkway is expected to be significant, this is for a short distance. Construction on Leigh road and Highway 1 is also expected to be able to be completed without lane closures. Brock Avenue and Larkhall Road have low traffic volumes and lane closures are not expected to have significant impacts. However, Brock Avenue and Larkhall Road are residential streets and the increased noise during construction may have adverse effects.	Social impacts are expected to be minor. While the reduced width of the Leigh Road corridor will likely result in single lane alternating traffic during construction, both Dunford Avenue and Station Avenue have lower volumes of traffic and the impacts are not expected to be significant. On Station Avenue in particular, using the E&N rail trail will allow this road to remain open during construction.	Social impacts are expected to be minor. While the reduced width of the Leigh Road corridor will likely result in single lane alternating traffic during construction, the Station Avenue and Langford Parkway , using the E&N rail trail or rail corridor will allow this road to be significant. On Station Avenue in particular, using the E&N rail trail will allow this road to remain open during construction.	Social impacts are expected to be moderate. While the reduced width of the Leigh Road corridor will likely result in single lane alternating traffic during construction, both Dunford Avenue and Jacklin Road have lower volumes of traffic and the impacts are not expected to be significant, however, the section of Goldstream Avenue in this alignment is the busiest part of Goldstream Avenue and the impacts there are expected to be major.	Social impacts are expected to be moderate to low for this alignment. While the route goes down Goldstream Avenue to Jacklin Road, this section of Goldstream Avenue is less busy than the section to the east of Jacklin Road. Both Jacklin Road and Station Avenue have low volumes of traffic and impacts are not expected to be major. On Station Avenue in particular, using the E&N rail trail will allow this road to remain open during construction.
Environmental Impacts	6%	4.0	3.6	3.8	2.9	3.0	2.9	2.1	4.2	3.5	Potential tree impacts around 1060 Goldstream Avenue which may be associated with the wetland/riparian area adjacent to this. East of this location, no tree clearing or vegetation impacts are expected. This option has assumed the gas station at the intersection of Goldstream Avenue and Veterans Memorial Parkway will not conflict with the new alignment of the main. There are also potential environmental risks associated with rock excavation (and potential blasting) for construction on Highway 1.	Potential tree impacts around 1060 Goldstream Avenue which may be associated with the wetland/riparian area adjacent to this. East of this location, no tree clearing or vegetation impacts are expected. This option has assumed the gas station at the intersection of Goldstream Avenue and Veterans Memorial Parkway will not conflict with the new alignment of the main. There are also potential environmental risks associated with rock excavation (and potential blasting) for construction on Highway 1.	Potential tree impacts around 1060 Goldstream Avenue which may be associated with the wetland/riparian area adjacent to this. There are also potential ornamental trees which may be impacted on Brock Avenue. Other than these two areas, there is no tree clearing anticipated and all lane closures are expected to be completed. There are also potential environmental risks associated with rock excavation (and potential blasting) for construction on Highway 1.	Wetland complex on Leigh Road (Spencer's Pond Park) contains environmentally sensitive plants, frogs, butterfly, and is critical habitat for the painted turtle. There is also a steep slope towards this completed. Ornamental tree clearing also expected on Brock Avenue. No major impacts are anticipated on Highway 1 or Veterans Memorial Parkway. There are also potential environmental risks associated with rock excavation (and potential blasting) for construction on Highway 1.	Wetland complex on Leigh Road (Spencer's Pond Park) contains environmentally sensitive plants, frogs, butterfly, and is critical habitat for the painted turtle. There is also a steep slope towards this completed. Ornamental tree clearing also expected on Brock Avenue. No major impacts are anticipated on Highway 1 or Veterans Memorial Parkway. There are also potential environmental risks associated with rock excavation (and potential blasting) for construction on Highway 1.	There are several trees in close proximity to Leigh Road which may be impacted, however it is assumed that work will occur in the existing paved areas. There are also a small number of mature trees at the intersection of Dunford Avenue and Station Avenue which may be impacted. Working on the E&N rail trail alignment will also increase the likelihood of encountering contaminated soil.	There are several trees in close proximity to Leigh Road which may be impacted, however it is assumed that work will occur in the existing paved areas. There are also a small number of mature trees at the intersection of Dunford Avenue and Station Avenue which may be impacted. Working on the E&N rail trail or rail corridor alignment will also increase the likelihood of encountering contaminated soil.	There are several trees in close proximity to Leigh Road which may be impacted, however it is assumed that work will occur in the existing paved areas. There are also a small number of mature trees at the intersection of Dunford Avenue and Station Avenue which may be impacted. Working on the E&N rail trail or rail corridor alignment will also increase the likelihood of encountering contaminated soil.	Potential tree impacts around 1060 Goldstream Avenue which may be associated with the wetland/riparian area adjacent to this. Working on the E&N rail trail alignment will also increase the likelihood of encountering contaminated soil.
Resiliency (Geotechnical, Seismic & Proximity to Other Mains)	10%	3.5	3.1	3.4	3.2	3.6	3.8	3.8	3.7	3.7	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain, Topography: Flat (0-5 degrees) overall slope, Groundwater: Estimated to be Moderately deep (>5m) in dry season. Seismic Demand: Assumed Site Class C. No other major active transmission mains identified in this corridor other than the existing Main No. 4 which is expected to be decommissioned.	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain and possible (D3) Peat over Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees), Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C No other major transmission mains identified in these corridors other than Main No. 14 on Veterans Memorial Parkway. The existing Main No. 4 is expected to be decommissioned. The presence of the existing main is not expected to significantly increase the seismic risk	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain and possible (D3) Peat over Sand and Gravel of the Colwood Delta and Outwash Plain. There are also sections with possible thin soil over bedrock. Topography: Flat (0-5 degrees), Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C. No other major transmission mains identified in these corridors other than Main No. 14 on Veterans Memorial Parkway. The existing Main No. 4 is expected to be decommissioned. The presence of the existing main is not expected to significantly increase the seismic risk	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain and possible (D3) Peat over Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C. No other major transmission mains identified in these corridors other than Main No. 14 on Veterans Memorial Parkway. The presence of the existing main is not expected to significantly increase the seismic risk.	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain and possible (D3) Peat over Sand and Gravel of the Colwood Delta and Outwash Plain. There are also sections with possible thin soil over bedrock outcrops. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C. No other major transmission mains identified in these corridors other than Main No. 14 on Veterans Memorial Parkway. The presence of the existing main is not expected to significantly increase the seismic risk.	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C. Main No. 1 and Main No. 3 are also present on Station Avenue. The presence of the existing mains is not expected to significantly increase the seismic risk as it is expected that the new main will be seismically resilient and able to span a crater created by an adjacent main break.	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Seismic Demand: Assumed Site Class C. Main No. 1 and Main No. 3 are also present on Station Avenue. The presence of the existing mains is not expected to significantly increase the seismic risk as it is expected that the new main will be seismically resilient and able to span a crater created by an adjacent main break.	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Potentially some shallowed groundwater on Goldstream Avenue section. Seismic Demand: Assumed Site Class C. No other major transmission mains are identified in these corridors. The existing Main No. 4 is expected to be decommissioned.	Geology: (G1) Sand and Gravel of the Colwood Delta and Outwash Plain. Topography: Flat (0-5 degrees). Groundwater: Estimated to be Moderately Deep (>5m) in dry season. Potentially some shallowed groundwater on Goldstream Avenue section. Seismic Demand: Assumed Site Class C. Main No. 1 and Main No. 3 are also present on Station Avenue. The existing Main No. 4 is expected to be decommissioned. The presence of the existing mains is not expected to significantly increase the seismic risk as it is expected that the new main will be seismically resilient and able to span a crater created by an adjacent main break.
Constructability Impacts (including Third-Party Utility Impacts)	10%	1.9	2.4	2.6	2.6	2.7	3.9	3.7	3.0	3.1	Existing utilities including Main No.4 along Goldstream will limit routing options for the new main. Maintaining access along Spencer Rd will be a challenge as this is a dead-end narrow road with existing utilities to work around. Consideration also required for emergency services and alternate parking options. Would be very involved for a contractor to maintain business access along this route, productivity would likely suffer as the work zone would probably need to be kept tight. Mature trees in medians and boulevards could potentially be in the way.	Existing utilities including Main No.4 along Goldstream will limit routing options for the new main. Maintaining access along Spencer Rd will be a challenge as this is a dead-end narrow road with existing utilities to work around. Consideration also required for emergency services and alternate parking options. TCH will require significant coordination with MoTI. If routing along southern boulevard, about 60% the alignment might need to be cut down (including in rock) and another 20% built up. Some larger utilities present in VMP. Relocations may be required. Parkway is wide which give options for relocation if required.	Existing utilities including Main No.4 along Goldstream will limit routing options for the new main. The road is wide and there are options to relocate utilities if required. Businesses typically have 2 driveways. TCH: It appears the area for the Leigh road onramp would need to be built up significantly which is ~15% of alignment. Another 10% might need to be built up, with ~40% needing to be cut down (mostly rock). Would be most likely be from HWY1 and we would need to coordinate with MoTI. Multi-residential complexes along Brock and Larkhall may only have access from one driveway. Consider opportunity to widen driveway and/or locate pipe joints to maintain access to this properties. Some larger utilities present in VMP. Relocations may be required. Parkway is wide which give options for relocation if required.	Leigh Rd: municipal WM, gravity mains, larger forts main and BCH ducts. The road is wide and there are options to relocate utilities if required. Businesses typically have 2 driveways. TCH: It appears the area for the Leigh road onramp would need to be built up significantly which is ~15% of alignment. Another 10% might need to be built up, with ~40% needing to be cut down (mostly rock). Would be most likely be from HWY1 and we would need to coordinate with MoTI. Multi-residential complexes along Brock and Larkhall may only have access from one driveway. Consider opportunity to widen driveway and/or locate pipe joints to maintain access to this properties. Some larger utilities present in VMP. Relocations may be required. Parkway is wide which give options for relocation if required.	Leigh Rd: Relatively congested utility corridor with watermain, gravity mains, BCH conduit, larger forts main. Dunford Rd: Most utilities are present, but the road is wide enough to allow relocations. The businesses usually have driveways that will allows for flexible access. Station Ave: Working in the E&N rail trail, while being a narrow corridor, is likely to make for more efficient construction as this corridor appears to be relatively clear of existing utilities and does not have vehicle traffic.	Leigh Rd: Relatively congested utility corridor with watermain, gravity mains, BCH conduit, larger forts main. Station Ave: Working in the E&N railcorridor, while being a narrow corridor (if avoiding impacts to the tracks), is likely to make for more efficient construction as this corridor appears to be relatively clear of existing utilities and does not have vehicle traffic. Station Ave: Working in the E&N rail trail, while being a narrow corridor, is likely to make for more efficient construction as this corridor appears to be relatively clear of existing utilities and does not have vehicle traffic.	Leigh Rd: Relatively congested utility corridor with watermain, gravity mains, BCH conduit, larger forts main. Dunford Rd: Most utilities are present, but the road is wide enough to allow relocations. The businesses usually have driveways that will allows for flexible access. Jacklin: Most utilities are present including larger forts main, watermain, gravity mains, comms. The road is wide and could accommodate relocation if required. Most driveways have duplicate entrances or are wide. Goldstream: Existing 1372 WM, also 300/400 DI, comms, gravity, larger forts present. The existing 1372 would limit routing options for new main and any potential relocations. Would be very involved for a contractor to maintain business access along this route, productivity would likely suffer as the work zone would probably need to be kept tight. Mature trees in medians and boulevards could potentially be in the way.	Goldstream: Existing 1372 WM, also 300/400 DI, comms, gravity, present. The existing 1372 would limit routing options for new main and any potential relocations. Jacklin: Most utilities are present including larger forts main, watermain, gravity mains, comms. The road is wide and could accommodate relocation if required. Most driveways have duplicate entrances or are wide. Station Ave: Working in the E&N rail trail, while being a narrow corridor, is likely to make for more efficient construction as this corridor appears to be relatively clear of existing utilities and does not have vehicle traffic.
Property and Land Acquisition Impacts	5%	4.3	3.2	3.8	3.2	3.7	3.8	3.6	4.1	4.1	Temporary rights-of-way (ROW): Construction corridor within road ROW. Compound areas opportunities along route: Combination of private and public land Permanent ROW: In existing road ROW. However, the CRD will likely need to obtain a ROW from MoTI for the sections of the main on Hwy 1 and VMP so that they are able to do future work on their main without the need for obtaining additional permits (notification would suffice).	Temporary ROW: Construction corridor within road ROW. Compound areas opportunities along route: Combination of private and public land Permanent ROW: In existing road ROW. However, the CRD will likely need to obtain a ROW from MoTI for the sections of the main on Hwy 1 and VMP so that they are able to do future work on their main without the need for obtaining additional permits (notification would suffice).	Temporary ROW: Construction corridor within road ROW. Compound areas opportunities along route: Combination of private and public land Permanent ROW: In existing road ROW. However, the CRD will likely need to obtain a ROW from MoTI for the sections of the main on Hwy 1 and VMP so that they are able to do future work on their main without the need for obtaining additional permits (notification would suffice).	Temporary ROW: Construction corridor within road ROW. Compound areas opportunities along route: Combination of private and public land Permanent ROW: However, the CRD will likely need to obtain a ROW from MoTI for the sections of the main on Hwy 1 and VMP so that they are able to do future work on their main without the need for obtaining additional permits (notification would suffice).	Temporary ROW: Construction corridor within road ROW. Compound areas opportunities along route: Combination of private and public land Permanent ROW: In existing road ROW for the majority. However, based on the assumed alignment down the E&N rail trail and corridor on Langford Parkway and Station Avenue, while any crossings of the railway are avoided, a permanent ROW on the Island Rail Foundation land will be required. This is not expected to be an issue as this option will only be progressed if the Foundation is open to having the transmission main on their property.	Temporary ROW: Construction corridor within road ROW. Compound areas opportunities along route: Combination of private and public land Permanent ROW: In existing road ROW for the majority. However, based on the assumed alignment down the E&N rail trail and corridor on Langford Parkway and Station Avenue, while any crossings of the railway are avoided, a permanent ROW on the Island Rail Foundation land will be required. This is not expected to be an issue as this option will only be progressed if the Foundation is open to having the transmission main on their property.	Temporary ROW: Construction corridor within road ROW. Compound areas opportunities along route: Limited (mostly private land) Permanent ROW: In existing road ROW.	Temporary ROW: Construction corridor within road ROW. Compound areas opportunities along route: Limited along Goldstream and Jacklin (private land). Rail corridor along Station Ave. Permanent ROW: In existing road ROW for the majority. However, based on the assumed alignment down the E&N rail trail and Station Avenue, while any crossings of the railway are avoided, a permanent ROW on the Island Rail Foundation land will be required. This is not expected to be an issue as this option will only be progressed if the Foundation is open to having the transmission main on their property.
Capital Expenditure Impacts	35%	2.0	1.0	2.5	1.0	2.5	5.0	4.2	2.1	2.9	Construction complexity: High - Utility impacts: Significant. Corridor is heavily congested with existing utilities (water, sewer, stormwater, sections of UJS electrical and gas) and existing water main No 4 (1370mm). The abandoned D900mm steel main on Goldstream Avenue would also be required for removal to allow adequate space for constructing the new main. - Roadway impacts: Significant. High traffic volumes in an active commercial area. Pipe will likely be constructed under pavement. - Third-party utility relocations: May be required. (Moderate CAPEX score due to short length)	Construction complexity: High - Utility impacts: Significant coordination works required along Goldstream Ave and VMP. Large number of distribution lines for water, sewer, gas, electrical. Main No.4 on Goldstream and Main No.14 on VMP. The abandoned D900mm steel main on Goldstream Avenue would also be required for removal to allow adequate space for constructing the new main. New main would likely be located under roadway unless significant utility relocation is undertaken. Roadway impacts: Moderate - Significant. High traffic volumes on Goldstream, TCH and VMP. Traffic impacts to Goldstream Ave and VMP are subject to the location of existing utilities and available space for the new main. On TCH, 2-lanes east bound could potentially remain open (with speed reduction and localised realignment past work zone) during works, subject to alignment finalisation and discussions with MoTI. - Third-party utility relocations: Potentially significant relocation works on VMP, depending on the available space and preference of service relocation vs construction in the VMP travel lanes. (Low CAPEX criteria score due to long length and expected high construction complexity)	Construction complexity: Moderate - High Utility impacts: Significant coordination works required along Goldstream Ave and VMP. Large number of distribution lines for water, sewer, gas, electrical. Main No.4 on Goldstream and Main No.14 on VMP. The abandoned D900mm steel main on Goldstream Avenue would also be required for removal to allow adequate space for constructing the new main. New main would likely be located under roadway unless significant utility relocation is undertaken. Roadway impacts: Moderate - Significant. High traffic volumes on Goldstream, TCH and VMP. Traffic impacts to Goldstream Ave and VMP are subject to the location of existing utilities and available space for the new main. On TCH, 2-lanes east bound could potentially remain open (with speed reduction and localised realignment past work zone) during works, subject to alignment finalisation and discussions with MoTI. Spencer, Brock and Larkhall are local roads. Brock and Larkhall in particular are likely to require full closure during construction. - Third-party utility relocations: Potentially significant relocation works, particularly along Goldstream and VMP	Construction complexity: Moderate-High Utility impacts: Moderate - Significant coordination works required along VMP - existing water, sewer, gas, electrical and Main No.14 on VMP. The abandoned D900mm steel main on Goldstream Avenue would also be required for removal to allow adequate space for constructing the new main. New main would likely be located under roadway unless significant utility relocation is undertaken. Roadway impacts: Moderate - Significant. High traffic volumes on TCH and VMP. Traffic impacts to Goldstream Ave and VMP are subject to the location of existing utilities and available space for the new main. On TCH, 2-lanes east bound could potentially remain open (with speed reduction and localised realignment past work zone) during works, subject to alignment finalisation and discussions with MoTI. Maintaining 2-way traffic on Leigh Rd should be achievable during construction. - Third-party utility relocations: Potentially significant relocation works on VMP, depending on the available space and preference of service relocation vs construction in the VMP travel lanes. (Low CAPEX criteria score due to long length and expected high construction complexity)	Construction complexity: Moderate Utility impacts: Moderate- Minor coordination works required for Leigh, TCH, Larkhall and VMP. Significant coordination works required along VMP - existing water, sewer, gas, electrical and Water Main No.14. The main location may be forced in the VMP roadway unless significant utility relocation is undertaken. Roadway impacts: Moderate - Significant. High traffic volumes on TCH and VMP. Traffic impacts to VMP are subject to the location of existing utilities and available space for the new main. On TCH, 2-lanes east bound could potentially remain open (with speed reduction and localised realignment past work zone) during works, subject to alignment finalisation and discussions with MoTI. Maintaining 2-way traffic on Leigh Rd should be achievable during construction. Spencer, Brock and Larkhall are local roads. Brock and Larkhall in particular are likely to require full closure during construction. - Third-party utility relocations: Potentially significant relocation works, particularly along VMP.	Construction complexity: Moderate-Low Utility impacts: Typical utility (distribution network) coordination works required for Leigh Rd, Dunford Rd, the main will be located on the E&N rail trail or corridor. Roadway impacts: Moderate. Collector roads with moderate traffic volumes. SLAT during construction along Leigh and Dunford. No road closures anticipated on Station Avenue. Third-party utility relocations: Minor works may be required along Station Ave depending on the available space in the E&N rail trail corridor.	Construction complexity: Moderate-Low Utility impacts: Typical utility (distribution network) coordination works required for Leigh Rd, Langford Pkwy, Station Ave on the E&N rail trail or corridor. Roadway impacts: Moderate. Collector roads with moderate traffic volumes. SLAT during construction along Leigh and Langford Pkwy. No road closures anticipated on Station Avenue. Third-party utility relocations: Minor works may be required at intersections depending on the available space in the E&N rail trail corridor.	Construction complexity: Moderate - High - Construction complexity: Moderate-High - Utility impacts: Significant along Goldstream - Corridor is heavily congested with existing utilities (water, sewer, stormwater, sections of UJS electrical and gas) and existing water main No 4 (1370mm). Typical utility (distribution network) coordination works required for Leigh, Dunford and Jacklin. - Roadway impacts: Moderate-Significant along Goldstream, high traffic volumes in an active commercial area along Goldstream. Station Ave has moderate traffic volumes but may be required along Station Ave depending on the available space and pipe location within road corridor. SLAT during construction along Jacklin. - Third-party utility relocation: Localised relocations may be required.	Construction complexity: Moderate - High Utility impacts: Significant along Goldstream. The abandoned D900mm steel main on Goldstream Avenue would also be required for removal to allow adequate space for constructing the new main. Goldstream corridor is heavily congested with existing utilities (water, sewer, stormwater, electrical, gas) and existing water main No 4 (1370mm). No major impacts expected on the E&N rail trail on Station Avenue. Roadway impacts: Moderate-Significant. High traffic volumes in an active commercial area along Goldstream. Station Ave has moderate traffic volumes but may be required along Station Ave depending on the available space in the E&N rail trail corridor.
Operation and Maintenance	8%	2.5	1.9	2.6	1.9	2.5	4.0	4.5	2.8	3.6	Pipe located within the road (under vehicle travel lane). Access will require a TMP likely specifying the following arrangement: - Goldstream and Spencer Ave: SLAT - TCH: Speed reduction past work zone, subject to: pipe location in the corridor, location of the permanent jersey barrier, access methodology, agreements with MoTI, and scale of works required. This will require O&M staff to park on the highway as there is not sufficient space for maintenance bays. - VMP: Reduce to a single travel lane on the impacted side of corridor. Access agreements will MoTI will be required for the length along TCH.	Pipe located within road corridor (and under road in sections). Access will require a TMP likely specifying the following arrangement: - Goldstream, Spencer Ave, Brock, Larkhall: SLAT - TCH: Speed reduction past work zone, subject to: pipe location in the corridor, location of the permanent jersey barrier, access methodology, agreements with MoTI, and scale of works required. This will require O&M staff to park on the highway as there is not sufficient space for maintenance bays. - VMP: Reduce to a single travel lane on the impacted side of corridor. Access agreements will MoTI will be required for the length along TCH.	Pipe located within road corridor (and under road in sections). Access will require a TMP likely specifying the following arrangement: - Leigh Rd: SLAT or 2-way with speed reduction for southern portion under the road. - Brock and Larkhall: SLAT - TCH: Speed reduction past work zone, subject to: pipe location in the corridor, location of the permanent jersey barrier, access methodology, agreements with MoTI, and scale of works required. This will require O&M staff to park on the highway as there is not sufficient space for maintenance bays. - VMP: Reduce to a single travel lane on the impacted side of corridor. Access agreements will MoTI will be required for the length along TCH.	Pipe located within road corridor (and under road in sections). Access will require a TMP likely specifying the following arrangement: - Leigh Rd: SLAT or 2-way with speed reduction for southern portion under the road. - Brock and Larkhall: SLAT - TCH: Speed reduction past work zone, subject to: pipe location in the corridor, location of the permanent jersey barrier, access methodology, agreements with MoTI, and scale of works required. - VMP: Reduce to a single travel lane on the impacted side of corridor. This will require O&M staff to park on the highway as there is not sufficient space for maintenance bays. Access agreements will MoTI will be required for the length along TCH.	Pipe located within the road (under vehicle travel lane). Access will require a TMP likely specifying the following arrangement: - Leigh and Dunford: SLAT - Station Ave: No closure anticipated.	Pipe located within the road (under vehicle travel lane). Access will require a TMP likely specifying the following arrangement: - E&N: No closure anticipated other than when crossing intersections	Pipe located within the road (under vehicle travel lane). Access will require a TMP likely specifying SLAT traffic (for Leigh, Dunford, Jacklin and Goldstream)	Pipe located within the road (under vehicle travel lane). Access will require a TMP likely specifying the following arrangement: - Goldstream and Jacklin: SLAT - Station Ave: No closure anticipated.
Connectivity	10%	4.0	2.0	3.0	1.0	2.0	4.5	4.5	5.0	5.0	Connectivity: Connectivity: - Follows the existing alignment, which allows for maintaining existing network connections. - Existing connection at Jacklin Road no longer possible. However, there is the potential to re-instate the connections at Spencer Rd. - Intersection works would also be required to reinstate the connection to Main No. 1 on the alignment of the new Main No. 4 would be on the eastern side of VMP. - Limited opportunity to connect to the ISP at Hwy 1 without connecting to the south through the road better or by constructing a connection underneath the highway to the north. - Limited opportunity for additional connections to the ISP on Brock or Larkhall Rd.	Connectivity: - Existing connection at Jacklin Road no longer possible. However, there is the potential to re-instate the connections at Spencer Rd. - Intersection works would also be required to reinstate the connection to Main No. 1 on the alignment of the new Main No. 4 would be on the eastern side of VMP. - Limited opportunity to connect to the ISP at Hwy 1 without connecting to the south through the road better or by constructing a connection underneath the highway to the north. - Some opportunity for additional connections to the ISP on Brock or Larkhall Rd.	Connectivity: - Existing connection at Jacklin Road no longer possible. - Limited connections possible on Leigh Rd as the main terminates south of Highway 1. - Intersection works would also be required to reinstate the connection to Main No. 1 on the alignment of the new Main No. 4 would be on the eastern side of VMP. - Limited opportunity to connect to the ISP at Hwy 1 without connecting to the south through the road better or by constructing a connection underneath the highway to the north. - Some opportunity for additional connections to the ISP on Brock or Larkhall Rd.	Connectivity: - Existing connection at Jacklin Road no longer possible. - Limited connections possible on Leigh Rd as the main terminates south of Highway 1. - Intersection works would also be required to reinstate the connection to Main No. 1 on the alignment of the new Main No. 4 would be on the eastern side of VMP. - Limited opportunity to connect to the ISP at Hwy 1 without connecting to the south through the road better or by constructing a connection underneath the highway to the north. - Some opportunity for additional connections to the ISP on Brock or Larkhall Rd.	Connectivity: - Existing connection at Jacklin Road no longer possible. However there is the potential to reinstate this at the intersection of Jacklin Rd with Dunford/Station. - Other potential connections to the JdF possible on all routes. - Connection to Main No. 1 and 3 able to be reinstated on Station Ave or Goldstream. - Additional connections to Main No. 1 and 3 possible on all routes. - Connection to Main No. 4 also possible here which could increase the downstream redundancy of the system. - Connection to the JdF at VMP can be improved or reinstated without crossing busy	Connectivity: - Existing connection at Jacklin Road no longer possible. However there is the potential to reinstate this at the intersection of Jacklin Rd with Station. - Other potential connections to the JdF possible on all routes. - Connection to Main No. 1 and 3 able to be reinstated on Station Ave or Goldstream. - Additional connections to Main No. 1 and 3 possible here which could increase the downstream redundancy of the system. - Connection to the JdF at VMP can be improved or reinstated without crossing busy	Connectivity: - Existing connection at Jacklin Road no longer possible. However there is the potential to reinstate this at the intersection of Jacklin Rd with Dunford/Station. - Other potential connections to the JdF possible on all routes. - Connection to Main No. 1 and 3 possible here which could increase the downstream redundancy of the system. - Connection to the JdF at VMP can be improved or reinstated without crossing busy
Sub Total		**2.9**	**1.9**	**2.8**	**1.8**	**2.7**	**4.2**	**4.0**	**3.0**	**3.5**						

Appendix F
Class D Cost Estimate

Capital Regional District

Capital Regional District 2023-2026 Transmission Main Upgrade Program

Main No. 4 Upgrade (Leigh Road to Veterans Memorial Parkway) - Leigh Road-Dunford Avenue-E&N Rail Alignment

Class D Conceptual Design Estimate

11-Aug-2025

Item	Description	Unit	Quantity	Unit Price ($)	Total Price ($)
Part A - Base Tender Items					
1	Bonding and Insurance	L.S.	1	$ 597,000.00	$ 597,000.00
2	Mobilization/Demobilization	L.S.	1	$ 895,000.00	$ 895,000.00
3	Traffic Management	L.S.	1	$ 597,000.00	$ 597,000.00
4	Supply of 1372mm(54") DIA Steel Pipe, 12.5mm (1/2")thick wall with Polyurethane Coating	Lin. M	2260	$ 3,700.00	$ 8,362,000.00
5	Installation by Open Cut of 1372mm DIA Steel Pipe	Lin. M	2147	$ 4,700.00	$ 10,090,900.00
6	Trenchless Pipe Installation of 1372mm Pipe - Allowance	Lin. M	113	$ 11,000.00	$ 1,243,000.00
7	Installation and Backfill of Launching Shaft - Allowance	L.S.	1	$ 650,000.00	$ 650,000.00
8	Installation and Backfill of Receiving Shaft - Allowance	L.S.	1	$ 350,000.00	$ 350,000.00
9	Connection of 1372mm DIA WM to existing pipe	each	1	$ 150,000.00	$ 150,000.00
10	Connection of 1219mm DIA WM to existing pipe including butterfly valve	each	1	$ 240,000.00	$ 240,000.00
11	Supply of 1219mm (48") DIA Steel Pipe, 12.5mm (1/2")thick wall with Polyurethane Coating	Lin. M	36	$ 12,000.00	$ 432,000.00
12	Installation by Open Cut of 1219mm DIA Steel Pipe	Lin. M	36	$ 8,100.00	$ 291,600.00
13	Relocation of Utilities - Allowance	L.S.	1	$ 1,000,000.00	$ 1,000,000.00
14	Site Restoration and Clean Up	m2	6000	$ 150.00	$ 900,000.00
15	Cleaning Flushing Pressure Testing and Disinfection	L.S.	1	$ 350,000.00	$ 350,000.00
16	Supply and installation of line valve chamber	each	2	$ 1,200,000.00	$ 2,400,000.00
17	Supply and Installation of 150mm offset air valve assembly - Allowance	each	5	$ 75,000.00	$ 375,000.00
18	Supply and Installation of 150mm flush valve assembly - Allowance	each	4	$ 105,000.00	$ 420,000.00
19	150mm connection with gate valve	each	0	$ 8,500.00	$ -
20	200mm connection with gate valve	each	0	$ 10,200.00	$ -
21	400mm connection with gate valve	each	0	$ 24,500.00	$ -
22	500mm connection with gate valve	each	1	$ 33,500.00	$ 33,500.00
23	500mm connection with butterfly valve	each	2	$ 21,500.00	$ 43,000.00
24	600mm connection to existing pipe with butterfly valve	each	2	$ 35,000.00	$ 70,000.00
	Decommissioning				
25	Decommissioning of existing valve chamber - allowance	each	2	$ 200,000.00	$ 400,000.00
26	Grout fill to abandon existing 1372 CPP main	Lin. M	1860	$ 1,100.00	$ 2,046,000.00
Sub-Total of Part A - Base Tender Items					$ 31,936,000.00
Part B - Provisional Tender Items					
P1	Over-excavation and Backfilling of Trench (19 mm MMCD Drain Rock)	Cu.m	50	$ 180.00	$ 9,000.00
P2	Rock Excavation and Removal from Site	Cu.m	50	$ 400.00	$ 20,000.00
P3	Loading, Transporting, and Stockpiling of Suspect (Contaminated) Material	Tonne	2500	$ 40.00	$ 100,000.00
P4	Loading and Disposal of Suspect Material Determined as Uncontaminated	Tonne	2500	$ 30.00	$ 75,000.00
P5	Loading, Transporting and Disposal of Hydrocarbon Contaminated Material Above CSR Residential Standards but Below Commercial/ Industrial Standards	Tonne	1250	$ 65.00	$ 81,250.00
P6	Loading, Transporting and Disposal of Hydrocarbon Contaminated Material Above CSR Commercial/ Industrial Standards but Below Hazardous Waste Regulations	Tonne	1250	$ 90.00	$ 112,500.00
P7	Loading, Transporting and Disposal of Metals Contaminated Material Above CSR Residential Standards but Below Commercial/ Industrial Standards	Tonne	100	$ 80.00	$ 8,000.00
P8	Loading, Transporting, and Disposal of Metals Contaminated Material Above CSR Commercial/Industrial Standards but Below Hazardous Waste Regulations	Tonne	100	$ 100.00	$ 10,000.00
P9	Collection, Treatment, and Disposal of Suspect (Contaminated) Ground Water	Litres	2500	$ 0.90	$ 2,250.00
P10	Restrictive Working Conditions due to Archaeological Investigations	Hr.	40	$ 1,200.00	$ 48,000.00
P11	Transporting & Disposal of Chloride-ion Contaminated Material Above CSR IL	Tonne	3500	$ 80.00	$ 280,000.00
P12	Removal of Obstruction during Trenchless Crossing	½ Hr	60	$ 508.61	$ 30,516.60
P13	MMCD Hot-mix Asphalt Upper Course #1	SQ.M	250	$ 140.00	$ 35,000.00
P14	MMCD Hot Mix Asphalt Lower Course#1	SQ.M	250	$ 150.00	$ 37,500.00
P15	MMCD 'Super Pave' Upper Course	SQ.M	50	$ 150.00	$ 7,500.00
P16	Asphalt Cold Milling up to 35 mm Depth, Dispose and Overlay	SQ.M	250	$ 35.00	$ 8,750.00
P17	MMCD 19 mm minus Granular Base to 100mm Depth	SQ.M	250	$ 20.00	$ 5,000.00
P18	MMCD Crushed Granular Sub-base to 300mm Depth	SQ.M	250	$ 40.00	$ 10,000.00
P19	MMCD C4 Barrier Curb and Gutter	L.M.	50	$ 200.00	$ 10,000.00
P20	MMCD 100 mm Thick Concrete Walk	SQ.M	50	$ 300.00	$ 15,000.00
Sub-Total of Part B - Provisional Tender Items					$ 905,000.00
Summary of Prices					
	Part A - Base Tender Items				$ 46,361,000.00
	Construction Costs			$ 31,936,000.00	
	Design Contingency		25%	$ 7,984,000.00	
	Construction Contingency		5%	$ 1,597,000.00	
	Escalation at 5%/ year applied to MidPoint of Construction. Construction Start on January 2027 for 20 months		12%	$ 4,844,000.00	
	Part B - Provisional Tender Items				$ 905,000.00
	Total Construction Costs				$ 47,266,000.00

	Class D Estimate	Low Range	Estimated Costs	High Range
		-20%		+30%
	Construction Cost	$ 37,089,000.00	$ 46,361,000.00	$ 60,269,000.00
	Provisional Items	$ 905,000.00	$ 905,000.00	$ 905,000.00
	Overall Opinion of Probable Construction Costs	$ 37,994,000.00	$ 47,266,000.00	$ 61,174,000.00

Capital Regional District

Capital Regional District 2023-2026 Transmission Main Upgrade Program

Main No. 4 Upgrade (Leigh Road to Veterans Memorial Parkway) - Leigh Road-E&N Rail Alignment

Class D Conceptual Design Estimate

11-Aug-2025

Item	Description	Unit	Quantity	Unit Price ($)	Total Price ($)
Part A - Base Tender Items					
1	Bonding and Insurance	L.S.	1	$ 735,000.00	$ 735,000.00
2	Mobilization/Demobilization	L.S.	1	$ 1,103,000.00	$ 1,103,000.00
3	Traffic Management	L.S.	1	$ 735,000.00	$ 735,000.00
4	Supply of 1372mm(54") DIA Steel Pipe, 12.5mm (1/2")thick wall with Polyurethane Coating	Lin. M	2915	$ 3,700.00	$ 10,785,500.00
5	Installation by Open Cut of 1372mm DIA Steel Pipe	Lin. M	2769	$ 4,255.00	$ 11,782,095.00
6	Trenchless Pipe Installation of 1372mm Pipe - Allowance	Lin. M	146	$ 11,000.00	$ 1,606,000.00
7	Installation and Backfill of Launching Shaft - Allowance	L.S.	1	$ 650,000.00	$ 650,000.00
8	Installation and Backfill of Receiving Shaft - Allowance	L.S.	1	$ 350,000.00	$ 350,000.00
9	Connection of 1372mm DIA WM to existing pipe	each	1	$ 150,000.00	$ 150,000.00
10	Connection of 1219mm DIA WM to existing pipe	each	1	$ 240,000.00	$ 240,000.00
11	Supply of 1219mm(48") DIA Steel Pipe, 12.5mm (1/2")thick wall with Polyurethane Coating	Lin. M	36	$ 12,000.00	$ 432,000.00
12	Installation by Open Cut of 1219mm DIA Steel Pipe	Lin. M	36	$ 8,100.00	$ 291,600.00
13	Removal of Existing Trees	each	50	$ 1,200.00	$ 60,000.00
14	Temporary Access Road	m2	4825	$ 100.00	$ 482,500.00
15	Relocation of Utilities - Allowance	L.S.	1	$ 1,000,000.00	$ 1,000,000.00
16	Site Restoration and Clean Up	m2	7500	$ 150.00	$ 1,125,000.00
17	Cleaning Flushing Pressure Testing and Disinfection	L.S.	1	$ 450,000.00	$ 450,000.00
18	Supply and installation of line valve chamber	each	3	$ 1,200,000.00	$ 3,600,000.00
19	Supply and Installation of 150mm offset air valve assembly - Allowance	each	7	$ 75,000.00	$ 525,000.00
20	Supply and Installation of 150mm flush valve assembly - Allowance	each	6	$ 105,000.00	$ 630,000.00
21	500mm connection with gate valve	each	1	$ 33,500.00	$ 33,500.00
22	500mm connection with butterfly valve	each	2	$ 21,500.00	$ 43,000.00
23	600mm connection with butterfly valve	each	2	$ 35,000.00	$ 70,000.00
	Decommissioning				
24	Decommissioning of existing valve chamber - allowance	each	2	$ 200,000.00	$ 400,000.00
25	Grout fill to abandon existing 1372 CPP main	Lin. M	1860	$ 1,100.00	$ 2,046,000.00
Sub-Total of Part A - Base Tender Items					$ 39,325,000.00
Part B - Provisional Tender Items					
P1	Over-excavation and Backfilling of Trench (19 mm MMCD Drain Rock)	Cu.m	60	$ 180.00	$ 10,800.00
P2	Rock Excavation and Removal from Site	Cu.m	60	$ 400.00	$ 24,000.00
P3	Loading, Transporting, and Stockpiling of Suspect (Contaminated) Material	Tonne	3220	$ 40.00	$ 128,800.00
P4	Loading and Disposal of Suspect Material Determined as Uncontaminated	Tonne	3220	$ 30.00	$ 96,600.00
P5	Loading, Transporting and Disposal of Hydrocarbon Contaminated Material Above CSR Residential Standards but Below Commercial/ Industrial Standards	Tonne	1610	$ 65.00	$ 104,650.00
P6	Loading, Transporting and Disposal of Hydrocarbon Contaminated Material Above CSR Commercial/ Industrial Standards but Below Hazardous Waste Regulations	Tonne	1610	$ 90.00	$ 144,900.00
P7	Loading, Transporting and Disposal of Metals Contaminated Material Above CSR Residential Standards but Below Commercial/ Industrial Standards	Tonne	130	$ 80.00	$ 10,400.00
P8	Loading, Transporting, and Disposal of Metals Contaminated Material Above CSR Commercial/Industrial Standards but Below Hazardous Waste Regulations	Tonne	130	$ 100.00	$ 13,000.00
P9	Collection, Treatment, and Disposal of Suspect (Contaminated) Ground Water	Litres	3220	$ 0.90	$ 2,898.00
P10	Restrictive Working Conditions due to Archaeological Investigations	Hr.	50	$ 1,200.00	$ 60,000.00
P11	Transporting & Disposal of Chloride-ion Contaminated Material Above CSR IL	Tonne	4510	$ 80.00	$ 360,800.00
P12	Removal of Obstruction during Trenchless Crossing	½ Hr	80	$ 508.61	$ 40,688.80
P13	MMCD Hot-mix Asphalt Upper Course #1	SQ.M	320	$ 140.00	$ 44,800.00
P14	MMCD Hot Mix Asphalt Lower Course#1	SQ.M	320	$ 150.00	$ 48,000.00
P15	MMCD 'Super Pave' Upper Course	SQ.M	64	$ 150.00	$ 9,600.00
P16	Asphalt Cold Milling up to 35 mm Depth, Dispose and Overlay	SQ.M	320	$ 35.00	$ 11,200.00
P17	MMCD 19 mm minus Granular Base to 100mm Depth	SQ.M	320	$ 20.00	$ 6,400.00
P18	MMCD Crushed Granular Sub-base to 300mm Depth	SQ.M	320	$ 40.00	$ 12,800.00
P19	MMCD C4 Barrier Curb and Gutter	L.M.	60	$ 200.00	$ 12,000.00
P20	MMCD 100 mm Thick Concrete Walk	SQ.M	60	$ 300.00	$ 18,000.00
Sub-Total of Part B - Provisional Tender Items					$ 1,160,000.00
Summary of Prices					
	Part A - Base Tender Items				$ 57,512,000.00
	Construction Costs			$ 39,325,000.00	
	Design Contingency		25%	$ 9,831,000.00	
	Construction Contingency		5%	$ 1,966,000.00	
	Escalation at 5%/ year applied to MidPoint of Construction. Construction Start on January 2027 for 24 months		13%	$ 6,390,000.00	
	Part B - Provisional Tender Items				$ 1,160,000.00
	Total Construction Costs				$ 58,672,000.00

	Class D Estimate	Low Range	Estimated Costs	High Range
		-20%		+30%
	Construction Cost	$ 46,010,000.00	$ 57,512,000.00	$ 74,766,000.00
	Provisional Items	$ 1,160,000.00	$ 1,160,000.00	$ 1,160,000.00
	Overall Opinion of Probable Construction Costs	$ 47,170,000.00	$ 58,672,000.00	$ 75,926,000.00

Appendix C.
Hydraulic Analysis

Technical Memorandum 6

Transmission Main Upgrade Program – Hydraulic Modeling and Sizing Analysis

UPDATED DRAFT

Project ID: 2023-120-CRD
Requested by: Jacobs
Date: November 29, 2024
Subject: Transmission Main Upgrade Projects A2.1 and A2.2

1 Introduction

GeoAdvice Engineering Inc. (GeoAdvice) was retained by Jacobs (Client) to undertake the hydraulic modeling and water main sizing as part of the *CRD RFP No 2023-892 Regional Water Supply and Saanich Peninsula Water Services 2023-2026 Transmission Main Upgrade Program* project.

Regarding Technical Memorandum 6, the objective is to determine the required pipe diameters for the transmission main upgrade projects A2.1 and A2.2, as shown in red in **Figure 1.1** and **Figure 1.2**, respectively.

Project A2.1 consists of a new watermain of about 2.3 km along Leigh Road, Dunford Avenue and Station Avenue, that will replace the section of Main No. 4 along Goldstream Avenue (i.e., the section of Main No. 4 along Goldstream Avenue is assumed to be decommissioned to size project A2.1). The alignment of project A2.1 was provided by Jacobs on August 26, 2024.

Project A2.2 consists of a new watermain of about 2.9 km along Wale Road, Wilfert Road and Island Highway, that will replace the section of Main No. 3 along Wale Road and Island Highway (i.e. the section of Main No. 3 along Wale Road and Island Highway is assumed to be decommissioned to size Project A2.2). The alignment of Project A2.2 was provided by Jacobs on November 14, 2024. Additionally, as confirmed by Jacobs, Project A2.1 will be completed prior to Project A2.2. Therefore, the recommended new pipe for Project A2.1 was considered “active” in the model when sizing Project A2.2.

The following modeling scenarios were developed and analyzed.

- Year 2023 Maximum Day Demand (MDD) + Kapoor Tunnel in Service
- Year 2100 Maximum Day Demand (MDD) + Kapoor Tunnel in Service

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As confirmed by Jacobs, it is assumed that Project A2.3 (as presented in GeoAdvice TM 3) will be completed prior to projects A2.1 and A2.2 (i.e., Main No. 1 operating at 169 m from Humpback PCS to Watkiss PCS).

All scenarios used for the modeling analysis were Steady State (SS) scenarios.

Finally, the CRD InfoWater Pro model used for this study was updated in February 2024 as outlined in the GeoAdvice Technical Memorandum - 2023 JdFWD, RWS & SPW Model Update (February 8, 2024).

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Figure 1.1: Extent of Transmission Main Project A2.1

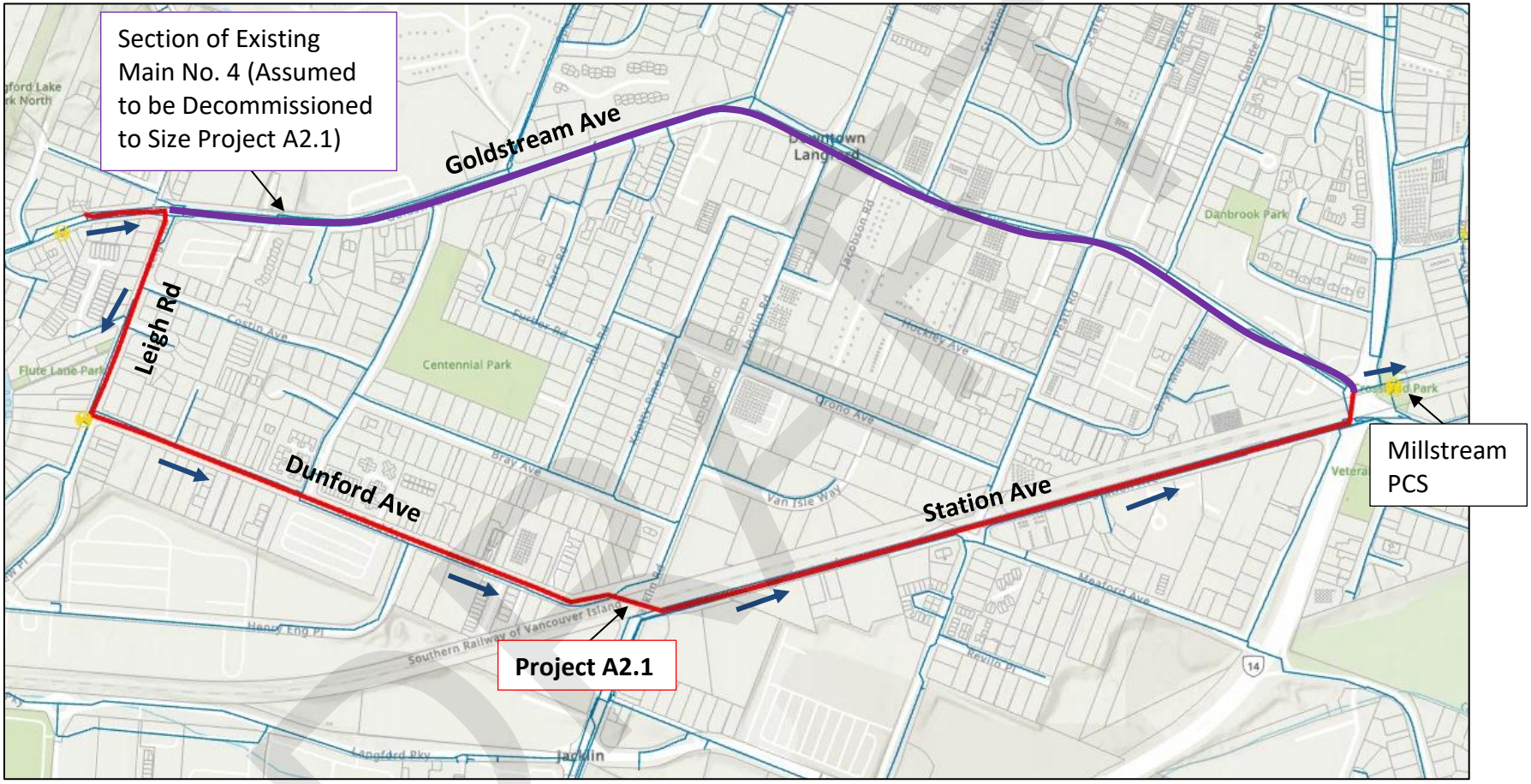
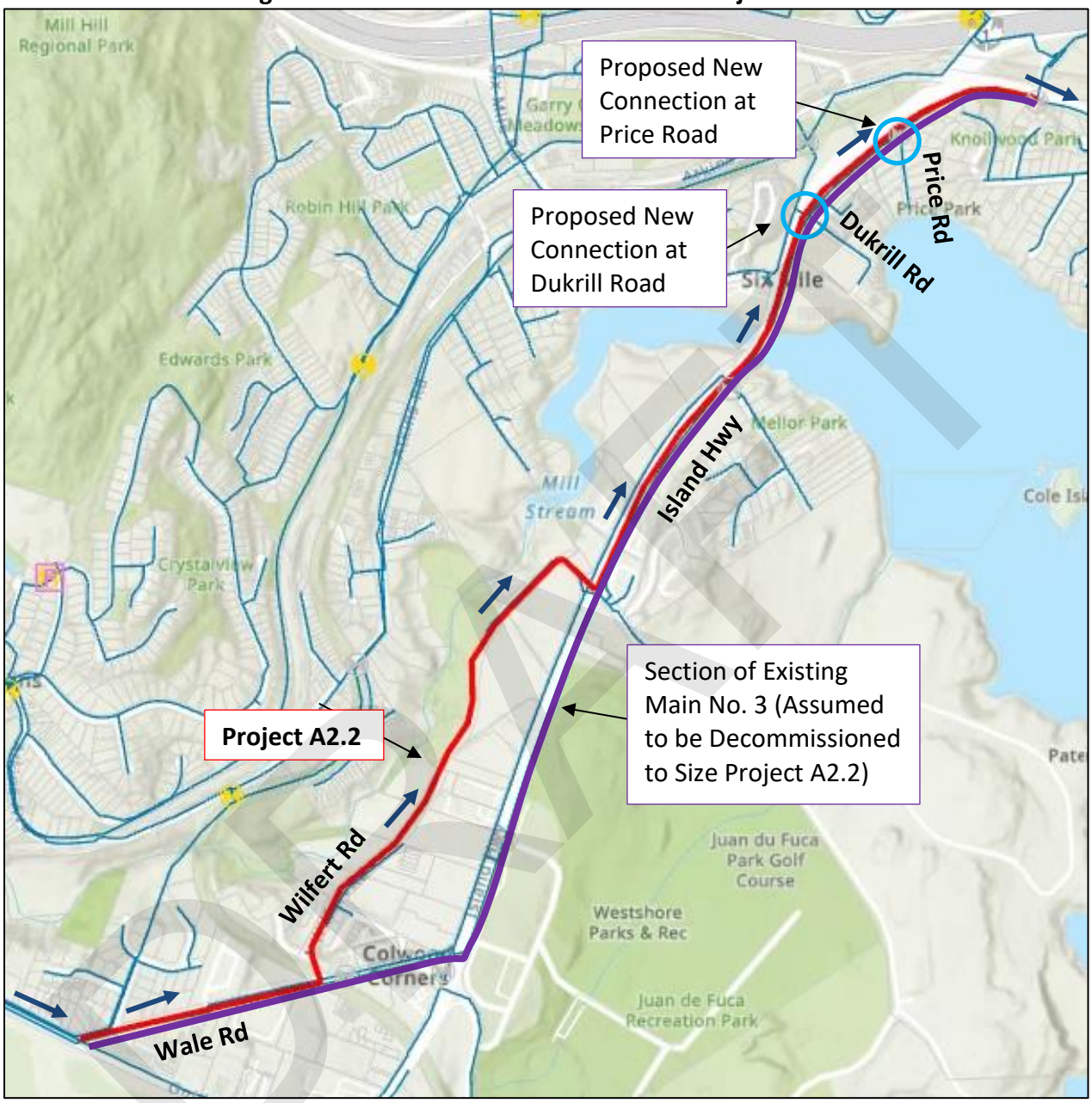


Figure 1.2: Extent of Transmission Main Project A2.2



2 Hydraulic Analysis

Table 2.1 summarizes the hydraulic criteria used for sizing projects A2.1 and A2.2.

Table 2.1: Hydraulic Sizing Criteria

Element	Criteria	Value
Transmission Main	Maximum Velocity	≤ 2.0 m/s
	Maximum Headloss Gradient	≤ 2.5 m/km
Pressure Control Valve (PCV)	Maximum Velocity	≤ 6.0 m/s
	Valve Failure Status	100% Open
Storage Tank	Storage Filling	≥ 0 L/s

Additionally, the Hazen Williams roughness coefficient used for the new pipe is C = 120, as agreed with CRD.

Upgrade Project A2.1

As confirmed by Jacobs, it is assumed that Project A2.3 (as presented in GeoAdvice TM 3) will be completed prior to Project A2.1 (i.e., Main No. 1 operating at 169 m from Humpback PCS to Watkiss PCS).

The recommended diameter of the new pipe was sized under the 2100 MDD scenario, to the minimum diameter which would satisfy the velocity and headloss gradient criteria. **The proposed diameter of Project A2.1 is 1,350 mm.**

Table 2.2 summarizes the modeling results of Project A2.1.

Table 2.2: Project A2.1 Modeling Results

Modeling Results	2023 MDD SS	2100 MDD SS
Flow (L/s)	1,418	2,462
Velocity (m/s)	1.03	1.80
Headloss Gradient (m/km)	0.74	2.06

As presented in **Table 2.2**, there are no velocity or headloss gradient deficiencies under the 2023 MDD and 2100 MDD scenarios.

The PCV modeling results were compared with and without Project A2.1. Under both 2023 and 2100 MDD scenarios, Project A2.1 does not impact the PCV modeling results.

The tank modeling results were compared with and without Project A2.1. Under both 2023 and 2100 MDD scenarios, Project A2.1 does not impact the tank modeling results.

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The HGL modeling results of the export nodes were compared with and without Project A2.1. Under both 2023 and 2100 MDD scenarios, Project A2.1 does not impact the export nodes.

The fire flow modeling results were compared with and without Project A2.1. Under both 2023 and 2100 MDD scenarios, Project A2.1 does not impact the fire flow modeling results.

Upgrade Project A2.2

As confirmed by Jacobs, it is assumed that both Project A2.3 (as presented in GeoAdvice TM 3) and Project A2.1 will be completed prior to Project A2.2.

Additionally, note that there are nine (9) existing connections between the section of Main No. 3 (assumed to be decommissioned to size Project A2.2) and JDF network. It is recommended to add at least two (2) new connections between Project A2.2 and JDF network:

- One (1) connection at Island Highway and Price Road, as Main No. 3 is currently the only main feeding this area. Therefore, Project A2.2 will need to take over and provide supply to this area.
- One (1) connection at Island Highway and Dukrill Road, as Main No. 3 is an important feed to the area West of Main No. 3.

The recommended diameter of the new pipe was sized under the 2100 MDD scenario, to the minimum diameter which would satisfy the velocity and headloss gradient criteria. Additionally, as part of the conceptual/preliminary design phase, it was agreed with Jacobs to maintain at least the same diameter as the existing Main No. 3. Any potential reduction in pipe diameter will be evaluated and discussed as part of the detailed design phase. **The proposed diameter of Project A2.2 is 1,200 mm.**

Table 2.3 summarizes the modeling results of Project A2.2.

Table 2.3: Project A2.2 Modeling Results

Modeling Results	2023 MDD SS	2100 MDD SS
Flow (L/s)	488	562
Velocity (m/s)	0.42	0.48
Headloss Gradient (m/km)	0.15	0.20

As presented in **Table 2.3**, there are no velocity or headloss gradient deficiencies under the 2023 MDD and 2100 MDD scenarios.

The PCV modeling results were compared with and without Project A2.2. Under both 2023 and 2100 MDD scenarios, Project A2.2 does not impact the PCV modeling results.

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The tank modeling results were compared with and without Project A2.2. Under both 2023 and 2100 MDD scenarios, Project A2.2 does not impact the tank modeling results.

The HGL modeling results of the export nodes were compared with and without Project A2.2. Under both 2023 and 2100 MDD scenarios, Project A2.2 does not impact the export nodes.

The fire flow modeling results were compared with and without Project A2.2. Under the 2023 and 2100 MDD scenarios, Project A2.2 creates twenty-five (25) and twenty-four (24) new additional fire flow deficiencies, respectively. All the deficiencies are located in the area along Project A2.2. Additional connections between Project A2.2 and the network will be required to address these deficiencies. This will be further evaluated as part of the detailed design phase.

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Submission

Prepared and Approved by:

Werner de Schaetzen, Ph.D., P.Eng.
Senior Modeling Review / Project Manager

Document History and Version Control

Revision No.	Date	Document Description	Revised By	Reviewed By
R0	October 10, 2024	Draft	Christopher Moens	Werner de Schaetzen
R1	November 29, 2024	Second Draft	Christopher Moens	Werner de Schaetzen

DRAFT

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Appendix D.
Permit Matrix

Permit Matrix

Date:	February 10, 2026
Project Name:	CRD Transmission Main Upgrade
Project No.:	CE870400
Attention:	Adrian Wardle
Client:	Capital Regional District
Prepared By:	Diana Chomack, R.P.Bio.
Reviewed By:	Bree Milne
Revision No.:	A - Draft

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1. Introduction

The Capital Regional District (CRD) has requested that Jacobs provide a preliminary review of permitting requirements for the Regional Water System Transmission Main Upgrade (the Program). This document provides the permits required for the Main No. 4 Upgrade, Goldstream Avenue. Alignment (A2.1). The purpose of this Permit Matrix is to provide an overview of potential permits and approvals for the Project to inform preliminary design and planning. Early identification of environmental sensitivities, timing windows, and regulatory risks will help to mitigate regulatory and schedule risk for the two Projects.

The review of permitting requirements is based on early design information and a detailed environmental desktop and literature review conducted for the Preliminary Design Report (PDR). The permitting risks and opportunities summarized in Table 1 have been developed based on the current preliminary design.

Early identification and ongoing refinement of permitting risks and opportunities can contribute to a more resilient approach to managing the Project's regulatory and schedule risk. As Project planning progresses, the permit list should be reviewed and updated, and a permit schedule should be developed that considers broader Project dependencies.

Table 1. Permits, Approvals, and Notifications

Agency	Permit/Approval	Legislation and Regulation	Responsible Entity	Approximate Application Review Timeline	Trigger	Application Considerations
Provincial						
BC Ministry of Environment and Climate Change Strategy (MECCS)	Soil Relocation Notification Form	*Environmental Management Act / Contaminated Sites Regulation (CSR)*	Construction Contractor		Required if the source site is/has been used for BC CSR Schedule 2 activities and the receiving site is not an authorized landfill. 14 day notification prior to soil relocation	Contingency only
BC Ministry of Forests (MoF)	Archaeological Overview Assessment (AOA)	*Heritage Conservation Act*	Millenia	N/A - complete	A Multi Assessment Permit (MAP) is required to assess impacts to archaeological materials and sediments via subsurface testing and construction monitoring in areas identified as having archaeological potential in an AOA or identified in the data gap analysis, or both.	N/A - complete
	Multi Assessment Permit	*Heritage Conservation Act*	WSP	N/A - obtained		N/A - obtained
BC Ministry of Transportation and Infrastructure	Work Notification / Lane Closure Request and Approval Form (H1080)	*Transportation Act*	Construction Contractor	14 days		
	Highway Use Permit - Utilities		Construction Contractor	30 days		
Regional & Municipal						
Capital Regional District (CRD)	Authorized Use of Fire Hydrants and Standpipes	Water Distribution Local Service Conditions, Fees, and Charges Bylaw No. 3889	Construction Contractor	TBD	If water from fire hydrants and standpipes is required during construction, and authorization from the General Manager is required.	--
City of Langford	Application to Construct, Use and Maintain Works within a Roadway or Lane	Traffic Bylaw No. 33	Construction Contractor	14-28 days	This is required for works within municipal road allowances	--
Vancouver Island Health Authority	Water Works Construction Permit	Drinking Water Protection Regulation	Jacobs	30 days	This is required for the construction of a water supply system	--
Other						

Agency	Permit/Approval	Legislation and Regulation	Responsible Entity	Approximate Application Review Timeline	Trigger	Application Considerations
Various First Nations	First Nations Permits or Notifications	First Nations policies	WSP	Variable	First Nations issue permits for archaeology work and construction activities conducted in their territory. These permits are in addition to the permit that is obtained from BC MWLRS.	--
Telus Communications	Third Party Agreement	--	Construction Contractor	60 days	Telus communications is to approve of any work near their infrastructure	
FortisBC	Pipeline and/or right of way works application (working adjacent)	*Energy Resources Activities Act*	Jacobs	122 – 183 months	Fortis BC is to approve of any work near their infrastructure	--
BC Hydro	30m Ground Disturbance Permit	--	Construction Contractor	30 days	BC Hydro is to approve of any work near their infrastructure.	--
BC Transit	--	--	Construction Contractor	TBD	If disruption to bus stops is required, BC Transit needs to be notified.	--
Private Landowners	Temporary Encroachment Agreement	--	Construction Contractor	TBD	May be required if the proposed alignment will impact private property.	--
WorksafeBC	BC 1 Call Registration	*Occupoational Health and Safety Regulation*	Construction Contractor		Conduct prior to ground disturbance (GD). GD must start within 14 calendar days of the OneCall ticket. If that occurs, the ticket is valid for 30 days from the request date.	

Appendix E.
Species and Ecological Communities of Conservation Concern with Potential to Occur Within CDF Biogeoclimatic Zone

Permit Matrix

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Regional & Municipal						
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Other						

Agency	Permit/Approval	Legislation and Regulation	Responsible Entity	Approximate Application Review Timeline	Trigger	Application Considerations
Various First Nations	First Nations Permits or Notifications	First Nations policies	WSP	Variable	First Nations issue permits for archaeology work and construction activities conducted in their territory. These permits are in addition to the permit that is obtained from BC MWLRS.	--
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WorksafeBC	BC 1 Call Registration	*Occupoational Health and Safety Regulation*	Construction Contractor		Conduct prior to ground disturbance (GD). GD must start within 14 calendar days of the OneCall ticket. If that occurs, the ticket is valid for 30 days from the request date.	

Appendix F.
Archaeological Overview Assessment

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ARCHAEOLOGICAL AND HERITAGE CONSULTING

January 31, 2025 MR 2340-4

Patrick Moore, BEng (Hons)
Civil Discipline Specialist
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Burnaby, BC
V5H 4N2

Via email: Patrick.moore@jacobs.com

Re: A2.1 Main No. 4 Upgrade – Dunford and Station Avenue Route – Archaeological Overview Assessment

Dear Patrick Moore,

Millennia Research Limited (Millennia) was contract by Jacobs Consultancy Canada Inc. (Jacobs) on behalf of the Capital Regional District (CRD) to conduct an archaeological overview assessment (AOA) for the proposed Main No. 4 Upgrades Project, Dunford Avenue and Station Avenue Alignment (Figure 1). According to the Consultative Areas Database (CAD), the project area is within the area of interest of the Esquimalt, Malahat, Pauquachin, Songhees, Tsartlip, Tsawout, and Tseycum First Nations, as well as that of the Te'Mexw Treaty Association.

The work consisted of a desktop review of the proposed project area. The review is intended to assess the potential for archaeological sites within the proposed project area to facilitate compliance with the *Heritage Conservation Act (HCA)*. The *HCA* provides automatic protection for recorded an unrecorded pre-1846 archaeological sites located on public and private land. Specifically, the review is intended to:

- Identify and evaluate the potential for archaeological resources within the proposed project area;
- Identify and evaluate potential impacts to any archaeological resources that may result from the proposed developments; and,
- Provide recommendations for any further archaeological work necessary to mitigate potential impacts to any archaeological resources within areas subject to ground disturbance.

This AOA report has compiled geographic, archaeological, and historical data from across the project area, providing an in-depth background review. This information can also provide the background for any AIAs, mitigation, and monitoring strategies completed for the project. Several datasets were reviewed to provide context for archaeological work within the project area. Environmental research focused on sea level history for the Greater Victoria area. Topographical analysis was conducted using LiDAR data. The Provincial Heritage Register was accessed to locate archaeological sites within 250 m of the Project and any previous archaeological studies related to the area. Ethnographic resources were consulted to identify broader land use patterns and traditional practices which may have contributed to the formation of archaeological sites. An assessment of the degree of land alteration and the resulting integrity of various landforms from historical development was completed principally by examining Google Earth satellite imagery and Google Street View, Capital Regional District orthophotos, and LiDAR Hillshade.

In keeping with professional best practices, this AOA was conducted to the standards of the British Columbia Archaeology Branch (1998a), as well as the reporting standards of the British Columbia Association of Professional Archaeologists (1999).

Project Description

Main No. 4 is a high-pressure transmission main that delivers bulk drinking water to customers in the Greater Victoria area, including the Saanich Peninsula. The proposed Main No. 4 upgrade extends from Leigh Road to Veteran's Memorial Parkway. The Main No. 4 Upgrade project is part of a larger scope of work by the CRD to maintain, reinforce, and increase the Regional Water Supply (RWS). This project in particular focuses on a critical section of the transmission main that currently has no redundancy for the RWS and is at risk for failure in a seismic event due to the pipe material and lack of pipe restraint. This section of transmission main was also recommended for future upgrading in a previous study for hydraulic capacity purposes. Anticipated impacts from the proposed work will include trenching excavations along the alignment. The project generally follows the developed roadways.

Methodology

The project area was subject to desk-based review of sources available through the online services of the BC Archaeology Branch and the Millennia in-house library. The project area was checked for previously recorded archaeological sites and modelled potential for unrecorded archaeological sites through the Archaeology Branch's Remote Access to Archaeological Data (RAAD) database. Archaeological and historical site data was obtained from all sites recorded near the project area from the RAAD database. The BC Archaeology Branch's Provincial Archaeological Report Library (PARL) was searched for reports related to previous archaeological surveys in the vicinity of the project area. Historical records were reviewed to assess the integrity of various landforms and identify historical land-altering activities which had the potential to damage earlier archaeological sites or result in material remains that could be found in excavations. Publicly available LiDAR imagery was referenced for further detail defining landforms and terrain.

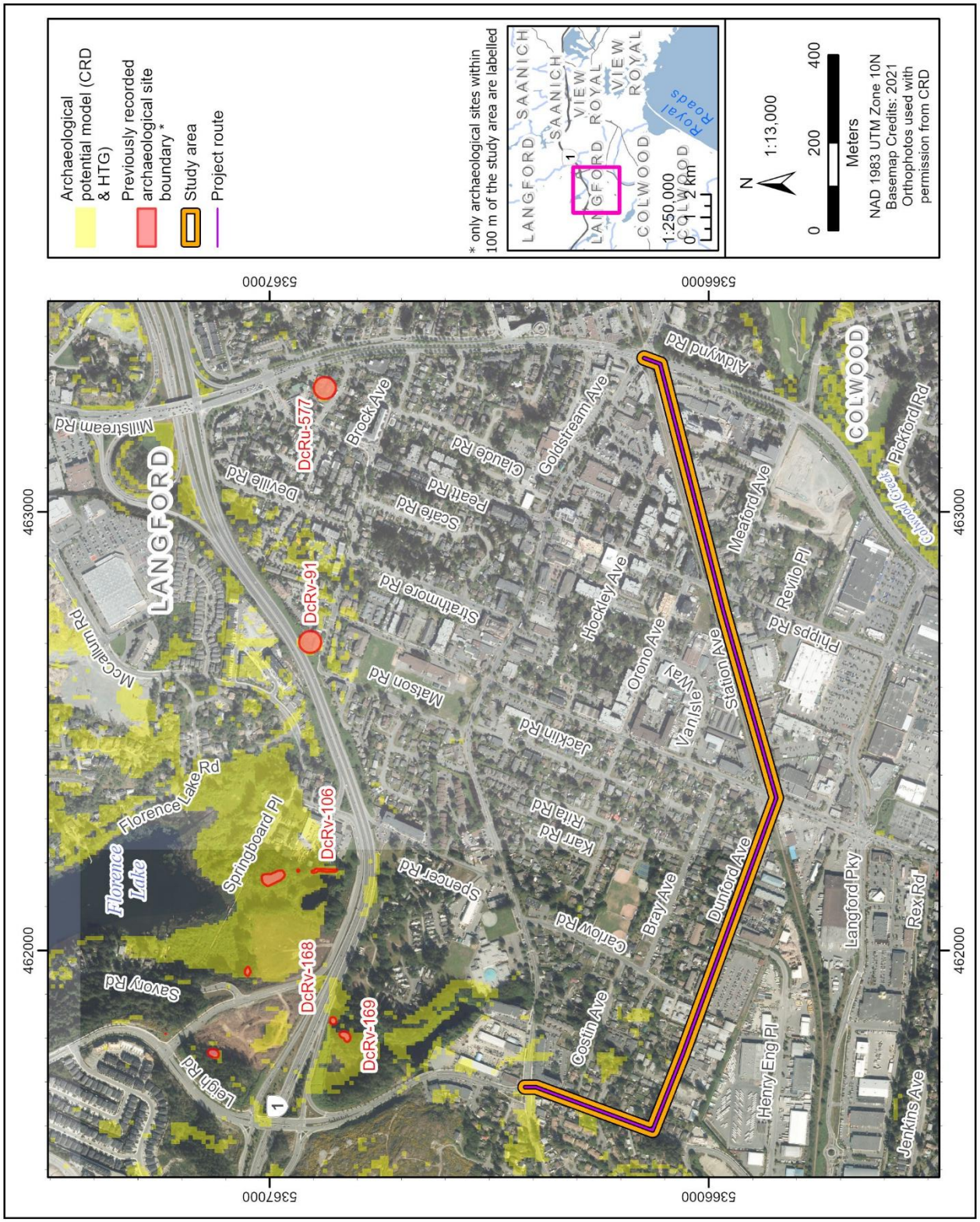


Figure 1. Project area map.

Study Area

Environment

Southeastern Vancouver Island, the Gulf Islands and a thin strip of the adjacent mainland of British Columbia fall into the Coastal Douglas-fir (CDF) biogeoclimatic zone as identified by Nuszdorfer *et al.* (1991). The islands of the zone have fewer wildlife species than mainland British Columbia. The CDF zone is characterized by warm, dry summers and mild, wet winters. Snowfall is minimal, with the region receiving the least amount for the shortest duration of any zone in British Columbia. Palaeoenvironmental studies of southern British Columbia indicate that although minor regional changes continued, relatively modern environmental conditions were established between 4,500-3,000 BP (Hebda 1995; Mathews 1985).

Sea Level History

Late Holocene sea level changes and tectonic events may have important implications for understanding the human and natural history of the Esquimalt Lagoon area. Hutchinson (1997:47) summarises the available evidence for relative sea level changes in the southern Strait of Georgia, the eastern Strait of Juan de Fuca and northern Puget Sound. About 13,000 years before present (BP) the relative sea level reached a maximum of 75 m above present-day sea level, then dropped to at least 10 m below present sea level between 12,000 and 11,000 years BP. The majority of the evidence indicates that relative sea levels stabilised at the present level by *ca*. 5,000 years BP.

Culture History

Archaeological sites are understood with reference to 'culture histories,' which are spatial and temporal frameworks established through archaeological research for the organization and analysis of material culture. The known culture history of the Salish Sea is comprised of at least six archaeological units, also known as phases or cultures (Table 1). In general, the more ancient the evidence, the more poorly understood it is, because the amount of data gets progressively smaller the more ancient the time period. The local archaeological cultures are reviewed in several sources, including Mitchell (1971, 1990), Matson and Coupland (1995) and Clark (2013), and a detailed summary of the closely-aligned Olympic Peninsula is provided in Morgan and Hartmann (1999). The various periods have been alternatively described as "Phases" which by definition should be confined to a relatively small area and short length of time, or the more widespread, long term, and potentially slow changing terms Culture Types or Traditions which seems more appropriate in this region (Abbott 1972). In practice, both sets of terms are used almost interchangeably. A portion of the Greater Victoria cultural sequence has been reviewed and revised (Clark 2000; Clark 2013), although not all Clark's revisions are consistent with the known record. The middle and later culture history periods are distinguished by mostly small changes and apparently gradual change between periods.

The oldest potential archaeological site in the Salish Sea region has been identified on the Olympic Peninsula, WA dating 13,800 calibrated years before present (cal. BP) (Waters, et al. 2011), and definite archaeological material occurs in Puget Sound at 12,500 cal. BP (Kopperl, et al. 2015). Two very early units present in the Puget Sound part of the Salish Sea (Clovis [13,200 – 12,800 cal. BP] and Western Stemmed [13,500 – 9,000 cal. BP]) have yet to be identified in the Strait of Georgia (Carlson and Magne 2008; Jenkins, et al. 2012). On the Strait of Georgia, the oldest published site is about 9,000 years old (Matson 1976). Sites dated significantly earlier have recently been found in the

northern Strait of Georgia. They are located at elevations associated with raised sea levels and the early postglacial period but to date, not publicly reported.

Table 1. Culture History Sequence of the Salish Sea Region.

Age (calibrated years Before Present)	Southernmost Vancouver Island and adjacent islands	Mainland/majority of Gulf Islands
Present–200 BP	Contact/Historic period	
200-1,100/1,500	Gulf of Georgia Culture Type	
1,100/1,500-2,000	Marpole Culture Type	Marpole Culture Type
2,000-2,400	Bowker Creek subphase of Locarno Beach	
2,400-3,300/3,500	Locarno Beach Culture Type	
3,300/3,500-5,000	Charles Culture Type	
5,000-9,000	Old Cordilleran/Cascade/Olcott Culture Type	
9,000-14,000+	Early traditions: Clovis, Western Stemmed	

There is considerable uncertainty regarding fundamental interpretations of the cultures that produced the record. For instance, the emergence of culture complexity in the form of an inherited stratified class society has been claimed for the Marpole (Matson and Coupland 1995), and the much earlier Charles (Coupland, et al. 2016) periods, while hints of it in the form of labrets and ear spools are also noted in the intermediate Locarno period (Cybulski 2010; Moss 2011). The development of cultural complexity was once seen as population replacement (Borden 1968; Borden 1954); then as a one-way evolution from simplicity to complexity (Fladmark 1982; Matson and Coupland 1995). Now cultural complexity is thought to be transitory, with wealth accumulation arising in the Charles/early Locarno periods, then returning to an egalitarian state during Locarno, then arising again part way through the Marpole period (Coupland, et al. 2016; Moss 2011). Carlson (2017) now suggests that the Locarno period was complex, with innovation and wealth and power demonstrated in art. The topic of status is complex with different lines of evidence suggesting status differentiation in most of the periods after about 5,000 BP (Burchell 2006; La Salle 2013; Schulting 1995).

Results

No previously recorded archaeological sites are located within the project area, and no previously recorded archaeological sites are within 250 m of the project area. The closest archaeological sites to the project area are approximately 400 to 450 m north of the Leigh Road and Goldstream Avenue intersection. All previously recorded sites in the vicinity of the project are outlined in Table 2.

DcRv-168 is a shell midden scatter measuring approximately 15 m by 15 m. This site was first identified by surface shell and lithics during the 2008 Spencer Road-Savory Road AIA (Willows 2008). Shovel testing found subsurface deposits of midden to 20 cm below surface but noted significant disturbance. The site is considered to be of low significance, but Willows (2008) notes that a Site Alteration Permit will be required if further ground disturbance to the site is anticipated.

DcRv-169 is an inland shell midden measuring approximately 24 m north-south by 17 m east-west. This site was first identified during the 2008 Spencer Road-Savory Road AIA (Willows 2008) Midden deposits, some intact, were observed to 30 cm below surface and several pieces of faunal bone, some burnt, were recovered from evaluative units during the AIA. The site is considered to have moderate significance, but due to extensive shovel testing and mostly negative results during the 2008 AIA, Willows (2008) recommends only monitoring and raking under a SAP for further ground disturbance to the site.

Table 2. Previously recorded sites in vicinity of Project.

Site #	Within 50 m of Project Area (Y/N)	Status	Location/ Proximity to Project	Site Type
DcRv-168	Y	Protected	11 m south of Leigh Rd onramp to Trans-Canada Highway south	Lithics, shell midden
DcRv-169	Y	Protected	42 m south of Leigh Rd onramp to Trans-Canada Highway south	Lithics, shell midden

Desktop Review

The proposed project area does not intersect any areas of modelled archaeological potential; however, one small pocket of modelled archaeological potential is noted immediately adjacent to the Dunford Avenue and Maurice Lane intersection. Additional modelled archaeological potential in the vicinity to the project area clusters around Langford Lake, and around the ephemeral drainage running east from Langford Lake. Smaller pockets of modelled potential exist south of Dunford Avenue and Station Avenue.

The LiDAR and aerial imagery of the area show a generally level to gently sloping terrain. Langford Lake stands adjacent to the project area, approximately 100 m west of Leigh Road and Dunford Avenue. The modelled archaeological potential focuses on the area surrounding this water feature that have not been impacted by highway and road construction. Available fresh water tends to have a higher potential for archaeological material due to increased subsistence activities that water provides, such as fishing, hunting, and drinking water. Archaeological sites associated with these features could include lithic and faunal scatters or shell middens depending on the level of use and specific function.

The average relative sea-level of the project area ranges from approximately 65 m to 75 m above sea level (asl). As noted in the study area description, sea level was previously as high as 75 m more than the current relative sea level. This could place the project area either at or near the previous shoreline, which could explain some of the inland shell midden sites already identified in the general area. As with any coastal region, the archaeological potential is increased due to an increased presence of abundant subsistence resources and accessible transportation. Slightly raised landforms throughout the project area may have increase archaeological potential as they would provide ideal habitation locations with nearby fresh water from Langford Lake as well as the coastal resources.

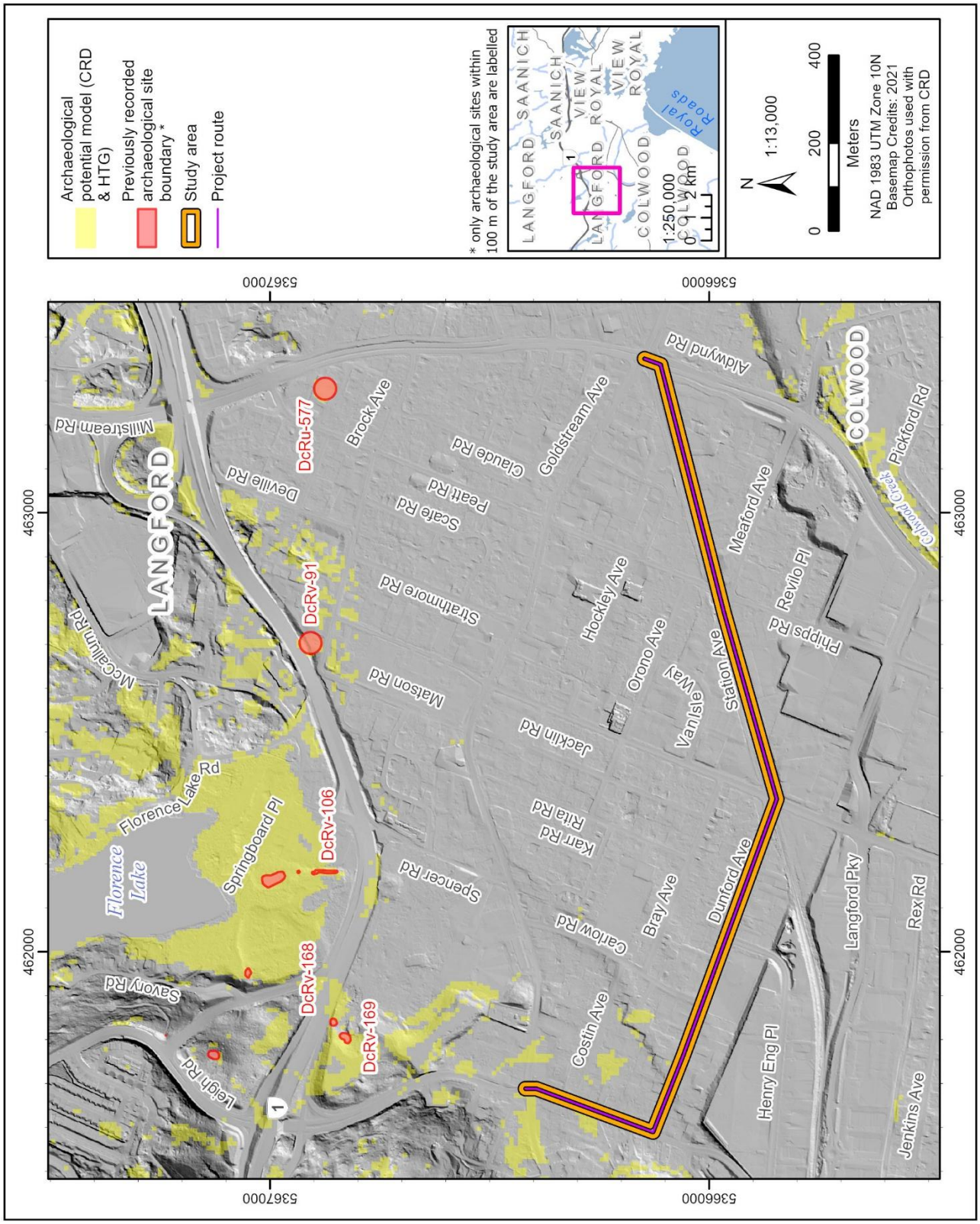


Figure 2. Project segment alignment with LiDAR.

Preliminary Potential Assessment and Recommendations

The desktop review measured the degree of archaeological risk associated with the proposed project alignment and indicates the project has a low potential to impact any archaeological resources. The alignment does not traverse any modelled archaeological potential, nor does it pass close to or within the boundaries of any known archaeological sites. This route generally falls within highly developed urban landscapes with no prominent landforms and otherwise level to gently sloping terrain which accounts for the low potential impact rating.

As a result of the low archaeological potential rating, it is recommended that archaeological awareness training be provided for the contractor's crew members responsible for excavations and an archaeological chance find management plan should be developed. Cultural monitoring is recommended where appropriate and as requested by First Nations with an interest in the Project area.

Limitations

The current study is concerned with the management of archaeological sites which may be affected by the proposed development. As with any archaeological investigation involving a sampling strategy, unidentified cultural deposits may be present within the project area. On provincial land these deposits may be protected under the *Heritage Conservation Act* (*HCA*). If unanticipated archaeological remains (including but not limited to those identified as potential site types in this document) are encountered during construction or land-altering activity the developer is advised to halt work in the immediate area and contact a professional archaeologist and the appropriate regulatory agency.

The information contained in this report has been compiled specifically for the project as defined by the proponent and discussed herein. Any subsequent changes to the proposed project may not be addressed by the current archaeological study and additional studies may be appropriate.

Professional Statement

The information compiled in this report has been prepared in accordance with the standards of the BC Association of Professional Archaeologists and the BC Archaeological Impact Assessment Guidelines (British Columbia Archaeology Branch 1998). The report has been prepared by Millennia Research Limited staff and reviewed by a senior archaeologist (see signatories below).

Millennia Research Limited
Per:



Graham Bowles, BA
Archaeologist

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Appendix G.
Preliminary Geotechnical Assessment Memorandum

November 7, 2024 File No.: 37959

Jacobs Solutions Inc.
Level 21, 4720 Kingsway,
Burnaby/BC
V5H 4N2

Attention: Anita Le

A2.1 - MAIN NO. 4 UPGRADE
LEIGH ROAD – DUNFORD AVENUE – STATION AVENUE
PRELIMINARY GEOTECHNICAL DESIGN REPORT

This letter provides a desktop level review of the "A2.1 – Main No.4 Upgrade" alignment for preliminary geotechnical design input. Thurber has reviewed information from previously conducted geotechnical investigations in the project area and outlined the anticipated geotechnical conditions, considerations, and potential challenges for this alignment.

It is a condition of this letter that the performance of Thurber's professional services is subject to the attached Statement of Limitations and Conditions.

1. BACKGROUND

Main No. 4 is a high-pressure transmission main delivering bulk drinking water to customers in the Greater Victoria Area, including the Saanich Peninsula. This main begins at the Kapoor Tunnel outlet and terminates at the McTavish Tank in North Saanich. The total length of the main is approximately 36.7 km, with existing pipe diameters between 610 mm to 1,372 mm and constructed using welded steel and concrete pressure pipe (CPP).

The existing Main No. 4 alignment on Goldstream Avenue from Leigh Road to Veterans Memorial Parkway is 1.9 km long section constructed of 1,372 mm diameter CPP. This section along Goldstream is a highly congested corridor with significant critical infrastructure, overhead and buried utilities, traffic volume in the order of 15,000 vehicles per day, and many stakeholders in mixed-use residential and commercial environments.

The overall objective of this upgrade is to replace the existing CPP pipe material with a transmission main which is less at risk of failure in a seismic event. Due to the congestion in the existing corridor for this section of Main No.4, an alignment options analysis was undertaken to mitigate the potential impacts during construction and operation as well as investigate the potential for the CRD to maximize the benefits of these works for future transmission and sewer capital projects.

Option 6 was selected as the preferred alignment which proposes upgrades from Leigh Road at Goldstream Avenue, along Leigh Road to Dunford Avenue, and along Station Avenue until

reconnecting to the existing main at Goldstream Avenue. This new alignment is approximately 2,200 m in length. Figure 1 (attached) illustrates the proposed alignment.

2. GEOTECHNICAL INPUT

2.1 Anticipated Ground Conditions

The surficial geology for the area of the proposed A2.1 project is mapped as interbedded sands and gravels of the Colwood delta and outwash plain. This deposit is known to extend to depths up to 30 m and may be deeper in areas near Colwood and eastern Langford. It is also expected that parts of the alignment will encounter thin organic layers generally less than 4 m thick at the north end of the alignments between Leigh and Carlow Road. Finally, there is a possibility of shallow rock in areas occurring less than 2 m from the ground surface at the north end of the alignment near Leigh road.

A geotechnical field investigation is planned to be carried out in support of detailed design to confirm subsurface conditions along the alignment.

2.2 Historical Geotechnical Investigations

Thurber has completed geotechnical investigations for other projects in the area of the preferred alignment option. The soil conditions for these locations are described below.

Two historical geotechnical investigations were conducted near Station Road between Jacklin Road and Veterans Memorial Parkway. Both investigations indicated that ground conditions consisted of compact to dense, moist, brown, sandy gravel with trace to some cobbles, and trace silt. Samples collected from both investigations indicated that the water content was less than 10% for all samples. Groundwater was encountered in one of the test holes along Station Road at a depth of approximately 10 m below ground surface.

The subsurface conditions described above should be verified by Thurber's geotechnical investigation for this scope of work.

3. PRELIMINARY DESIGN INPUT

3.1 Settlement Risk

For conventional utility construction, settlement is not anticipated to be a significant concern based on the anticipated ground conditions. However, the potential for settlement will be considered in more detail once the geotechnical investigation is completed and the ground conditions along the proposed alignment have been confirmed.

3.2 Seismic Performance

Pipeline seismic design criteria for buried CRD pipelines are closely related to the Metro Vancouver standard seismic design criteria for Class III and IV pipelines. Seismic demand is similar to what is defined for Class IV pipelines. Acceptance criteria are similar to Class III pipelines. Only earthquake-generated permanent ground displacement needs to be considered for the design of buried CRD pipelines. The level of earthquake ground shaking shall be that corresponding to an annual probability of being exceeded (AEP) of 0.0004 (equivalent to 2% in 50 years or and mean return period of 2,475 years).

Given the anticipated relatively shallow depth of the existing pipe, lack of topographic relief, anticipated groundwater depth, and experience in the Colwood sand and gravel, we do not consider liquefaction or lateral spreading to be of concern along the proposed alignment.

3.3 Soil Corrosion Potential

The planned geotechnical investigation will collect soil samples available for corrosivity testing by others.

3.4 Pipe Bedding & Backfill Material

Pipe bedding and surrounding materials will likely follow MMCD standard specification for excavating, trenching, and backfilling underground utilities.

3.5 Construction Considerations

Given the anticipated geotechnical conditions, it is expected that the pipe will be able to be installed following conventional open excavation and backfilling methods. Where subsurface trench conditions comprise sand and gravel, it's likely that excavation can be completed using a standard trench box. Further recommendations will be available once the geotechnical investigation is completed, and the proposed pipe elevations have been determined.

4. CLOSURE

We trust this information meets your present needs. If you have any questions, please contact us at your convenience.

Yours truly,
Thurber Engineering Ltd.
Steven Coulter, M.Sc., P.Eng.
Review Engineer

Kevin G. Golding, P.Eng.
Geotechnical Engineer

Thurber Engineering Ltd.
Permit to Practice #1001319

Attachment
- Statement of Limitations and Conditions
- Figure 1: A2.1 Alignment – Surficial Geology Map

THURBER

STATEMENT OF LIMITATIONS AND CONDITIONS

1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

5. INTERPRETATION OF THE REPORT

a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.

d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

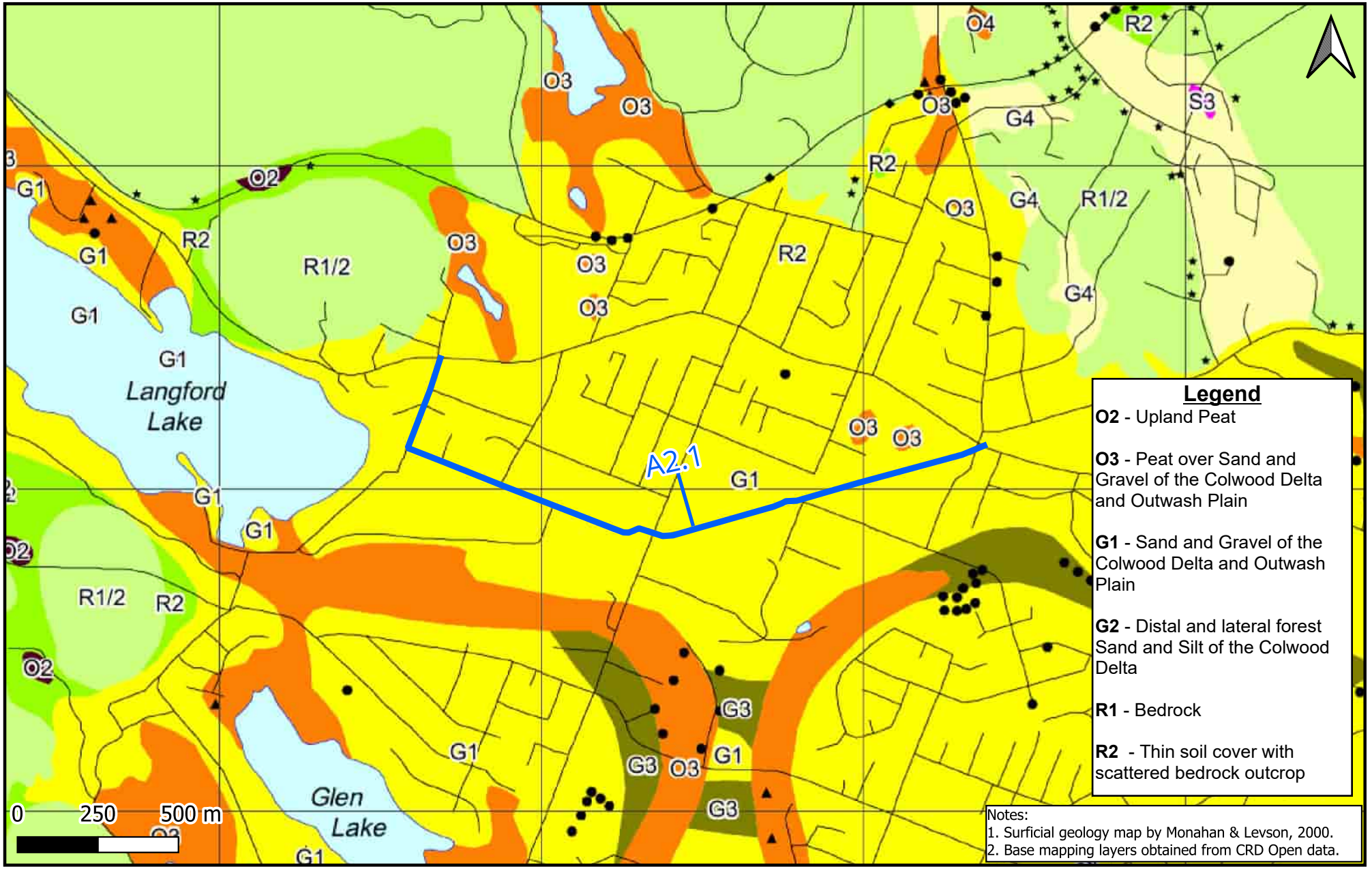
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THURBER

CRD TRANSMISSION MAIN UPGRADE PROGRAM RFP NO. 2023-892

PROJECT A2.1 - MAIN NO. 4 UPGRADE, LEIGH RD.- DUNFORD RD. - STATION AVE. ALIGNMENT



Client: Jacobs Solutions Ltd.
File No: 37959

FIGURE 1

Date: November 07, 2024
Drawn by: KGG

Appendix H.
Geotechnical Site Investigation Plan

December 13, 2024 File No.: 37959

Jacobs
740 Hillside Avenue, Suite 203
Victoria, BC
V8T 1Z4

Attention: Anita Le, P.Eng.

A2.1 - MAIN NO. 4 UPGRADE
LEIGH ROAD – DUNFORD AVENUE – STATION AVENUE
GEOTECHNICAL SITE INVESTIGATION PLAN

Dear Anita,

This letter provides our proposed geotechnical investigation plan for the A2.1 Main No. 4 upgrade.

It is a condition of this letter that the performance of Thurber's professional services is subject to the attached Statement of Limitations and Conditions.

1. BACKGROUND

Main No. 4 is a high-pressure transmission main delivering bulk drinking water to customers in the Greater Victoria Area, including the Saanich Peninsula. This main begins at the Kapoor Tunnel outlet and terminates at the McTavish Tank in the District of North Saanich. The total length of the main is approximately 36.7 km, with existing pipe diameters between 610 mm to 1,372 mm and constructed using welded steel and concrete pressure pipe (CPP).

The existing Main No. 4 alignment on Goldstream Avenue from Leigh Road to Veterans Memorial Parkway is a 1.9 km long section constructed of 1,372 mm diameter CPP. This section along Goldstream is a highly congested corridor with significant critical infrastructure, overhead and buried utilities, traffic volume in the order of 15,000 vehicles per day, and many stakeholders in mixed-use residential and commercial environments.

The overall objective of this upgrade is to replace the existing CPP pipe with a transmission main which is less at risk of failure in a seismic event. Due to the congestion in the existing corridor for this section of Main No.4, an alignment options analysis was undertaken to mitigate the potential impacts during construction and operation as well as investigate the potential for the CRD to maximize the benefits of these works for future transmission and sewer capital projects.

Option 6 was selected as the preferred alignment which proposes upgrades from Leigh Road at Goldstream Avenue, along Leigh Road to Dunford Avenue, and along Station Avenue until

reconnecting to the existing main at Goldstream Avenue. This new alignment is approximately 2,200 m in length. Figure 1 (attached) illustrates the proposed alignment and test hole locations.

2. SCOPE OF WORK

The proposed scope of work is intended to investigate the subsurface soil conditions, test the density of the soils, and conduct in-situ testing where required or beneficial for developing future design recommendations. The proposed investigation will consist of clearing test hole locations from utility conflicts then drilling the proposed test hole locations with the use of traffic control services.

2.1 Health, Safety and Environmental (HSE) Plan

Prior to undertaking our field investigation, we will complete a site-specific HSE plan that will list the hazards identified for the site and how they will be mitigated. All field and subcontractor employees will sign this plan indicating that they have read and understood all aspects of it. In addition, our field employees will complete tailgate meetings with subcontractors prior to work each day to review hazards and safety aspects of the project.

2.2 Traffic Control

We anticipate that traffic control will be required for most of the proposed test hole locations. As such, a traffic control plan will be created for the safety of all on-site personnel. The traffic control plan will be created by the traffic control subcontractor and reviewed by Thurber prior to beginning work on site to confirm it is adequate for each test hole location. Traffic control plans will be in accordance with WorkSafeBC requirements and Occupational Health and Safety (OHS) Regulation Part 18: Traffic Control.

2.3 Utility Locates

We will notify BC One Call of our investigation plan before mobilizing to site. We assume that reliable drawings will be provided to us showing any underground services at the site. To further reduce the risk of damage to underground utilities during the investigation, we will engage a private utility locator to scan the proposed test hole locations where utilities are likely for metal conduits and conductors using inductive methods and ground penetrating radar. Non-metallic pipes such as PVC water and gas lines cannot be readily detected. Thurber cannot accept any responsibility for damage to any underground utilities that are not clearly identified to us prior to drill mobilization.

2.4 Drilling Investigation

We have reviewed geological mapping of the area, historical groundwater well records, and nearby past projects. Ground conditions along the alignment are anticipated to consist of sand and gravel of the Colwood delta and outwash plain.

We propose completing a sonic drilling investigation at 9 locations along the Main No. 4 proposed alignment at roughly 250 m spacing. We will collect information on the subsurface conditions which will be used in our geotechnical analysis to inform our recommendations. The work will be undertaken using a track mounted sonic drill and is estimated to take four days. The drilling investigation will include standard penetration tests (SPTs) at regular intervals or dynamic cone penetration tests (DCPTs) to provide an estimate of the density of the granular soils. We anticipate eight test holes will be completed as indicated on the attached drawing, Figure 1: Proposed Test Hole Locations, Project A2.1.

Test holes are anticipated to be advanced up to a depth of approximately 4.5 m or to bedrock (whichever is shallower). We anticipate this drilling depth will be adequate to inform all construction and design needs. Please let us know if information on deeper subsurface conditions is required.

The soil and groundwater conditions will be logged in the field by experienced geotechnical personnel and selected soil samples will be retained for testing in our laboratory. Test holes will be backfilled upon completion in accordance with the BC Groundwater Regulations. All soil samples will be subjected to routine moisture content and visual classification testing in our laboratory. Gradation analyses, fines content (percent passing 75 um sieve) and Atterberg limit testing will be carried out on selected representative samples, as appropriate.

2.5 Reporting

We will prepare a geotechnical report following completion of our geotechnical field investigation. Our initial report will be a geotechnical data report that will summarize the observed soil and groundwater conditions, test hole locations, and laboratory test results. This report is intended to provide a factual overview of information gathered from the geotechnical investigation outlined above. As the project transitions into detailed design, we will provide a detailed design report with geotechnical recommendations as they are related to design and construction works. If design requirements are added following our investigation that require geotechnical input, additional investigations may be required.

3. FIELD INVESTIGATION ASSUMPTIONS

Our investigation plan assumes the following:

- No hydro vacuum excavation is required to clear the required test hole locations of underground infrastructure.
- Measurements of test hole locations will be completed using handheld GPS equipment which has a typical accuracy in the order of 5 m.
- Unimpeded access to the test hole locations proposed by Thurber will be available and no access preparation will be required to access these locations.
- Holes are anticipated to be drilled on public property or in the public right of way. No allowances have been made for permits to access on private property. If access to private property is required, we understand Jacobs will coordinate with stakeholders appropriately to obtain the necessary permits.
- No rock coring will be required. If shallow rock is encountered test holes will be terminated once bedrock is confirmed.
- No archaeological services are included for the proposed geotechnical investigation.
- Overnight security not required for geotechnical investigation.
- We have not included well installations or monitoring at any test hole locations.
- Traffic control is included in our proposal and will be used during all on site operations requiring lane closures.
- The work will be completed during regular working hours during weekdays.
- Environmental sampling and testing of samples has not been included.
- Corrosion testing of samples collected will be conducted by others if required.

4. CLOSURE

As required by the bylaws of Engineers & Geoscientists BC, we inform you that we carry professional liability insurance applicable to the scope of services being offered, details of which can be provided if authorized to carry out this assignment.

We trust the above provides the information you require at this time. If you have any questions with regard to the above, please do not hesitate to contact the undersigned.

Yours truly,
Thurber Engineering Ltd.
Steven Coulter, M.Sc., P.Eng.
Review Engineer



Kevin G. Golding, P.Eng.
Geotechnical Engineer

Attachments:
- Statement of Limitations and Conditions
- Figure 1: Proposed Test Hole Locations, Project A2.1

THURBER

STATEMENT OF LIMITATIONS AND CONDITIONS

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7. INDEPENDENT JUDGEMENTS OF CLIENT

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Plotted: December 12, 2024



LEGEND:

PROJECT A2.1 - MAIN NO. 4 UPGRADE, LEIGH ROAD & DUNFORD AVE

PROPOSED TEST HOLE LOCATION

NOTES:
1. 2023 ORTHO IMAGE FROM CRD OPEN DATA.
2. PROPOSED TEST HOLE LOCATIONS ARE APPROXIMATE.

THURBER

CAPITAL REGIONAL DISTRICT

PROPOSED TEST HOLE LOCATIONS
PROJECT A2.1

MAIN NO. 4 UPGRADE, LEIGH ROAD & DUNFORD AVE — VICTORIA, BC

DESIGNED	DRAWN	APPROVED	DATE	SCALE	PROJECT No.	FIGURE. NO.	REV.
DJE	DRB	KGG	DEC. 12, 2024	1:10,000	37959	**FIGURE 1**	-

37959-CAD004.dwg

Appendix I.
Class C Cost Estimate

Capital Regional District

Capital Regional District 2023-2026 Transmission Main Upgrade Program

Main No. 4 Upgrade (Leigh Road to Veterans Memorial Parkway) - Leigh Road-Dunford Avenue-E&N Rail Alignment

Class D Conceptual Design Estimate

11-Aug-2025

Item	Description	Unit	Quantity	Unit Price ($)	Total Price ($)
Part A - Base Tender Items					
1	Bonding and Insurance	L.S.	1	$ 597,000.00	$ 597,000.00
2	Mobilization/Demobilization	L.S.	1	$ 895,000.00	$ 895,000.00
3	Traffic Management	L.S.	1	$ 597,000.00	$ 597,000.00
4	Supply of 1372mm(54") DIA Steel Pipe, 12.5mm (1/2")thick wall with Polyurethane Coating	Lin. M	2260	$ 3,700.00	$ 8,362,000.00
5	Installation by Open Cut of 1372mm DIA Steel Pipe	Lin. M	2147	$ 4,700.00	$ 10,090,900.00
6	Trenchless Pipe Installation of 1372mm Pipe - Allowance	Lin. M	113	$ 11,000.00	$ 1,243,000.00
7	Installation and Backfill of Launching Shaft - Allowance	L.S.	1	$ 650,000.00	$ 650,000.00
8	Installation and Backfill of Receiving Shaft - Allowance	L.S.	1	$ 350,000.00	$ 350,000.00
9	Connection of 1372mm DIA WM to existing pipe	each	1	$ 150,000.00	$ 150,000.00
10	Connection of 1219mm DIA WM to existing pipe including butterfly valve	each	1	$ 240,000.00	$ 240,000.00
11	Supply of 1219mm (48") DIA Steel Pipe, 12.5mm (1/2")thick wall with Polyurethane Coating	Lin. M	36	$ 12,000.00	$ 432,000.00
12	Installation by Open Cut of 1219mm DIA Steel Pipe	Lin. M	36	$ 8,100.00	$ 291,600.00
13	Relocation of Utilities - Allowance	L.S.	1	$ 1,000,000.00	$ 1,000,000.00
14	Site Restoration and Clean Up	m2	6000	$ 150.00	$ 900,000.00
15	Cleaning Flushing Pressure Testing and Disinfection	L.S.	1	$ 350,000.00	$ 350,000.00
16	Supply and installation of line valve chamber	each	2	$ 1,200,000.00	$ 2,400,000.00
17	Supply and Installation of 150mm offset air valve assembly - Allowance	each	5	$ 75,000.00	$ 375,000.00
18	Supply and Installation of 150mm flush valve assembly - Allowance	each	4	$ 105,000.00	$ 420,000.00
19	150mm connection with gate valve	each	0	$ 8,500.00	$ -
20	200mm connection with gate valve	each	0	$ 10,200.00	$ -
21	400mm connection with gate valve	each	0	$ 24,500.00	$ -
22	500mm connection with gate valve	each	1	$ 33,500.00	$ 33,500.00
23	500mm connection with butterfly valve	each	2	$ 21,500.00	$ 43,000.00
24	600mm connection to existing pipe with butterfly valve	each	2	$ 35,000.00	$ 70,000.00
	Decommissioning				
25	Decommissioning of existing valve chamber - allowance	each	2	$ 200,000.00	$ 400,000.00
26	Grout fill to abandon existing 1372 CPP main	Lin. M	1860	$ 1,100.00	$ 2,046,000.00
Sub-Total of Part A - Base Tender Items					$ 31,936,000.00
Part B - Provisional Tender Items					
P1	Over-excavation and Backfilling of Trench (19 mm MMCD Drain Rock)	Cu.m	50	$ 180.00	$ 9,000.00
P2	Rock Excavation and Removal from Site	Cu.m	50	$ 400.00	$ 20,000.00
P3	Loading, Transporting, and Stockpiling of Suspect (Contaminated) Material	Tonne	2500	$ 40.00	$ 100,000.00
P4	Loading and Disposal of Suspect Material Determined as Uncontaminated	Tonne	2500	$ 30.00	$ 75,000.00
P5	Loading, Transporting and Disposal of Hydrocarbon Contaminated Material Above CSR Residential Standards but Below Commercial/ Industrial Standards	Tonne	1250	$ 65.00	$ 81,250.00
P6	Loading, Transporting and Disposal of Hydrocarbon Contaminated Material Above CSR Commercial/ Industrial Standards but Below Hazardous Waste Regulations	Tonne	1250	$ 90.00	$ 112,500.00
P7	Loading, Transporting and Disposal of Metals Contaminated Material Above CSR Residential Standards but Below Commercial/ Industrial Standards	Tonne	100	$ 80.00	$ 8,000.00
P8	Loading, Transporting, and Disposal of Metals Contaminated Material Above CSR Commercial/Industrial Standards but Below Hazardous Waste Regulations	Tonne	100	$ 100.00	$ 10,000.00
P9	Collection, Treatment, and Disposal of Suspect (Contaminated) Ground Water	Litres	2500	$ 0.90	$ 2,250.00
P10	Restrictive Working Conditions due to Archaeological Investigations	Hr.	40	$ 1,200.00	$ 48,000.00
P11	Transporting & Disposal of Chloride-ion Contaminated Material Above CSR IL	Tonne	3500	$ 80.00	$ 280,000.00
P12	Removal of Obstruction during Trenchless Crossing	½ Hr	60	$ 508.61	$ 30,516.60
P13	MMCD Hot-mix Asphalt Upper Course #1	SQ.M	250	$ 140.00	$ 35,000.00
P14	MMCD Hot Mix Asphalt Lower Course#1	SQ.M	250	$ 150.00	$ 37,500.00
P15	MMCD 'Super Pave' Upper Course	SQ.M	50	$ 150.00	$ 7,500.00
P16	Asphalt Cold Milling up to 35 mm Depth, Dispose and Overlay	SQ.M	250	$ 35.00	$ 8,750.00
P17	MMCD 19 mm minus Granular Base to 100mm Depth	SQ.M	250	$ 20.00	$ 5,000.00
P18	MMCD Crushed Granular Sub-base to 300mm Depth	SQ.M	250	$ 40.00	$ 10,000.00
P19	MMCD C4 Barrier Curb and Gutter	L.M.	50	$ 200.00	$ 10,000.00
P20	MMCD 100 mm Thick Concrete Walk	SQ.M	50	$ 300.00	$ 15,000.00
Sub-Total of Part B - Provisional Tender Items					$ 905,000.00
Summary of Prices					
	Part A - Base Tender Items				$ 46,361,000.00
	Construction Costs			$ 31,936,000.00	
	Design Contingency		25%	$ 7,984,000.00	
	Construction Contingency		5%	$ 1,597,000.00	
	Escalation at 5%/ year applied to MidPoint of Construction. Construction Start on January 2027 for 20 months		12%	$ 4,844,000.00	
	Part B - Provisional Tender Items				$ 905,000.00
	Total Construction Costs				$ 47,266,000.00

	Class D Estimate	Low Range	Estimated Costs	High Range
		-20%		+30%
	Construction Cost	$ 37,089,000.00	$ 46,361,000.00	$ 60,269,000.00
	Provisional Items	$ 905,000.00	$ 905,000.00	$ 905,000.00
	Overall Opinion of Probable Construction Costs	$ 37,994,000.00	$ 47,266,000.00	$ 61,174,000.00